United States Department of Commerce

National Telecommunications and Information Administration

Office of Spectrum Management

Commerce Spectrum Management Advisory Committee (CSMAC) Meeting

Friday, March 18, 2016

The Advisory Committee met in the Wiley Rein Conference Center, 1776 K Street, N.W., Washington D.C. at 1:00 p.m., Larry Alder and H. Mark Gibson, Co-Chairs, presiding.

Members Present:

Larry Alder, Co-Chair

H. Mark Gibson, Co-Chair

Michael A. Calabrese, Member

Michael S. Chartier, Member

Martin Cooper, Member (by telephone)

Mark E. Crosby, Member

Thomas S. Dombrowsky, Jr., Member

David L. Donovan, Member (by telephone)

Harold Feld, Member

Harold Furchtgott-Roth, Member

Dale N. Hatfield, Member

Paul Kolodzy, Member

Robert Kubik, Member

Mark A. McHenry, Member

Janice Obuchowski, Member

Robert Pepper, Member

Carl Povelites, Member

Charla Rath, Member

Richard L. Reaser, Jr., Member

Jeffrey H. Reed, Member

Dennis A. Roberson, Member

Mariam Sorond, Member

Bryan Tramont, Member (by telephone)

Jennifer Warren, Member

Also Present:

Lawrence E. Strickling, Assistant Secretary of

 Commerce for Communications and Information, Department of Commerce

Paige R. Atkins, Associate Administrator, Office of Spectrum Management, National Telecommunications and Information

Administration, U.S. Department of Commerce

Matthew Hussey, Associate Chief of Policy,

 Office of Engineering and Technology,

 Federal Communications Commission

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Proceedings

(1:00 p.m.)

Co-Chair Gibson: Good afternoon, everyone. Welcome to the March 18th CSMAC Meeting. I will say it again.

The agenda has this being kicked off with remarks from Larry Strickling, so without any further ado, I will turn it over to Larry. I believe in an agenda.

# Welcome and Opening RemarksLarry Strickling

Mr. Strickling: Great. I hope everyone has noticed Bruce Washington's tie this afternoon. So we want to -- yes, we want a hearty "Go Terps!" for this afternoon, and somebody I assume will be providing us every 15 minutes with score updates from inside the Wiley Conference Center? We'll see what we can do in that regard.

But welcome, and thanks for all of you to come out even on a -- on a typical TV-viewing afternoon to spend your time here on CSMAC. But we know how important this issue is, even during March Madness, and I'm glad everyone was able to get over here this afternoon.

I wanted to give you an update on a few things. First off, for each of you, all of you have now been reappointed to the CSMAC for another six-month term. You will remember that we decided to extend everyone's term to get through the current work cycle.

Shortly, we will be releasing the solicitation, the invitation for people to sign up for the next version of CSMAC, and so we'll let all of you know when that comes out, and I encourage all of you who are interested in continuing on to be sure to come back and reapply through that process, and I think the goal is to have that team constituted, ideally, before the end of this year, and up and running.

But we'll see how things play out over the course of the summer and fall. But be looking for that notice, and again, we'll make sure that that information is supplied to you when it's filed.

Also in that regard, with respect to administrative details, I am very pleased to announce that Dave Reed, who is heading up our Spectrum Policy Division, has now been designated by me as the Designated Federal Officer for CSMAC, so Dave, I think people know you, but stand up and be recognized. I think folks know he has a -- you know, people would have spotted you sooner if you had followed Bruce's lead and worn a Terp tie, but we'll -- we won't beleaguer that issue.

Anyway, Bruce is still going to stay involved and help transition Dave into the new position, so I would also ask that everybody recognize Bruce for his years of service with a nice round of applause.

(Applause.)

Mr. Strickling: In terms of other events, I think folks know we're still working to implement the Spectrum Pipeline Act. We're looking forward to some of the first applications from agencies for monies from the Spectrum Relocation Fund to help them better understand and better prepare for accommodating commercial broadband services in their spectrum, and so we're looking forward to getting some of those first applications through the process this year.

Congress has been active, notwithstanding the Spectrum Pipeline Act being enacted last year. The Senate Commerce Committee just last week passed out from committee the Mobile Now Act, which has a comprehensive set of provisions regarding Spectrum, including their effort to tailor the President's 500 megahertz broadband goal.

It calls for some studies on certain bands -- is this a score update coming in, Mike? Yes, Syracuse now down to Dayton I guess.

I -- on the 500 megahertz goal, Chairman Wheeler and I have been talking about what we can do to try to be able to announce before the end of the year that we have identified 500 megahertz a spectrum to meet the President's goal, and we'll be updating people over the upcoming months in terms of how we do that, but I would just say now that we'll get this done only with the Cooperation of industry, so I hope all of you are able to help support these efforts, particularly in the two bands and five gigahertz that are of great interest for unlicensed use.

But this is an area where industry support will help us greatly in terms of getting our analyses and testing conducted this year to hopefully be able to reach some conclusions on those bands before the end of this year.

In that regard also, we will hear more today from Matt on the FCC's Frontiers proceeding, Spectrum Frontiers proceeding, but that is a very important proceeding for this year as we look at how to -- the FCC in particular, with support from us, how to meet the needs of the new 5G services.

Throughout all of this, CSMAC will be an important component in terms of providing advice to us and providing guidance to us as to how to navigate through the -- these very important issues, so I am looking forward today to hearing your latest set of recommendations and issues based on the questions that you've been working on.

And with that, I will turn it back to the Co-Chairs to get going on that. Thank you.

# Opening Comments and IntroductionsCo-Chairs

Co-Chair Gibson: Thanks Larry.

The only opening remark I'd like to make is to thank Tom and the folks at Wiley Rein for hosting us yet again for CSMAC. It's nice to be at a place where we can eat at the table, so take advantage of the food there. Not that NTI is not a great place to meet, but we can't have food.

And I'd also like to say thanks for all the work being done. I have been on most of the calls, and there is a lot of work being done behind the scenes to get to this place where we are now, and then the recommendations at the meeting in Boulder in July/August time frame, so thanks to everybody for all the work they have done.

I would also like to join Larry in thanking Bruce for his work. I have really enjoyed working with Bruce. He is, you know, notwithstanding that great tie, he has really been very helpful in making the load a lot lighter, so thank you again to Bruce.

Other than that, Larry, do you have anything?

(No audible response.)

Co-Chair Gibson: Okay. So now we'll do the roll call, which is always fun.

Let's start with Bob. We'll go counterclockwise around the table, and then we'll do the phone.

Member Pepper: Robert Pepper, Cisco.

Member Furchtgott-Roth: Harold Furchtgott-Roth, Furchtgott-Roth Economic Enterprises.

Member Povelites: Carl Povelites, AT&T.

Member Chartier: Mike Chartier, Intel.

Member Reaser: Rich Reaser, Raytheon.

Member Calabrese: Michael Calabrese, New America.

Member Obuchowski: Janice Obuchowski, FTI.

Member Warren: Jennifer Warren, Lockheed Martin.

Member Reed: Jeff Reed, Virginia Tech.

Co-Chair Gibson: Hang on a minute. Stand by, Jeff.

So we need a little tutoring on how to use the mics. If the red light is on -- cool. All right, so be sure, when you -- just I'll say this because I always do. Since you're saying your name, just get used to that, so when you say your -- when you ask your question, say your name, or one of us will try to remember that. So starting back again, go ahead, Jeff. Thank you.

Member Reed: Okay. This is Jeff Reed, Virginia Tech.

Member Dombrowsky: Tom Dombrowsky, Wiley Rein.

Ms. Atkins: Paige Atkins, NTIA.

Member Alder: Larry Alder with Google.

Member Gibson: Mark Gibson with Comsearch.

Mr. Strickling: Larry Strickling. Go Terps.

(Laughter.)

Member Rath: Charla Rath, Verizon.

Member Hatfield: Dave Hatfield, University of Colorado.

Member Roberson: Dennis Roberson, Illinois Institute of Technology.

Member Sorond: Mariam Sorond, DISH Network.

Member McHenry: Mark McHenry with Shared Spectrum Company.

Member Crosby: Mark Crosby, Enterprise Wireless Alliance.

Member Kubik: Rob Kubik, Samsung.

Member Feld: Harold Feld, Public Knowledge.

Co-Chair Gibson: Go ahead Matt.

Mr. Hussey: Matthew Hussey, FCC.

Co-Chair Gibson: Cool. And then what I'd like to do, I'll call the names of the CSMAC Members that are not here to see if you're on the phone. So is Marty Cooper on the phone?

Member Cooper: Yes I am.

Co-Chair Gibson: Hey Marty. Thank you.

Dave Donovan?

Member Donovan: Yes I am.

Co-Chair Gibson: All right. Thank you.

Kurt, are you going to make it?

(No audible response.)

Co-Chair Gibson: I think Kurt is ill, yes, so and then finally Bryan Tramont. Bryan, are you on the phone?

Member Tramont: Yes I am.

Co-Chair Gibson: Great. Are there any CSMAC Members on the phone that I may have missed? There shouldn't be.

(No audible response.)

Co-Chair Gibson: Okay, cool.

Now what we'll do is we'll run around the outside of the room for visitors, starting back there in the corner with Paul.

(Off microphone introductions.)

Co-Chair Gibson: Anybody I missed?

(No audible response.)

Co-Chair Gibson: Okay. Everybody else is working the meeting, so great.

Any -- I'd like to -- again, Matthew Hussey is here representing the FCC, and he will have a little bit of a brief. Are there any other visitors I should mention?

(No audible response.)

Co-Chair Gibson: If you're a visitor that I should mention, let me know.

(Laughter.)

Co-Chair Gibson: Okay. Having -- I think we're through the --

Participant: Paul Kirby?

Co-Chair Gibson: Yes, there's Paul still, yes, right. Careful.

So now we're at the OSM update, so we're already 15 minutes ahead. Go ahead, Paige.

# OSM Spectrum UpdatePaige Atkins

Ms. Atkins: Paul, thanks.

(Laughter.)

Ms. Atkins: Just kidding.

Co-Chair Gibson: Just think about the game.

Ms. Atkins: So we were hoping our efforts would have slowed down a little bit over the holidays, and that didn't happen, which is actually a good thing because it shows and reaffirms the important interest in visibility that Spectrum has across the -- speak up? -- across the legislative and executive branches and industry at large.

We're making progress on all fronts, and as CSMAC -- or as Larry said, CSMAC has played a key role in our success and will continue to do so. Still not loud enough? Okay.

And I wanted to say thank you to all the Members around the table -- is that better, Pepper?

Member Pepper: Yes.

Ms. Atkins: Okay -- for your dedication and support. You know, being on a federal advisory committee is not a very glamorous job, and I do appreciate folks volunteering their time and participating and engaging across these important issues. It really helps us do a better job, so thank you to everyone in this room and on the phone. And we sincerely appreciate your commitment and the collective wisdom that we're deriving from these discussions.

Now at our last meeting, we spent some time discussing the actions that NTIA had identified in response to the recommendations during the last cycle, and we finalized some new actions that we're in the process of either initiating or will initiate in the future.

This session, we're going to focus on the current set of questions, and that will be an initial discussion to a large degree on some of the preliminary recommendations coming out of the subcommittees, and we're hoping to have a really robust dialogue as we move into the next meeting, where we're hoping to have the final recommendations presented and approved by the Membership here.

So I want to remind everybody, we're on a compressed schedule, and that was on purpose, because we want to be able to close out these current set of questions as we move into the new term, and as Larry said, we'll be soliciting nominations for new Members. I know many of you will be back, but we wanted to wrap these questions up before we bring new Members into the fray, and then we will address a new set of questions at that time.

And the -- the key for bringing in the final recommendations and approving them at our next meeting in May is that will give us the following meeting in August to do something similar that we did with the last cycle where NTIA will tell you what we're going to do in response to those recommendations and have that dialogue before we close out this term.

Now given this timeline, and I've said this before, but it will be very important to prevent scope creep and to focus on the questions at hand and on practical -- practical and actionable recommendations so for the ones that we will accept we can move forward relatively quickly based on resources and priorities.

Now, those actions may include topics that you think are critical to tee up for the next cycle within CSMAC, and that is okay as well. But if we can focus on NTIA actions, that would be preferable, but also teeing up actions for the next CSMAC cycle may be relevant since we're in a compressed cycle right now.

So before we dive into the subcommittee updates and the deliberation around the preliminary recommendations, I want to give you a quick update as I normally do on Spectrum activities, and I am pleased to have Matthew here as our FCC liaison who will go after me and give an update based on the FCC perspectives and activities that are ongoing, so we appreciate your participation, Matthew.

So the first item I wanted to touch on is just to reaffirm that NTIA and the agencies are very focused on continuing a successful transition for AWS-3. Formal coordination, as you know, started the beginning -- end of October, beginning of November, with the coordination portals going live for both the 1755 to 1780 MHz band as well as the 1695 to 1710 MHz band.

The most intensive activity has been on 1755 to 1780, which we expected. And there have been over 150 coordination requests submitted to date, so quite a lot of activity, and I think things are progressing, and there's good dialogue between the licensees and the agencies that are involved, so I appreciate that.

And as you know, CSMAC played a critical role to get us to where we are, and that is important not only for setting the stage for successful AWS-3, but it also was important in terms of solidifying and strengthening the collaboration between industry and the government.

Now at the last meeting, we also had an update on the World Radio Conference for 2015, and it was a pretty extensive update since the conference had just closed. During the last meeting, we still had people in Geneva, and that was for the conference preparatory meeting for 2019.

As I think most folks know, this is like a Spectrum Olympics. Even though there is a culminating event, you know, there is a four-year intensive cycle leading up to it, and it starts immediately after the last conference.

So I can assure you that the conference for -- or the preparatory activities for WRC '19 are under full swing, and that includes the completion of the first international meeting of Working Party 5D, and for those not familiar with 5D, that is focused on international mobile telecommunications, so wireless broadband, which is very important to all of us at the table as -- as consumers and citizens.

And a reminder, for WRC '19, the focus for IMT predominantly millimeter wave bands, so very aligned with our -- our topic of looking at unique challenges with 5G here and actions we should take to facilitate success I'll say.

Now I did want to take a moment and talk a little bit about 5G and my observations, and this includes many meetings that we've had over the last few months as well as the Spectrum Frontiers Workshop that FCC hosted last Friday, I believe.

But G5 is not one thing, and I think that is important to realize. It is envisioned as a breadth of technologies, an ecosystem of capabilities that will satisfy a very diverse set of requirements and require a very diverse set of characteristics and capabilities to satisfy those requirements.

And as we all know, all spectrum is not equal, so you have to apply it appropriately in those conditions. And as such, and we've talked about this here and in many of the forums that I have attended, you need a mixture of low, mid, and high bands to satisfy this ecosystem of -- of 5G.

One thing we have heard consistently over the last few months from industry is that a key gap is at the higher bands, and not that you don't think you need more at the low and mid, but one of the key gaps is at the higher bands, and that at this time, technology has matured enough that it could be leverage for things that we wouldn't have even imagined a few years ago, so the timing is right.

And we are very excited about Spectrum Frontiers, not only to fill that gap that industry has identified, but to offer even more opportunities for a mix of licensed and unlicensed use spectrum sharing among industry as well as between federal and non-federal users, and potentially dual-use technologies, and that is really to better satisfy both public and private sector requirements.

Several of the questions this cycle, to include 5G, will inform both domestic and international activities. I talked about Working Party 5D a little earlier, but there are multiple topics that we're addressing to include the sensing and measurement focused on 5 GHz. 5 GHz is another topic that we're focused on internationally.

So a lot of the advice that we're getting here is important not just domestic, but as we look at our international activities. And we'll look forward to Matthew talking more about Spectrum Frontiers specifically in a few minutes.

Now as we look toward spurring innovation, the NTIA and the FCC's Office of Engineering and Technology are drafting a joint public notice inviting proposals for participation in the new Model City Program, and this initiative builds on the President's Council of Advisors on Science and Technology, PCAST, as many of you know, their recommendation that the Secretary of Commerce establish a public/private partnership to facilitate the creation of an urban test city that would support real-world, rapid experimentation and development of policies, technologies, and system capabilities for advanced and preferably dynamic spectrum sharing.

The goal of the PCAST report, the Model City Program is intended to bring together forward-thinking cities with key wireless innovators from industry, academia, and all levels of government to demonstrate, evaluate, and advanced spectrum-sharing technology and policy solutions needed to increase spectrum access and grow wireless services and applications, and wireless being I'll say a broad, encompassing wireless description, not just wireless broadband specifically.

And we think the model city will act as a catalyst and accelerator for advanced spectrum sharing technology by providing greater scalability of deployment trials than is possible with indoor labs, anechoic chambers, or limited testing environments, even outdoor environments.

And real world applications at real world scale, and in challenging urban environments in particular, will enable examination of the technical, policy, and institutional mechanisms needed for realizing the potential of these spectrum-sharing technologies, so we think this is a key enabler for the future, and we are really excited about that, so you should be seeing this joint public notice in the I'll say near term, next few weeks we anticipate it being out.

And just for a little bit of background, this follows an initial joint public notice that was published last year seeking comment on the creation of the model city as well as an NTIA and FCC workshop that was held last year as well, so we have taken that input and have integrated that into this next public notice that will be going out.

And we did have quite a bit of interest in the first public notice and the workshop, so we think we will garner quite a good participation when we go out for proposals.

So Larry mentioned the Spectrum Pipeline Act, and we talked about that a little bit last time. As Larry mentioned, this is a great step forward. It gives us more flexibility to apply SRF funds to advance spectrum planning as well as research and development in support of making additional spectrum available for commercial access, so that is all good.

We are moving very quickly to put mechanisms in place so we can execute against the provisions of the Pipeline Act. That includes recently updating our regulations. So the technical panel who will receive the proposals and approve the proposals as appropriate, they will be ready and in a position to start accepting these nearer term, and that will be over the next few weeks as well, so we're looking forward to that.

And as -- as Larry also mentioned, it isn't over. There's still a lot of congressional interest as we've seen with the Mobile Now Act and other activities, so we are obviously watching and engaged in those discussions.

So last but not least, I want to highlight that we will be publishing our sixth interim progress report on the ten-year plan, and I don't know if folks are familiar with our interim progress reports. This reports describes the annual progress toward achieving the administration's goal to identify and make available 500 MHz of federal and non-federal spectrum by the end of 2020.

And this is a -- though it's an NTIA report, it is very closely coordinated with the FCC, obviously, as well as the federal agencies. And as we've discussed in prior meetings, we are about halfway there, 245 MHz at this time, and we are very confident that we'll reach the goal by the end of 2020.

Now this report identifies the related major activities and accomplishments for the prior year as well as the initiatives being pursued for the future year, and it's -- the timing, as you can imagine, it takes us a little while to get the report out, so it will be somewhat skewed on dates, so keep that in mind as you read it, but it's a great summary of what is occurring and the progress we continue to make.

It also includes the running tally that we have, and that is in terms of bands that are made or have been made available, those that are in the queue, to include things like the incentive auction as well as those that are currently under study, so that is laid out in this in-progress review or report as well.

And if you haven't had a chance to see one before, they are all posted on our website. This one will go up once it is published, and I encourage you to read it and read each one as it comes out.

And again, I can't emphasize enough that this represents collective progress. It is not just NTIA's activities, but FCC's and the agencies' as we work this goal as a team.

Now there are many other efforts. I could go on probably another few minutes, but I am not going to. I'd like to go ahead and turn the floor over to my colleague, Matthew Hussey, to give us an update on some of the FCC activities and priorities at this point in time. Thank you.

Mr. Hussey: Thank you, Paige.

Co-Chair Gibson: Hang on a minute, I --

Ms. Atkins: Oh, do you want questions?

Co-Chair Gibson: Well yes.

Ms. Atkins: Oh yes, sure.

Co-Chair Gibson: So are there any questions?

Yes, Jennifer.

Member Warren: Hi Paige. Jennifer Warren.

On the model city, do you expect it to also allow for testing of the bidirectional sharing?

Ms. Atkins: Absolutely.

Member Warren: Okay.

Ms. Atkins: Yes.

Member Warren: Thank you.

Ms. Atkins: Yes, it is spectrum sharing in general, and it may also include sharing not only between federal and non-federal, both ways, it could be non-federal against non-federal, you know, commercial-to-commercial, federal-to-federal, so it's absolutely open in terms of really demonstrating and accelerating sharing technologies that then we can quickly implement, or as quickly as possible.

Member Warren: Thanks.

Co-Chair Gibson: Actually, I had a question.

Do you -- do you expect also to entertain testing for things like spectrum access systems and that type of thing as well?

Ms. Atkins: Yes --

Co-Chair Gibson: Okay.

Ms. Atkins: -- again, spectrum sharing --

Co-Chair Gibson: Okay, cool.

Ms. Atkins: -- so anything that enables us to get to a better end state related to spectrum sharing.

Co-Chair Gibson: Thanks. Okay, any other --

Ms. Atkins: And these -- I'll also add, so the model city activities is not just about the technology, it's also about processes, policies. We want to use this to inform how we institutionalize, to include things like enforcement.

Co-Chair Gibson: Okay.

Ms. Atkins: Can we use this as an experimentation test bed for enforcement as well as, again, feed our policy development?

Co-Chair Gibson: Okay, great.

Any other questions for Paige on the report?

Member Roberson: Really don't want to make this a model city discussion, but I think there really are a lot of questions around the model city. Given that it's a coordination activity, there's effectively no funding involved in it, and it's very hard to see how it's actually going to proceed.

The cities were really expecting some money to flow, and in the absence of money, I am seeing -- and I talked to not only Chicago, but other cities' representatives in Boston and so on, and their interest has really declined given that there's no money, so --

Ms. Atkins: Okay. And I will confirm there is no money.

Member Roberson: Yes, yes.

(Laughter.)

Ms. Atkins: But -- and not that there may not be other funding vehicles to fund certain elements, but based on the feedback that I've gotten, I think there is still a lot of interest, and folks are potentially ready to come forward with I'll say collaborative teams --

Member Roberson: And maybe we can talk off the record.

Ms. Atkins: Okay, yes. But part -- part of this public notice is to solicit proposals, and we'll have to see what that looks like, and that will help shape how we move forward.

Co-Chair Gibson: All right. Thanks. Any other questions for Paige on her report, and whatever?

(No audible response.)

Co-Chair Gibson: Okay. One thing, just for the purposes of the roll call, Paul Kolodzy is now with us. He waves.

Okay. Matthew, thank you very much for waiting.

# FCC Spectrum UpdateMatthew Hussey

Mr. Hussey: Sure, certainly.

So I'll just give a brief overview on three particular areas of interest: the activities of the TAC, 3.5 GHz, and then also Spectrum Frontiers.

The timing is pretty good here given that last week, the FCC held its first TAC meeting of 2016, and some of the items discussed included the FCC implementation of past actionable recommendations, also current progress of TAC work initiatives, and then also kind of some of the 2016 goals for the working groups.

And just -- Julie kind of highlighted some of the activities that the FCC, in taking the actionable recommendations -- just to give you an idea, for 2015, there were over 40 recommendations from the TAC alone, just for 2015, and so it touched on a lot of areas including, you know, activities and initiatives in unlicensed spectrum use, cybersecurity, mobile device theft prevention, and then also future technologies including Game-Changing as well as 3.5 and Spectrum Frontiers. So there has certainly been a significant impact that the TAC has made on the work that the FCC has moved forward with.

And then in regards to the TAC working groups, I will just touch, highlight, you know, highlight a few of them.

Obviously the Mobile Device Theft Prevention, it's pretty straightforward what they're focusing on. Some of the key activities for 2016 will be really focusing on next-gen -- exploring next generation anti-theft features, and then also how to kind of look into more effective consumer outreach efforts and education on mobile device theft prevention.

Cybersecurity, another working group, kind of one of the areas it's really focusing on is G5 security, and I think the plan for them moving forward in 2016 is really looking, exploring and possibly drafting a set of key security principles that could be implemented into the standards development process for 5G, primarily high-priority Internet of Things applications, and that's expected to be produced in the summer of 2016.

The Next Generation Internet Working Group is focusing on a couple different areas, primarily exploring the measurement of quality of service; encryption, which has obviously been a very big issue recently, both in the industry and on the Hill; and then also internet efficiency.

The Future Game-Changing Technologies is really looking to kind of identify the technical challenges in developing 5G and what can be done -- be done to ensure the rapid deployment in the U.S. They are planning several white papers on 5G adoption and programmable networks for 2016.

Then also, a new working group, the Mass Deployment of Aeronautical and Space Transmitters, that working group is really looking at spectrum and interference analysis, and is -- also a goal for 2016 is to develop a framework and recommendations for spectrum allocation and spectrum coexistence given, you know, the just explosion of popularity of drones and other type of aeronautical radio transmitters.

And then finally, the Spectrum and Receiver Performance working group is focusing on recommendations to improving access to and making efficient use of radio spectrum. That has kind of been the main mission of that working group since the onset. And two of the goals are really to continue to develop recommendations on next-generation systems, architecture for radio spectrum interference resolution, which is near and dear to a particular Member on the CSMAC here.

And then also, they are planning to conduct analysis and make recommendations related to risk assessments and the statistics of interference in a rapidly changing RF environment.

And if you want to look at the presentation in more detail or the actual TAC meeting itself, it is video archived on the FCC TAC website.

And now moving on to the 3.5 GHz. Currently, the second report and order on reconsideration is currently on circulation on the eighth floor. The Wireless Bureau and OET held a 3.5 GHz SAS workshop last month with prospective SAS administrators and environmental sensing capability operators to discuss the proposal submission process and address any questions that the participants had.

In December, the Commission, as many of you might know, the Commission released a public notice announcing the application window for the first wave proposals. Those applications are "due," and I do that in quotes, April 15th. And I do it in quotes because even though April 15th is kind of a deadline, it's a soft deadline in the sense that applications will continue to be accepted, but priority will be given to those proposals that are submitted prior or on that date of April 15th.

And the -- obviously, the FCC will consult with NTIA and DoD with applications as it does consider them and moves forward with those applications.

And -- and then the next one, the next steps that was planned, so for applicants that do meet the requirements which were outlined in the December public notice, those applicants will then be invited to bring in their systems to demo and to be evaluated, and that will be determined on the process of how that will be accomplished.

So now moving on to the Spectrum Frontiers: the Commission adopted its Spectrum Frontiers NPRM in October 2015, which proposed new rules for flexible use services in frequencies above 24 GHz, and that includes specifically service rules for 28 GHz, 37 GHz, 39 GHz, and then also 64 to 71 GHz spans.

The Office of Engineering, or OET, excuse me, and the Wireless Bureau as well as the International Bureau, hosted a workshop exploring the concepts raised in the Commission's NPRM, actually, just last -- last week, on March 10th, and there was a lot of really interesting discussions regarding that and the state of technical developments in the millimeter wave band.

One thing that should be reiterated that the chairman has been pretty vocal on and insisted on saying is that the Commission's intention is to create a flexible framework that will allow technologies to evolve, and in addition, a further notice of proposed rulemaking and rules will be -- are expected to be considered this summer by the commissioners and chairman.

And -- and then also, I think Paige requested that, given that we have just a minor auction coming up at the end of this month, to read an anti-collusion statement, so I'll start that statement right now:

"All participants in today's meeting are reminded that the FCC's anti-collusion rules are in effect for companies that have submitted short-form applications for the 600 MHz auction. Accordingly, any discussions that take place must not involve any disclosure directly or indirectly of bids, bidding strategy, or the post-auction structure of the 600 MHz market. For additional guidance, please consult with your own counsel."

So thank you. I am happy to answer any questions, or attempt to, at least.

Co-Chair Gibson: Thanks for leaving us with that final statement.

So are there any questions for Matthew?

Oh, Harold.

Member Feld: I did have a question. Maybe you're not somebody who can advise on this. Maybe it's more of an OGC question, or a Wireless Bureau question.

But with regard to that last statement -- excuse me -- not as a participant in the auction by any means, but as somebody who does advocacy work on a number of related matters, does discussion of advocacy regarding either the issues that are still live in the TV white space or overall auction present an issue with regard to the non-disclosure rules, just so that we don't talk to people we shouldn't be talking to?

Mr. Hussey: I am not -- I can't answer that --

Member Feld: Yes.

Mr. Hussey: -- so certainly -- you know, but we'll certainly reach out, work with you to talk with OGC --

Member Feld: Thanks.

Mr. Hussey: -- to answer that question.

Member Feld: Thank you.

Co-Chair Gibson: Yes, I think since Matthew can't answer that, I think that goes back to the final point he made, contact your counsel.

(Laughter.)

Member Feld: I am my counsel.

(Laughter.)

Co-Chair Gibson: Well you know what they say about a lawyer who has his own counsel.

Member Feld: I think it's totally okay.

(Laughter.)

Co-Chair Gibson: I'm not going there.

Okay. Now we're back to the -- to the meeting.

All right, Matthew, thank you, and thank --

Mr. Hussey: Sure.

Co-Chair Gibson: -- you Harold for your question. Any other questions for Matthew?

(No audible response.)

Co-Chair Gibson: So I think based on Matthew's feedback, let's just keep it within the NTIA.

Okay. I think for that, we're ready to go to the committee out briefs. Gary?

# FY 2016 Questions and Subcommittee Reports

Co-Chair Alder: But before we get to the committee updates, so we've got today five subcommittees that are going to be reporting, and as Paige mentioned, our goal is to present draft recommendations, and I think many of the committees have achieved that and produced draft recommendations.

This is really the meeting to have a substantive discussion, so we've allowed quite a bit of agenda time for that discussion. Get the points out on the table, and then the hope is that in the next meeting, which is scheduled for May, exact date to be determined, we will have final recommendations.

So again, this is kind of a great time to get the full committee input. So I am going to chair this part of the working group because my colleague Mark has been doing yeoman's work actually attending almost every subcommittee meeting, which is -- I can't even get my head around that.

So -- and I know he's going to have lots of input, so I volunteered to chair this meeting, and what we'll do is we'll start off then with our first subcommittee, and so what we're thinking is you have roughly 20 minutes, so we're hoping that, you know, the chairs can give an overview on the order of five minutes, we can have about 15 minutes for robust discussion and debate.

So we will start off with Federal Access to Non-Federal Bands. I think Charla is going to lead that.

## Federal Access to Non-Federal Bands

##  (Bi-directional Sharing)

Member Rath: Thank you, Larry.

So Rather than -- the first two pages, we know the first page, it's a question that NTIA asked us, and then the list of subcommittee Members. The meat begins on the third page. Just wanted to review the progress we've made.

We've had a number of meetings, both meetings of the subcommittee, which Mark did attend I think every single one of them, but also we had meetings with representatives of the public safety community, and also with DoD's CIO's office.

So that is what we've, you know, that we've been doing to take a look at the series of use cases that -- that we have before us.

The last meeting, what we mentioned to everybody is we split them into, even though there is, you know, there is some overlap among them, but we -- we took those that dealt with the public safety agencies and dealt with them separately from the DoD's, and we have actually

-- the recommendations we have are right now only recommendations on the public safety side because we will be having another meeting with the CIO's office.

We had -- you know, we received -- we got the use case, had to go through some additional efforts, so we really didn't even have it until December and weren't able to meet the first time with them until February.

So -- so the -- the next page is basically the preliminary recommendations, and what I'm going to do is Mark Crosby has been instrumental in this for obvious reasons, and I would like to turn it over to Mark to sort of walk you through the recommendations and start the discussion on this piece.

Member Crosby: Thank you, Charla. This is Mark Crosby. Hope it's not that obvious why I have to do this.

We -- and listen, there was great feedback from all the Members of the subcommittee, so these preliminary recommendations are a product of the subcommittee, not just one or two people.

You know, I think to start, I think we asked what are some typical use cases? And of, you know, sharing or potential sharing or needs for sharing, and we actually received some very helpful use cases around DOT, DOE, DOJ, DOI, and Tennessee Valley Authority, and there were some very, very good requests for sharing.

But what we learned rather quickly, the subcommittee, looking at this, is some of the federal agencies were very good at and had already secured and were operating under memorandums of understanding with public safety people, state, local, for a variety of technologies.

And so they were like ahead of the curve. There were other agencies that were behind the curve. So saying, well how can we do this? And so it was sort of interesting and sort of, you know, it sort of comes to you quickly: wouldn't it be great to have some sort of reference document that embodies, you know, best practices and procedures and instances of how memorandums of understanding and other collaborative arrangements could be worked out, which we thought would be of a benefit to the federal agencies?

So that was I think our first recommendation, you know, some sort of book or guidance or somewhere that they could find it and go oh, wow, this has been done before, this is a well-worn path, and I have this need, and let's see if we can go down there, so that was the -- sort of our first recommendation.

Of course, the other recommendation, so there's the next logical step: if you have all these MOUs and other collateral arrangements, there is a benefit to have, and there isn't -- I don't think there's anyone now, at least we don't think so -- to have a database of these agreements where the feds are sharing with non-federal public safety people, and I think there's two purposes.

One, because if you're a federal agency, you go oh, wow, this is one here, and maybe I can join this collaborative effort, which would save time, perhaps money, and maybe there's some commonality on the solution. So that was a good idea, you know, to have a database so that they can see that.

And the reverse, the non-federal folks who are coordinating non-federal systems in the spectrum, it would be good to know where these are before you do another public safety, or before you certify or coordinate another entity in an area that may be in the way of an existing MOU between a federal agency and -- and a public safety entity.

So to have a database, it is beneficial for a variety of reasons, and -- but it's not only to help the federal agencies, but also to help the non-federal so they know where they are, and so that you can protect them and maybe, you know, actually promote -- for all we know, someone could come in and go I need this, and if you have the database, they go well, we happen to know that there's already one there between, pick one, DOE and, you know, the Wyoming public safety community or state police. And so there is this knowledge base that would facilitate this type of sharing at these levels.

And of course then the third recommendation after you have a reference document and a database is, well, what's the next logical step? And the next logical step is well, do I have to do an MOU? Do I have to do an agreement with a public safety entity, state, local, or whatever? Can I get my own authorization from the Federal Communications Commission to use non-federal-government spectrum?

Now I don't know whether that's a bridge too far or not, but at this point, it's a recommendation of the subcommittee that's been raised by some of the federal agencies I think in some of our discussions, is would it be possible, and under what circumstances, could we perhaps secure our own authority from the FCC to have a federal agency system on the non-federal-government spectrum?

And so that is briefly the three recommendations we have at this point in time for this type of sharing.

Member Rath: What I was thinking is then just to quickly say what our next steps would be and then circle back to have any of the subcommittee Members who might want to add any comments.

But just so you know, we did say that we're going to have another meeting with the CIO's office, DoD CIO's office. There also is a short paper that we are working on. It is very short, one- to two-page white paper that will actually define the current process, and then, you know, obviously the full draft recommendations that would include the part dealing with the DoD request as well.

Any comments or -- to come from, first, what I'd like to do is just ask Members of the subcommittee first who were involved, any comments specifically on what is here or wishing to add any additional?

(No audible response.)

Member Rath: Okay. No? Guess not. Janice?

Member Obuchowski: While these came up in the context of public safety use cases, bullet 1 very much addresses that, but bullets 2 and 3 potentially could apply to other kinds of federal --

Member Rath: Yes.

Member Obuchowski: -- commercial sharing, bi-directional sharing. But no, Charla, I wanted to compliment you, as you and Audrey as chairs, and also observe that, you know, when you get into it, the federal/FCC relationship is strong, and when you look at the specifics of these kind of informal agreements, they happen, but they're very personality-dependent.

And we did experience on these calls with people discussing the use cases that to the extent the individuals have been at it for a while, they work these things out, but then some of them were like on the phone saying, well, really you can do that.

So some of this in bullet 1 is transparency.

Member Rath: Yes, and Janice, you're referring specifically to the call that we had with --

Member Obuchowski: Well, we had multiple --

Member Rath: -- the agencies --

Member Obuchowski: -- public --

Member Rath: Yes.

Member Obuchowski: -- safety --

Member Rath: Yes.

Member Obuchowski: -- individuals.

Member Rath: Any other comments from the -- I guess, yes. This is your meeting.

Co-Chair Alder: Oh, keep going, I mean you can go ahead, Charla.

Member Rath: Yes.

Co-Chair Alder: So we have a comment from Rick Reaser here, I think he had a question for non-committee-Members?

Member Reaser: Rick Reaser. Who do you think should maintain the database of these MOUs? Have you thought about that? Should that be like a third party, or is that the federal government, or -- just curious.

Member Crosby: Mark Crosby. It ought to be, if you're a federal agency, you ought to be able to look at it through NTIA, and if you're a non-federal, you ought to be able to look at it through the FCC, so maybe there's one, and you look at it from both -- you have the ability to look at it no matter what side you're on.

I -- I would not -- well personally, EW would not advocate more than one database, right? Wouldn't be an advocate for that, that would be a little messy.

Member Rath: Harold?

Co-Chair Alder: Is that good, Rick? Okay. And Harold?

Member Furchtgott-Roth: Harold Furchtgott-Roth.

Thank you, Mark, for the presentation. I just had a question of clarification on the third point.

In the notes, it specifically says look at whether a federal agency can hold an FCC license. There's certain language to that effect. And in your oral description, it was more authorization. And I didn't know if there was any magic or nuance between holding a license and authorization, or --

Member Crosby: They are synonymous to me, an authorization or a license. My day-to-day vernacular, it's -- I use them as the same. Perhaps for clarity, it would be better to say license, perhaps, in this thing --

Member Furchtgott-Roth: Which is a much narrower --

Member Crosby: Yes.

Member Furchtgott-Roth: -- concept.

Member Crosby: But again, I -- a lot of other folks can weigh in on that.

Co-Chair Alder: Michael?

Member Calabrese: I don't know that we've discussed it, but yes, I was certainly assuming we meant in that third preliminary recommendation, you know, literally a license, in other words, a right, because some form of opportunistic sharing or use would be an entirely different, you know, matter, yes.

Member Crosby: Of course.

Co-Chair Alder: Dale?

Member Hatfield: You already know what I'm going to say, so --

(Laughter.)

Member Hatfield: -- but --

Co-Chair Alder: So say it clearly in the microphone.

Member Hatfield: Yes. This is Dale Hatfield.

Obviously, changing the bilateral so the sharing goes the other direction raises interference enforcement issues: who is responsible for detecting interference or remediating it and resolving it and so forth?

So that may be band-specific, of course, but -- but nevertheless, it is something we probably should think about earlier Rather than later.

Co-Chair Alder: I had a question. Charla, in your conversations with these folks, what are -- can you summarize like some of the key use cases that really came up? Is that easy to summarize, or is it just too diverse?

Member Rath: Actually, can I -- Mark, can I refer you, too? Because you spent a lot of time talking to them.

It struck me is they were very similar --

Member Crosby: Day-to-day --

Member Rath: -- across the board.

Member Crosby: -- day-to-day mission, critical activities of agency personnel on the street, on the road, in forests. You know -- you know, the voice and data and I need a response now, and it's like day-to-day blocking and tackling of what they use, you know, to -- to support their missions and their activities.

So it was very hands-on, very very, you know, day-to-day, I need responses, and the telecommunications systems provide that to us.

Co-Chair Alder: And just as a quick follow-up, and what bands -- what kind of non-federal bands would they typically want access to in order to fulfill that?

Member Crosby: Most of the requests were 800, and -- and there were some at VHF, which we said that's unlikely given the difficulty with that band, but most of them were 800 and 700, and -- and there's a lot of technology. It's a great band. It propagates well for -- and there's a lot of -- of course the other benefit is there's a lot of product being developed at both 700 and 800, which helps federal agencies as well.

Co-Chair Alder: All right, Paul, I think you had a question?

Member Kolodzy: Yes, yes I do. Paul Kolodzy.

When you saw some of these examples that are going on, was there any distinction between is it mostly in smaller areas or less populated areas that we're able to make these things, or did you actually see any examples that were in highly populated areas?

Member Crosby: Both.

Member Kolodzy: Both, that is excellent.

Member Crosby: Would you agree? I am sorry to -- Mark Crosby again, Janice and Jennifer, the conversations, it was both, both urban and –

Participant: Yes.

Member Crosby: -- non-urban areas?

Co-Chair Alder: Mark? Mark McHenry?

Member McHenry: So is the presumption that everybody wants to share? What if you wanted to share, and the other guy was unresponsive or kind of said no? Do you have the presumption that he's got to prove no, or -- I am not quite -- you made it sound like everyone wants to do this paperwork, but what if they're not responsive or they don't want to?

Member Rath: Yes, I think in part what, and this is, you know, getting back to what Mark was saying earlier, in part this was almost us saying there's a process, and you, you know, it was really trying to call attention to the process for the organizations that didn't know it.

And I am not even sure you got to that -- that stage with this particular set of use cases. That may be a little bit different when we start to talk about the DoD use case, but -- although I don't think it's usually non-responsive, it's usually, you know, not available.

So, but this, with the public safety, it seemed at least from what I heard from what was reported back to us on the calls, it was really that they didn't necessarily know how to actually go about getting access. It wasn't that they couldn't get access. It was in large part that they didn't know how to do it.

Member Crosby: Mark Crosby. Mark McHenry's question is very good, though.

Member Rath: Yes.

Member Crosby: So federal agency goes, wow, this is a need, there is a system there, I have a database, I found it, there's a mechanism how I can participate. May I participate?

And the non-federal go, uh, no.

(Laughter.)

Member Crosby: Wait a minute, what are you going to do --

Member Rath: Yes.

Member Crosby: -- what are you going to do if the non-federal person goes, uh, no. I go well what do you mean? So that we haven't worked out. It's -- we haven't worked that detail out yet, but it would seem to be a legitimate question that deserves -- I mean, is it -- are you obligated to say yes, or -- or --

Member McHenry: Yes, who has the presumptive right?

Member Crosby: Well --

Member McHenry: Share unless you prove a no.

Member Crosby: Yes, it is a great question.

Co-Chair Alder: All right. We will go to Janice, and then Paige wanted to have some comments. Jennifer, excuse me.

Member Warren: That's the second time --

Co-Chair Alder: I have done that before --

Member Warren: Yes --

Co-Chair Alder: -- I know, I apologize.

Member Warren: That's okay, I have been complimented at another meeting earlier today the same way, so that's okay.

So I think it was -- I think it's fair to -- so Jennifer Warren, for clarity.

I think it was fair to say on the calls though, because the use cases are very similar, I mean, we're not talking about a great deal of difference in how these -- how the spectrum is going to be used, that you didn't run into as many likelihoods of no as you might with other federal non-users.

And I have never found a federal non-user who felt that I had the burden -- or it has always been on me of I've wanted access to -- to demonstrate why I should be given access.

So just as a personal aside, from a corporate perspective. But on the calls, I mean, I don't think we're running into the dichotomy that we may run into when we're talking about two less similar types of uses.

Co-Chair Alder: Paige?

Ms. Atkins: I just wanted to add that in our discussions prior to the CSMAC picking this up, we saw public safety as low-hanging fruit because in general, everybody wants to do the right thing, and they -- if they can accommodate the requirement, they are willing to do that. Now whether we need something more formal in place that answers your question, Mark, I think we need to look into that.

And in some cases, it also may be for instance a law enforcement requirement that may not align necessarily purely with public safety that may want to leverage first in that spectrum, or there may be other use cases. I am not sure if you had any discussions in that vein as well.

But I think in general, formalization, so we understand what the rule sets are, is -- is something that should be addressed, but overall, in the public safety community, if they can do it, they want to do it, so -- .

Co-Chair Alder: Is there any other comments, feedback for this subcommittee? I know you said you still have some work to do with the meeting with the DoD CIO's --

Member Rath: And this is helpful too. I think we have added a couple of things here that we can talk about.

Ms. Atkins: And I know you didn't have anything formally on the DoD side. Can you give us any kind of insights on what you're thinking there, or it's just really --

Member Rath: I think --

Ms. Atkins: -- too premature?

Member Rath: -- it's too hard to. There is a fair amount of, you know, divergence of opinion on the subcommittee on that issue, particularly because the -- the DoD use case was very different than the other ones in the sense that it was looking for co-primary access to auctioned frequencies, and, you know, the possibility of doing things like aeronautical in them, and so I think it just raised a lot of pretty fundamental issues in the group, and we did feel very strongly that we wanted to go back and talk to Fred.

And, you know, there are some -- we have been circulating some ideas about how we might deal with it, but it really isn't baked enough yet to I think -- you know, to put something on the table. I don't think there's one thing that all of us -- I'd feel comfortable, but --

Co-Chair Alder: Go ahead, Dale?

Member Hatfield: Oh, just one quick clarification. It just dawned on me.

Are you looking -- limiting it to spectrum sharing, or it can be infrastructure sharing as well? And the reason is I happen to be involved in a study in Alaska, I think in VHF, where there was an agreement between the state operation and the Coast Guard because they were saving -- all serving very difficult to serve locations, and it made sense to do infrastructure, and they had some sort of an MOU.

So that jumped into my mind as to what -- obviously, if you share everything, it's just -- then you're sort of a customer of the other, all the way to sharing the infrastructure, all the way to getting access to the spectrum, non-interference-based.

Did I make that -- is that very clear?

Co-Chair Alder: So Charla, do you want to respond?

Member Rath: We didn't.

(Laughter.)

Member Rath: So I mean, we really did just look at it from the point of view that we're all talking about, as, you know, sharing the spectrum, not going back.

And we talked, actually the last go-round, we really did talk more about gradations of sharing in -- on the short-term side about, you know, everything from, as you said, Dale, you know, actually being a customer, to, you know, sharing the spectrum and dealing with it that way.

But we -- we -- in fact, I think in part, one of the reasons why we asked NTIA to give us particular use cases is we did not want to go down that broad path again. We wanted to actually have things to -- you know, explicitly to comment on.

Member Crosby: If I may, I think -- Mark Crosby, I think the answer is both, and everything in between.

Member Rath: Yes.

Member Crosby: Sharing spectrum, whatever works for the parties. I don't think there should be any encumbrances --

Member Rath: But in all fairness Mark, we didn't really --

Member Crosby: No, we didn't.

Member Rath: -- we didn't really talk about --

Member Crosby: Right.

Member Rath: -- some of these other issues, yes.

Co-Chair Alder: Jennifer, did you have something that you wanted to add?

Member Warren: Jennifer Warren. I was going to say I think it's important the comment that Charla made, which was we had tried to look at this issue in the Bi-Directional Sharing group that Janice and I had the pleasure of chairing, and there was no traction really on that particular point.

And as Charla said, we came back and asked for more definition on the one question in part because it -- the longer-term sharing, which would be kind of an infrastructure, you would assume that would be longer-term, we just wanted a lot more definition.

And I think that's what led to actually -- or at least in part, I hope, led to some of the use cases being shared, because we needed that specificity. We weren't getting very far.

Co-Chair Alder: All right. Charla and the rest of that committee, thanks so much for the good work. I think it looks like very good progress, and I know there's a little bit more to do, but thank you.

So with that, we will move on to the next subcommittee, which is the Agency in Industry Collaboration. And I think Thomas is going to take us through that.

## Agency in Industry Collaboration

Member Dombrowsky: Yes, that will be me. I apologize for not having a readout.

Our group has met and had discussions. I will remind everybody of what the question we were looking at was, which is how should traditional regulatory approaches change to better leverage and incorporate direct federal agency to industry collaboration, negotiation, and coordination to enable greater spectrum sharing?

So to try and answer that question, we have had a series of calls and meetings among the group to sort of brainstorm issues that led to some outreach to DoD, NOAA, a few other federal agencies to sort of talk about best practices and cases where collaboration has actually been successful.

And I think the fundamental take-back that we have at this point is we're not seeing a lot of regulatory changes that are needed, but we did have an interesting conversation on Monday that I do think could be helpful to bring forward in terms of recommendation, which is really focused in on clearances and classified information sharing.

And I think we will be able to in the next -- in the May meeting time frame come forward with a fairly discreet, focused recommendation looking at that issue alone. And the things that we were finding out is there's vehicles put together by DoD and by other agencies under the FACA provisions that may be a way forward to at least investigate the sharing of classified, or have clearances for folks to discuss that kind of information.

And really, I am going to give a whole bunch of time back to you guys because that is really our report out, and that is why we don't have slides, because we didn't have a lot to report out.

Co-Chair Alder: Throwing it open for questions.

(No audible response.)

Co-Chair Alder: I'll ask a question if no one else has one.

So are you saying that you're really focusing on that one area for the recommendations? I know there was a -- initially, there was some debate about, you know, trying to find a way for smaller working groups to work. Did you guys work through that and decide that was feasible, non-feasible, or is it really the data --

Member Dombrowsky: So what we did --

Co-Chair Alder: -- is classified?

Member Dombrowsky: -- that was the last sort of committee group. We went forward with the framework that NTIA presented, and I know they are working hard to sort of figure out a framework for those sort of small group discussions.

What we're trying to do is focus in on the thing that really stopped it, which was this sort of clearance/classified information issue, so it goes hand-in-glove, but we're really just focused on just that one issue at this point.

Co-Chair Alder: Okay.

Ms. Atkins: I have a question.

Co-Chair Alder: Paige?

Ms. Atkins: When you spoke with DoD, did you peel back what they're doing in 2025 to 2110 on --

Member Dombrowsky: Yes.

Ms. Atkins: -- the collaboration with broadcasters?

Member Dombrowsky: Yes, we talked to them about that --

Ms. Atkins: Okay.

Member Dombrowsky: -- as well, and we're hoping to bring some of that information forward.

Ms. Atkins: Okay.

Co-Chair Alder: Other questions, comments?

(No audible response.)

Co-Chair Alder: All right. We did get a lot of time back, so that we can hopefully use in some other discussions here.

So the next group that we have is the Measurement and Sensing group in the 5 GHz band, and I think Dennis is going to take us through that.

## Measurement and Sensing in 5 Ghz

Member Roberson: Actually Paul, we didn't have anything --

Co-Chair Alder: Okay.

Member Roberson: -- to say. I had the opportunity --

(Laughter.)

Co-Chair Alder: Okay, so it's going to be Paul. Paul, please go ahead.

Member Kolodzy: I usually don't have trouble actually finding something to say, right?

I will try to go, as Charla did, I think I'll try to go quickly.

We -- in the front side here, which is the first pages, actually, the Membership, which has actually been very very -- has participated quite a bit, and what the work plan was in the sense that we actually got going by the end of December, and we actually have been meeting once weekly since then, so we've actually got a lot done over the last eight, nine weeks.

So I actually have to say thank you to everybody who has been participating because that's taking a lot of time out of your schedules, busy schedules, to help out.

What we have done in this group was broke the measurements into three topic areas, in a sense of asking the question what are the strengths and weaknesses of the architectures, measurement architectures, characterizing the kind of measurements that need to be made, meaning what are the kinds of systems you have to measure? Are they very very powerful systems? Very very distributed systems? Very weak systems in the sense of power levels?

And also asking a question which may not have been thought of by NTIA, but actually trying to figure out what are the policy implications in the sense in the workarounds for measurements? Because you can't be -- you can't know perfectly the entire environment, and so therefore there is this trade space between how you deal with policy issues associated with a lack of information coming from the measurements.

And then we looked at what measurement tasks did you actually want to try to take on? And there's the classic case, which is before you do sharing, is there a possibility to do sharing? What is the utilization of the spectrum, and how well is it being utilized? Who is using it, how often, where at, and the like?

But it is also, the next step after that is what kind of measurements might be needed during sharing, and how are you going to actually implement those types of systems? Are those fixed systems? Are those systems that are going to be actually done by the licensees? Or whatever.

And then finally, the measurements that need to be taken after sharing has gone on to find out what the impact is of sharing, and if it actually has any deleterious effects or the like. We're actually looking at trending and how well things are going on.

There was a fourth area that we were looking at and are not addressing, but I just wanted to put it in there just to be complete, and that is enforcement: there's measurement enforcements for interference mitigation and actually looking at people who are actually doing the sharing in an appropriate manner and the like.

That has been covered by a couple other -- I mean a couple subcommittees I think last go-round, at least some of the pieces parts, and it might be actually a topic in the future, considering we've been talking more and more about enforcement issues. And so that might be something for the next session.

The status of it, and I'm going to go walk through these quickly, are the first thing we have done is we've actually done a list of systems, and we've had some great help by -- by Rick, in a sense of going out there and finding all the different systems that are out there in the government, in the federal bands, and trying to characterize it as to what the application is, and you'll see that in page 5, if it's currently in use or what is actually being thought of it being in use. There are some things going on and WiMAX systems being deployed in airports and things like that.

Trying to characterize it with respect to how much power it is actually throwing out, how much bandwidth is it using, is its footprint a large footprint or a small footprint, is it up very high, so it's a very, you know, much more easily measured, is it continuous, is it intermittent, is it fixed, is it mobile?

These are all the things, believe it or not, you have to take into consideration when you make measurements and actually figure out what kind of architecture that you want to take a look at.

And so we laid out this, this is just showing you an example of that, but we've actually had a good amount of discussion on actually understanding what's out there in the 5 GHz band.

The other area was actually looking at the architectures, and that's the next page, page 6, the architectures that might want to be employed to actually make those measurements.

Now, no one architecture fits all the problems that you may want to solve, in a sense of sometime you may want to use distributive systems, sometimes maybe only hitting it once in a while and notice that that goes to continuous transmission, then all you need to do is measure it once and you now know it's there, right?

So there is all this kind of trade space that needs to be looked it, and so we have started this extremely high-dimensional matrix trying to understand what architectures you may want to take a look at, like fixed sites or from pneumatic sites, meaning do you have a pneumatic measurement system, a fixed measurement system, or a mobile, and exactly what the pros and cons of those are, compared to some of these options that we're looking at.

So the column, before you make sharing possible, actually you're doing sharing or post-sharing, is trying to map out how well those architectures map to those types of measurements.

And we're -- you know, obviously, we have not finished this entire matrix up at this point, but we have actually been trying to use this as a methodology to understand where the weaknesses are, or where do -- an architecture needs to be used that's a lot different than what you might want to think about using for expediency.

So Dennis had a lot of very interesting discussions going on on that. And so what we have done is, and I -- the next page is basically an outline for a report. Let me just go to the draft recommendations, and these are extremely drafty.

We have -- as we've been putting all this material together, this is just sort of some of the initial discussions that have gone on.

The first thing that has gone on through our discussions were that there was a lot of -- at least we had heard about a lot of consternation of federal users having issues with the measurements that have been made, and that they did not capture in the past, did not capture their usage of the spectrum.

So one of the possible recommendations was to have a feedback between the federal spectrum user community under study and the occupant measurements, and that should be strengthened, meaning you don't want to make measurements in this typical way, take months and months and months and months and months to do the reporting, and then give it back to somebody after a year and say oh, you remember last year on Thursday, we made these measurements?

We didn't see anybody, and trying to get that correlation of the user community trying to understand did you measure us in a proper way or not, and be able to actually do that just to make sure that you get a better understanding of the pros and cons of whatever you measured, okay? So that was -- and that was one of our recommendations.

Another was some of these systems are extremely difficult to measure, and so the question becomes can you use some kind of emitter beaconing technologies on the federal side? Now there's a lot of problems and questions associated with that, with security and with potentially for privacy issues and things like that, depending upon if it's -- how it's being used.

But it would actually aid considerably in the sense of being able to make the measurements properly, so you maybe want to take a look at it for some cases, looking at beaconing technologies that would allow you, you know, not all the time, but enough that you could actually make the measurements more precisely.

The third draft recommendation, okay, was that we -- that if we don't finish this spreadsheet that we actually put together, that NTIA finish this spreadsheet in the sense of understanding the different architectures, they have become very knowledgeable about how those architectures map into one of the systems that are out there in 5 GHz.

The second -- I mean the fourth recommendation is that we need to take a look at the architectures, okay, for monitoring, and look at the different architectures that are needed, and then map those architectures appropriately to the problem you're trying to solve.

The goal -- and then the idea is that you should develop a technical criteria so that the measurements have a high detection probability. What are you trying to measure? What are the characteristics? Make sure that's reflected into the architecture, and then make sure you employ that architecture when you do your measuring processes.

It is not just somebody out with a spectrum analyzer sitting outside and saying okay, I've got a good detector, I'm going to run around a lot and hopefully they'll pick up the signals. You need to understand --

Participant: That's so fun to do, though.

Member Kolodzy: Well yes, you -- both of us have made a living doing that. It is fun, but it is -- it may not be what you need to actually get a good understanding of the environment.

And last is maybe the NTIA and FCC, which we've worked as panels not part of, but you look at methodologies for how to make comprehensive measurements on equipment. If you're going to take a look at the equipment that you're going to use for sharing is going to be appropriate, and this is kind of a little bit outside of our scope, so maybe you'll push back at us and saying we shouldn't be thinking about things like this.

But if you're going to have systems that are going to adapt and have to measure the environment and then adapt to that, how do you measure all the possibilities? The space -- the operational space is very large, and so you're not going to be able to do an exhaustive set of tests.

So the question has to become what are you going to do to actually solve that problem? Do you actually look at particular features and then partial testing of all the rest of the operational space, or are you going to try to do completely comprehensive tests, or what is the process?

And so the process is going to have to actually be targeted to take a look at, and maybe that's also something you push to a future question, which is how do you make those measurements? This is the old problem that the FCC had at one point, which how do you do software-definable radios, and how do you assess them for security, right?

It is, you know, what are the processes that you can use to make sure that you -- that the system works properly across the entire operational space?

And our -- I'll stop at that, but our action from this point on is to kind of firm some of these up, these recommendations up, and to move forward in trying to fill out some of the questions that we were trying to address since the architecture slide.

Co-Chair Alder: Great, and if no one has questions, then I'd ask Paul to go line-by-line through the matrix.

Member Kolodzy: Oh, right.

(Laughter.)

Member Kolodzy: If anybody has insomnia --

(Laughter.)

Co-Chair Alder: Thomas, go ahead.

Member Dombrowsky: Thanks Paul.

Just a quick question on the -- I guess it's the feedback discussion on slide 8.

Member Kolodzy: Yes.

Member Dombrowsky: I like the idea at a concept level. I guess the question I have is from an implementation standpoint, is the vision that this would be something managed by NTIA in order to get past sort of the classified clearance issues? Because problems we've had in the past with trying to get that feedback is we're doing stuff, but we can't tell you what we're doing.

Member Kolodzy: Right.

Member Dombrowsky: So the two questions are sort of interwoven from my perspective: if NTIA is managing it, that maybe is a way to do it, but then how does that information then flow too to the -- to the commercial --

Member Kolodzy: Right.

Member Dombrowsky: -- industry?

Member Kolodzy: And --

Member Dombrowsky: Something we've been struggling with for a while.

Member Kolodzy: I think in the discussions that we had had in the group, it was thought of that NTIA would play that role. I mean, it is not explicit in this recommendation, and maybe we'll take under consideration as to --

Member Dombrowsky: Yes --

Member Kolodzy: -- making it more explicit --

Member Dombrowsky: -- well I think that would help, yes.

Member Kolodzy: But that was I think at least the general conversation in the group, was thinking that NTIA would be doing that, having that role.

Member Dombrowsky: And then how would the information come from NTIA out to the public, if you will?

Member Kolodzy: Well, what the issue here we're trying to find out was when NTIA or any group is trying to measure the occupancy, how do they tell the people who are being measured how well they were being measured, right?

So I think the feedback, the other side, I don't know where that actually comes into play, unless you're talking about further on when you're talking about -- when you're actually doing sharing and trying to actually ask the question how well are you doing the sharing.

Member Dombrowsky: Well, I think it kind of goes hand-in-glove from my perspective. I mean, it's sort of hard, if you're not -- if you're creating something and you give it to say NTIA and they say you're doing great, that's good, but if they say there was a problem, how does that information come back to help improve the next time around, if you can't share that piece of information, which is what we've been struggling with in some of the other groups?

Member Roberson: If I could respond?

Member Dombrowsky: Sure.

Member Roberson: But that's not what this is about. We're taking a recommendation here. The recommendation here is that there are issues. Ed and company do measurements. They put out a result, tell you everything is clean. And then somebody in the DoD for instance says but I was there, and you didn't -- you didn't indicate that I was there, so your measurements are flawed.

So this is the way of closing that loop.

Member Dombrowsky: Yes --

Member Roberson: That's what this is about.

Member Dombrowsky: I understand that, but I am just suggesting to you that that's useful, but then the next piece is what if -- how do you get that information back to the folks that are actually creating equipment? Maybe I'm going down an endless loop here.

Member Roberson: Yes, that is a different point. I mean it may be a good point, but it's not this point.

Member Reaser: Let me help you, Dennis. This is Rick Reaser.

But basically, where you're going is the next study, because to be honest with you, what you really want to do is take this information, expand it into what you're talking about, and then go into things like enforcement, and then maybe nationwide monitoring and those kind of things for enforcement purposes, and Dale's group at the TAC has been looking at those things.

But the problem -- we started down this path, but we're really limiting it to just the question we were asked, and what you're asking is the logical follow-on, it's something that ought to be probably looked at in future studies and so forth, because I think that is kind of where the world is going to head eventually, what you're talking about, but we do have a short time period to finish our work, and we're not going to get down that path because we spent like a whole hour one time just talking about what you're talking about, and then we realized, well, that was not what our question was.

Member Dombrowsky: All right, thanks.

Member Roberson: Actually exactly what happened.

(Laughter.)

Co-Chair Alder: So we'll go with Jennifer.

Member Reaser: And I was the one that took them down the rabbit hole, so I just wanted --

(Laughter.)

Co-Chair Alder: We got the queue, we'll go Jennifer, Mark. Go ahead, Jennifer.

Member Warren: Okay, Jennifer Warren.

Paul, just two quick questions, at least I think they are quick.

Given what you said about the timeline that there's been between the occupancy reports and then disagreement, et cetera, was there any discussion of why not give the federal agency or user that's being monitored same-day notice so that they actually can bookmark that they're -- I mean, same day, so they can't really change, you know, anything, so that they at least can bookmark and know when you come back three months later? Because three months, nine months, it is still difficult.

Member Kolodzy: Right, okay, well actually --

Member Warren: That's the first question.

Member Kolodzy: Okay. And you reserve the second question.

Member Warren: Yes.

Member Kolodzy: We actually did talk about that, not in exactly the way you were mentioning it, which we were saying should we actually tell them we're going to make the measurements before we make them so they're all prepared? And the answer was no, we didn't want to do that, because you want to get, you know, naturally, you know, to figure out what the exact characteristics are.

But to actually tell them right after might be an interesting idea there, which is actually to give them, okay, we made measurements on this day. Just to let you know, mark it on your calendars, you may actually want to do a dump of your systems and keep it off to the side so that way, when we come back with our measurements, you are able to compare it.

Member Warren: Yes, okay.

Member Kolodzy: So that is actually a pretty good idea. I don't know about anybody else in the group, but I think that was --

Member Warren: Score one.

(Laughter.)

Member Warren: Thanks Paul. I'll leave --

Co-Chair Alder: Did you have something else, Jennifer, or --

Member Warren: I did. I had a second question.

Then, when you go to page 9, and you have a sub-bullet under the first bullet there that the goal is to ensure basically that silence is assent or consent, that the -- I mean, when I read this to say and further that the signal is not present Rather than there's some other problem, I mean, the goal is to get it right.

Member Kolodzy: Right.

Member Warren: But I guess I am a little confused by why is the burden on the one side Rather than the other? It seems to be --

Member Kolodzy: Well actually, we were talking about that the burden is on two sides --

Member Warren: Okay.

Member Kolodzy: -- as to how you actually want to optimize your system --

Member Warren: Okay.

Member Kolodzy: -- and so that's actually a real problem. Sometimes you want to make sure you miss nobody, okay? But then you -- you err completely on one side, right? And then the other direction is no, you want to have as much for sharing, and then you err obviously on the opposite side.

So the idea was trying to figure out where that balancing act was associated with some of the -- so the goal is to ensure the lack of detecting -- if the goal was intent to lack of detecting of a signal infers that the signal is not present, okay?

So the idea was if you didn't hear it, does that mean it's not there?

Member Warren: And the answer here is yes, according to the way this is written.

Member Kolodzy: Well, if you -- if you're using -- right, well that's the question, is if -- well, okay, let me -- let me tighten up that wording a little bit.

Member Warren: Okay.

Member Kolodzy: Mark? Yes.

Member McHenry: I think if you had proven ahead of time measurement setup 14 is effective against a, b, c, d, e, and f, you went out there and you said oh, you didn't see me. Well I say, well, we've proven the technique works. Either you don't have one of these signals or you weren't there.

I think if we had this dictionary beforehand, it gets rid of all these arguments.

Member Warren: Well first of all, they're not going to know that -- they're not going to know because you're not giving them notice yet.

But two, again, that's not the way this is written. This is written --

Member McHenry: That's what it was intended to say.

Member Warren: Well, again, it --

Member Kolodzy: Thank you. Good point. They are drafts.

Member Warren: Can we -- so I'd like to talk about -- I'll join the next call, if I could.

Co-Chair Alder: All right, thanks, Jennifer.

Mark, did you have anything?

Member McHenry: Well I think that addresses Tom's issue. If you know the measurement system is good, you've proven it, and the guy comes up and says oh, you didn't see me, you have the power over him now because we should have seen you, we know you should have been there, so you weren't there.

Co-Chair Alder: Paige, you had some comments?

Ms. Atkins: Thank you.

So the original question was initiated by our endeavor to look at two 5 GHz bands in particular, 5350 to 5470 and 5850 to 5925, which was in the -- the question itself.

And the intent, if you recall, I believe we discussed in the last meeting or the one before, was to help us as we move down the path of determining if sharing is possible, either via various mechanisms, maybe DFS, dedicated sensing, et cetera, if we were missing something in terms of possible techniques that could be used, and in particular, unlicensed devices in those two 5 GHz bands.

And so I -- I want to ensure that that is part of what we're explicitly looking at, and in particular, as it relates to what the discussions are in those two bands currently as we move forward over the last -- or the next few months.

So with -- if we're missing something that is a good way to implement, or a slightly different approach, we want to make sure we fold that back into our activities for those two 5 GHz bands in particular, but relevant to other -- potentially other 5 GHz bands.

Member Kolodzy: Yes, I think we went broad initially, just to try to understand the waterfront, and what you're asking for is make sure the narrowness comes back in the instance of those particular bands.

Ms. Atkins: Yes, and that, right now, that -- the narrowness is our priority, and especially as we move forward over the next few months, so getting something on that explicitly at the next meeting would be very helpful.

Member Kolodzy: Yes.

Ms. Atkins: Another piece to the question was how could you identify and mitigate before interference actually occurs?

So in terms of perhaps sensing, and again, thinking an unlicensed environment as the noise floor increases or whatever the case may be, how can you understand what's going on and trigger a mitigation --

Member Kolodzy: Yes.

Ms. Atkins: -- before the interference actually occurs to the incumbent, as --

Member Kolodzy: Right.

Ms. Atkins: -- an example?

So are you looking at that as well as part of -- I am not sure I --

Member Kolodzy: Yes, that trending --

Ms. Atkins: -- followed. Okay.

Member Kolodzy: -- part, so the third category there --

Ms. Atkins: Okay.

Member Kolodzy: -- is the trending part --

Ms. Atkins: Okay.

Member Kolodzy: -- where you see something occurring after sharing has started.

Ms. Atkins: Okay.

Member Kolodzy: And how do you make those measurements, which would be distinctly different than prior?

Ms. Atkins: Okay. Okay.

Co-Chair Gibson: Yes, I would add something. It's Mark, by the way, Gibson.

That is actually possibly part of the last bullet, which is the certification, so that there can be some measurements occurring during the certification process to ensure that you don't have interference occurring because a device has either not been properly certified or there are spurious emissions that haven't been caught or something like that, and we spent a fair amount of time on the last call talking about what some of the implications are, so you might see some of that there as well.

Ms. Atkins: Okay.

Okay. Thank you.

Member Kolodzy: Yes.

Co-Chair Alder: Oh please, go ahead. Dale?

Member Hatfield: I am on the committee. What did we have in mind for beaconing? Can you elaborate just a little bit on -- is that out-of-band beaconing, in-band beaconing? What were the --

Member Kolodzy: Actually, this goes out to some of the things you actually mentioned, Dale, which was trying to understand is there methodologies in there that help make it easier to actually find the signals?

And so the beaconing is -- was just like an identifier on the signals --

Member Hatfield: Yes --

Member Kolodzy: -- that's --

Member Hatfield: -- because there's the whole issue of reviewing within the TAC on identifiers and on emission designators and a whole bunch of other things.

Member Kolodzy: Right. We were using the word "emission designators" before, but that sometimes gets confused by how the emission designation terms are used in books, and so that is why I used beaconing versus that term.

Member Hatfield: Maybe we should say "in-band beaconing."

Member Kolodzy: But it is in-band, yes.

Member Hatfield: Yes.

Co-Chair Alder: I personally had the same, you know, feedback I think that Paige did around, it felt like very broad, and getting into the 5 GHz, I noticed that the specific bands that were asked for weren't even -- there weren't systems identified in those bands.

Member Kolodzy: Actually, there are, just that it -- you didn't see the whole list.

Co-Chair Alder: Oh, you didn't publish the --

Member Kolodzy: I mean, I only gave you the first page of the list.

Co-Chair Alder: Oh, okay. Oh, those are just examples, okay.

Member Kolodzy: Yes.

Participant: There are quite a number of pages each in those slides.

Co-Chair Alder: Okay. I stand corrected then.

Other questions?

(No audible response.)

Co-Chair Alder: No other questions?

(No audible response.)

Co-Chair Alder: All right. Thank you. And we'll move on to the next group.

And the next group is the Spectrum Access System and Spectrum Databases for International, and I think Jeff Reed is going to take us through that.

## Spectrum Access System (SAS)/Spectrum Database International Extension

Member Reed: Well, this is Jeff Reed, and to begin with, let me reread the question.

What are the challenges in using database and sensing approaches for international spectrum management, and how can NTIA help address these challenges?

And our methodology was to discuss, interview, discuss, and we've gone through several sets of interviews, and the recommendations that you see here are very preliminary. In fact, they don't incorporate some of the input that we've gotten on the latest round of interviews.

So for the preliminary recommendations, the -- the first one is that NTIA should establish priorities for collaborative sharing internationally. In other words, if we're going to negotiate with these countries on how we share, then the first rule in negotiating is knowing what you want, and having NTIA prioritize what bands, what systems would be best suited, and for which we would want to share sooner than later.

Examples could be at 3.4 GHz or 3.8 GHz to correspond to sharing systems in the U.S. Maybe, maybe not. But it is -- it is an example of what might guide the priorities for NTIA.

NTIA should also study and develop policies regarding privacy and security within international sharing. And also, we felt that other countries may need some help. They may conceptually like this idea of collaboration through some sort of database management, but they may lack the resources or the technology to be able to do that, so it may be in our best interest to share that technology, and that also brings up potential issues on export restrictions for spectrum sharing technology.

The third preliminary recommendation is that NTIA should expand its efforts to engage internationally to best represent U.S. interest. And that is somewhat of an educational process as well as expanded visibility within the international community to socialize some of these concepts, perhaps through standards bodies.

Perhaps it is a peer-to-peer socialization.

And perhaps the best way to get collaboration is to set the example. If we take the leadership role, and we can show internally how we share, it's going to make it an easier sell for sharing internationally.

Okay. The next one is one that we have -- we have heard before, and it -- it's applicable here as well, and that is NTIA should develop policies to facilitate disclosures of waveforms and waveform parameters to facilitate spectrum sharing.

If we're going to fit in within this -- this spectrum sharing framework, international spectrum sharing framework, we may have to reveal certain parameters of the signals that we expect to share, and we haven't quite worked that out internally yet. And it -- it certainly could be an important issue as we go forward and try to accommodate some sort of international extension of sharing.

And then finally, NTIA should become more cognizant of shared spectrum R&D programs and work to disseminate the information in the government and the international community. This somewhat gets back to the educational mission for NTIA. NTIA can host workshops that could help built this international collaboration. It could ask for spectrum demonstrations that incorporate technologies perhaps from other nations to help facilitate that collaboration.

And we might want to think about, given all of these numerous R&D programs that are going on in spectrum sharing, between DARPA, the National Science Foundation, and others, how do we leverage that information and perhaps disseminate it to the international community to help facilitate a more collaborative spectrum sharing management approach?

So our work plan is that we're going to continue with some additional reviews. We will probably hold a conference call soon to discuss some of the more recent interviews that we have had. And I think we are getting pretty close to being able to start to draft text and refine our final recommendations.

That's pretty well all I had. Other Members of the subcommittee, do you have any comments that you'd like to add here?

Co-Chair Gibson: Go ahead Janice.

Member Obuchowski: So I'll start out by a disclaimer saying I have kind of jumped in and out of this particular effort.

Having been involved in I guess yesterday's call --

Co-Chair Alder: You might want to get the mic a little closer.

Member Obuchowski: Oh, sorry.

I was involved in yesterday's call, and as always, I am educated by my peers. And, you know, a lot of the discussion went to the interesting question of before you even get to sharing with the government, what about peer-to-peer sharing? I mean, when you look at G5, it's going to be a system of systems. People are going to be sharing, you know, within the industry, and, you know, you get into what I call the free rider problem.

For sharing, it's a schoolyard thing. I mean, sharing is a lot easier if everybody is behaving. And, you know, about five years ago, or maybe a little less, Cisco advanced this case in -- in the 5 GHz band where because there was interference with the federal incumbents, the FCC out of courtesy to the feds closed down all sharing for a period of time, and Cisco had a lead to market with legit technology, and the bad actor in that particular band was some Motorola technology.

And, you know, Cisco I think quite rightfully made the case that, you know, at least -- well, I shouldn't judge, but I mean it seemed that they made the case that we were ready to go, we lost our first mover advantage because somebody else in the playground wasn't behaving.

And Jennifer and I and others were involved this morning in a session with the Senate Committee, and Jennifer talked about I think designing into systems sharing. I think that is kind of a way forward, not just between the government and people on the outside, but I also think it's sort of high time for the FCC to start addressing -- maybe they are -- the free rider problem.

If you expect people to share within a band, licensed, unlicensed, whatever, everybody who comes to the party needs to have some skin in the game, some commitment through their technology to make this sharing more acceptable all around, and then that also translates across the federal/commercial divide.

And, you know, I am saying this in, you know, non-lawyer speak -- I mean non-engineer speak, lawyer yes, but non-engineer speak, but I think there's this kind of schoolyard problem that I found fascinating on yesterday's call that, especially as you move into more advanced forms of sharing among commercial users, how do you address designing into the system the need for people to all Cooperate?

And then that translates of course across the divide, but, you know, even that second problem is, you know, no more complicated than the first, it seems to me.

Co-Chair Alder: Thanks Janice.

Mark, you had a comment?

Co-Chair Gibson: Actually Jennifer was up first.

Co-Chair Alder: Oh, Jennifer was up first? Go ahead, Jennifer.

Member Warren: Jennifer Warren.

So this was -- this group has been really interesting and fun because it is dealing with the technical side of issues, but also cultural.

Because when we're talking about international and international expansion, it is to other regulatory bodies around the world, many of whom are not in developed worlds, in developing countries, and there is a cultural question. There's some resource questions. There's a lot of other questions than just what's the technical answer?

And so it has been kind of interesting to have that discussion because not all regulators are -- they may be created equal, but they're not staffed equally, they're not at the same level of technology sophistication or capabilities. There's a lot of differences.

So when I looked at the question, I looked at the question what are the challenges with a very different perhaps lens than an engineer might look at the question, more technical challenges versus policy and -- and cultural.

And I still think we have to address some of those as well, but one of the -- the -- a major question that I had was in the first recommendation, it's NTIA should establish spectrum priorities for collaborative dynamic sharing internationally. To me, integral to that is how do you decide, what are the criteria for deciding when an experimental regulatory model is actually ready for export?

We don't want -- it's great to export disruption, but it needs to be disruption that we know works towards the U.S. advantage, not chaos just for chaos's sake. I mean, some people might like that, Paul.

Participant: She points at Mark.

Member Warren: No, I pointed at Paul.

Participant: Oh, okay.

(Laughter.)

Member Warren: Because he was smiling.

Anyway, but I do think we need to talk a little bit more about when is something ready for that launch? Because once you launch it and the U.S. launches something, it is taken to be effective, perhaps, particularly if we don't sell it with caveats, and we're not as good with caveats as we are with promotion and proselytizing.

So I -- I just think -- I think we need to talk about that, and venues, and where we can then have those kinds of discussions that don't necessarily immediately have treaty ramifications, would be perhaps the ITU and the development sector, a role for which the development sector might be ideally suited, but again, after we've decided as a country, what is, you know, what's right, but based on some criteria that I imagine would be both FCC, NTIA, and in conjunction with industry stakeholders and other stakeholders, to put together.

But I think we'll have more discussion perhaps about that in some of the follow-up calls.

Thank you.

Co-Chair Alder: Thanks Jennifer.

Any response, Jeff? Or I'll just go to Mark.

Co-Chair Gibson: It's Mark Gibson.

I was on the same call yesterday that Janice was on, and I just was in the car, I couldn't say anything. But I had a different takeaway, but it's -- and I don't want to talk too much out of school because we haven't had a chance to process -- but the takeaway I got is that, you know, my feeling on this international sharing is the technology is kind of getting there. This is really going to be mostly about policy and regs.

The call yesterday was with a bunch of folks from DoD, and these are all guys that have been around this sharing thing for a long time. They know this very well. And they were very -- it was a very productive discussion with the silences, because there were a lot of questions being asked about how do we do this, and no one really knows.

So as we process this information, I think one clear recommendation we're going to need to work on, and maybe it's already in here, is how do we work this in an international process? Because that is what the, you know, the crux of this subcommittee is, and we really don't have a way to do SAS or any sort of dynamic sharing like this internationally.

And I can tell you from just personal experience working on a program where part of our responsibility is to look at how you instantiate a spectrum sharing machine in a foreign country, there are a lot of issues that may get kicked to a work -- or certainly, that have to be worked through ITU.

So we'll talk about this when we get a chance to process, but I just wanted to kind of funnel into what Janice and Jennifer have been saying. We've got some interesting work to do.

Co-Chair Alder: Thanks Mark.

Mike Chartier?

Member Chartier: So just to kind of second what Jennifer said, I noticed that part of the work is to discuss what the LSA community -- the LSA community, their first implementation of -- of LSA, they would love to be something like AWS-3. That's the poster child for -- for sharing or getting access to federal spectrum.

And that's largely unknown outside of the United States. So most of the world would benefit much more from -- from understanding how we implemented AWS-3, and mechanisms and coordinations that are in there, before SAS, that we haven't even deployed in this country.

So just to second what Jennifer said, if the United States decides to go on a road trip to promote sharing mechanisms, you know, the first thing that the rest of the world would benefit from would be our great successes with AWS spectrum before SAS.

Co-Chair Alder: Thanks. We'll go to Michael, and then I'll come to you, Paige.

Member Calabrese: Sorry if I missed this, but could someone I guess state, articulate again, what would be the benefit -- what is the purpose of this from NTIA's perspective, of this international extension? I am wondering if it's for -- to accommodate our agencies operating overseas, or if it's mainly a harmonization of market --

Co-Chair Alder: Jeff, do you want to –

Member Calabrese: -- or some other --

Co-Chair Alder: -- respond to that, or --

Member Calabrese: -- some other purpose.

Co-Chair Alder: -- as a Member of the committee, I will, but go ahead.

Member Reed: Sure.

You know, I think there are multiple purposes. One is I think it would make it easier for federal agencies such as DoD as they operate overseas if there is some sort of standardization internationally.

I also think that it could help the U.S. economically if we are technology leaders in this -- in this particular area.

And I think it could also help with harmonization between countries along our border, and how that we manage spectrum.

Co-Chair Alder: So I'll just chime in, respond.

My working assumption, and maybe I'll stand corrected, is that we're really working on the problem, if we do something in the United States, say, 5 GHz band, and we protect the radars or something, but there's radars internationally. How are those -- there's the worry that those devices will go out internationally, and so that was my working assumption, that the focus of the study group was how do these people get the protection internationally when we do something domestically?

With that comment, I'm going to turn to Paige, and she can correct me.

Member Reaser: -- comment before Paige comments, though.

Co-Chair Alder: What?

Member Reaser: I want to make one comment before Paige comments.

Co-Chair Alder: Okay.

Member Reaser: The other thing, we're going to have a telecon with the -- the CPT people, because they're already doing this. The other thing you've got to worry about is there's already models being implemented in the developed countries overseas in terms of a two-tier system that we don't know that much about.

And so then you have this issue about device migration into our territory, or how that's going to work. So you -- I wouldn't say it's a competition or a race to the finish, but there are people in the more highly developed parts of the world that are already looking at other kinds of sharing models, and so we're going to have a conversation with them to find out what they're doing because we're not the only ones thinking about this, and they may be trying to export their idea here, as far as we know, or to the ITU.

Ms. Atkins: One of the primary drivers of this question is looking at approaches that we want to implement, potentially in the U.S., that will enable sharing, that agreements would be based on that sharing occurring under those circumstances in which some agencies, for instance, may not believe could be implemented outside of the U.S. due to security or other concerns.

So I think our approach is we don't necessarily want to base our approach for sharing in the U.S. and base agreements that may then be carried internationally that couldn't be implemented and prevent federal systems, DoD systems, going overseas and they wouldn't be protected or we would have no control over those systems, whether they be SAS systems, databases, et cetera.

So it's really all about helping us make smart decisions domestically, and then how we would carry that forward internationally to protect our interests. Did that make sense? Okay.

Co-Chair Alder: Mariam.

Member Sorond: Thank you. I just wanted to highlight, I think Jeff is raising one of the points -- is a really good point -- in the standards participation. And I wanted to give an example of that that's kind of relevant.

NTIA, through ITS, has been participating in 3GPP for years. And for public safety requirements related to FirstNet, they've done an amazing job at getting those implemented. And as a natural occurrence of that, what happens is that they have to coordinate with the U.K. home office. They have to coordinate with a lot of the regulators who are showing up in the standards body to essentially get these requirements in.

So I think that, you know, just maybe a question, have you contemplated expanding that because standards are always a good ground for going in and getting these agreements in outside of the work process and things like that?

Co-Chair Alder: Thanks. Do you want to respond to that, Paige?

Ms. Atkins: And I think standards are important and critical for enabling things internationally, but going back to what Mark said I believes it goes beyond technical concerns into policy and other concerns as well. So we want to make sure we're looking at it holistically.

Co-Chair Gibson: First thing, Rick, put your table tent down, please.

The other thing I wanted to say is to Michael's point and I know a lot have tried to address it, but I think I'd like to add to that, too. If you look internationally to allocation 3100 to 35 or 36, depending, it's internationally allocated to ready relocation, which implies radar. And that's the band that a lot of us are looking at for new technologies, whether it be mobile or otherwise. And so the way we're doing it in the United States is through a spectrum access system or something that looks like that. And so to the extent you want to put a spectrum access system and have it work internationally, there's going need to be some facility to break those barriers down and a lot of that radio location is military or is government.

So I think what we need is in this discussion and I'm learning this from the talk we had again yesterday is the role that NTIA can play in that international realm, not for commercial, but more for the sharing commercial and federal governments. So I think that's one of the asks that will be coming from this working group is to better work those issues.

Co-Chair Alder: Jennifer.

Member Warren: Jennifer Warren. I do have a question though because I missed the call where this was discussed and so my apologies. But there's a reference here to red book changes and the export of spectrum sharing technology. And I'm wondering if what we're talking about there is -- are we talking about export control issues or are we really talking about NTIA Redbook? Because I've been wondering if there are export control issues that we do need to look at as well, and I don't know the answer to that, but I know that's not within NTIA's purviews. But is it something that we need to flag as an issue? I just raise that more broadly to the community.

Member Reed: I think it's probably beyond the scope of this group, but I think it will be an issue because spectrum sharing could be viewed as a military technology or it could be viewed as a commercial technology that has military ramifications and hence, subject to errors.

Member Warren: Perhaps we should just note that.

Co-Chair Alder: Paige, did you want to give any other feedback to this committee?

Ms. Atkins: So you talked about interviews, conducting interviews, and again part of the genesis of this is can we address the concerns for things like security or other issues well enough to even then bring these solution sets internationally and be confident that we'll be able to do what we need to do.

Have you generated a list of what those major concerns are, based on the interviews that you've done that then would be addressed within the context of this subcommittee?

Member Reed: I don't think we have a comprehensive list and we have noted that certainly security is going to be an important part of it, but yes, we need to come up with that.

Ms. Atkins: And that's consistent -- these concerns are consistent in the 3.5 discussions and other ongoing activity. So I think if we can at least summarize what those major issues are because what we want to do is to be able to try to address those major issues and the recommendations in terms of how we would overcome them.

Member Reed: You know, I'm not sure that the committee will have the bandwidth on how to overcome those issues because, for instance, the security one is a very complex one. That's probably going to take a lot of smart people working --

Ms. Atkins: I agree, maybe not in detail, but I think we need that definition of what those major issues are as we look at potential recommendations that we might want to move forward with.

Member Reed: Sounds reasonable.

Co-Chair Alder: Last call then for questions on the spectrum access for international group.

Thanks, Jeff, and to that subcommittee. And then we'll move on to our final subcommittee which is the 5G Exploration Subcommittee and I'm not sure if it's going to be Mariam -- Mariam, are you going to present? Or Robert?

## 5G Exploration

Member Sorond: I was going to start and then Rob will chime in.

So we have had very good participation on our calls. The first page lists the Co-Chairs, NTIA, and the Members.

Second page is our study question. It has been revised. We don't have the old revision in, but this was with the approval and guidance from the NTIA to make it more specific on related on what aspects of 5G we're looking at.

And then moving on to the work plan, we've met four times since December and we're going to continue to have our regular meetings. I think we also got feedback from the NTIA to focus on differentiators between 5G and 4G and we have a report that has been ongoing. So I just wanted to highlight one of the things about 5G.

And I think Paige -- Jennifer, everyone has been talking about how it's a system of systems and I think the agreement right now in the industry and also a lot of different workshops and conferences and everything is that. That's what it is. It's not just a 3G to 4G evolution in terms of a fatter broadband pipe and then it's going to include a lot of vertical markets and everything else.

That's the only thing I think there's agreement on. On how to get there, there's definitely different views. And that's one of the challenges that carries over to the work that we're doing. The multiple views right now on it is that there's one view that says, here's this particular standard, here's a date that's defined by it. Let's say 2020 is part of the IMT. Stuff like the I2 and that's what 5G is. When you get there, you call yourself 5G.

There is also a different view that says it's going to come in phases. There's Olympics sort of activities that are going on, so you can say that some stuff is going to come in 2018. The rest of it in 2020 and there's a progression.

There's also this final view that 5G is here today. And machine type communications are -- and that's a very true statement. So you could kind of take this question and run with it and just focus on MTC today and answer it and be done with, but obviously, we understand that there was this futuristic view of how to approach this. But it is going to be challenging because a lot of the things are not defined. So we're hoping that, you know, NTIA would consider this as a start and then ongoing as things come in more and get defined.

So what we did is spend a considerable amount of time on a report. We got input from a lot of the subcommittee Members, very good input that outlines a lot of these different areas of information, standards, bodies, regulatory and everything to sort of like say hey, this is out there and so we can kind of derive from that because again, the unclear nature of how things are going we have to be comprehensive and at the same time same limit the scope of what we're looking at.

And then just on our last two calls we got close to kind of finalizing that report and I think it's a 20 some page good report and got close to the recommendations. Per the guidance of NTIA and Paige, our recommendations are focusing on differentiators. And if you go over to Slide 5, it is just listing some concepts over here, so obviously we were going to be more specific about these concepts and give specific recommendations around these, but just to highlight the topics, you know, it's obviously things like deployment scenarios. You can envision that, you know, you're not just going to be a macrocellular type architecture. You're going to have OIT applications. You could operate on a lot of spectrum, little slices as opposed to big chunks, but then at the same time you need all the big chunks because of the higher throughputs, so it's a variety of sort of the kitchen sink thrown in at this problem statement, so you'll have to be specific about the deployment scenarios and we're going to have specific recommendations.

Frequency bandwidths is another thing and sharing, we have talked about how like you know, you have a 10 megahertz, you share that 10 megahertz, and there's a 10 megahertz next to you and this is what's happening. Well, when you're talking about 500 megahertz of spectrum, there's going to be so many different types of operations in there that it's going to have to kind of engage a whole new look and dynamic because of these large frequency spectrums that are coming in.

Probability aspects, you know, I think a lot of the studies so far have been a lot of worse case analysis. I think this is an appropriate time to bring in probability aspects because that's why 5G is going to be special in the sense of the types of operations that are going to be in there, ranging from things that are at all not like critical communications, or not even -- they're not time-sensitive communications like parking meters or whatever, something you can push through during the night, all the way to broadband. So obviously, the probability aspect needs to be brought into this whole picture.

And then, interesting, subcommittee Members brought up this next generation of federal access. So as commercial systems are going to 5G, there's the 5G of NTIA and federal agencies as well, so that's also a good thing to look at and maybe collaborate that as you are you developing technology, both look at sharing or other enablers for this technology development.

Those are some concepts. I just thought I'd say some words so you'd know that we've been doing work. And that is all I had at this point.

Rob, did you want to add?

Member Kubik: The only thing I can add is that Mariam did a great job of covering where we're at right now. I think just to put a finer point on things, for example, on the probability aspects, you know, when you start looking at these higher frequencies, 28, 39, 60 gigahertz bands, you have new possibilities with phased arrays. So now you're scanning beams and things like that with your transmitters and in the receivers, make this whole analysis much more complex. So that's certainly a new aspect with that probability.

And the other side she already talked about is we're not talking tens of megahertz for a channel, we're talking hundreds and even larger, maybe even gigahertz channels as we start to get higher in frequency. So all these new aspects that we have to consider as we start doing this sharing considerations. That's all I have.

Co-Chair Alder: Thank you. I'd like to say I certainly enjoyed the reading of the report. It was very informative and covered a lot of ground. So thanks for preparing that.

And I know my personal comment was I think that 5G is a big area and as we drafted the question in concert with NTIA, I think the key thing was to focus on one, what's unique for sharing in 5G? So I think that's some guidance I would give. Focus on what you need for sharing in 5G and actions the NTIA could take. Because obviously the 5G subject matter is just so broad you'll just be swimming.

Harold, did I see that you had a question?

Member Feld: I did. Thank you. Understanding that the report is still incomplete, but there is an open proceeding on this at the FCC and I'm curious whether the CSMAC recommendations are something that are likely to be filed or if they inform NTIA with regard to possible filing at the FCC or none of the above?

Ms. Atkins: My initial reaction is it will inform us, not necessarily for filing per se, but I think we have to see what it looks like in terms of what comes out and how it relates to the frontiers proceeding that you're referencing.

Member Feld: If I could just have a follow-up question. In the flip direction, I'd just like to ask the chairs of the working group here, the subcommittee, if they're monitoring the docket with regard to any of the filings that might be relevant to federal and non-federal sharing? And if not, whether it would be useful to pull the filings? And I know it's laborious, but there are a number of us who are following the docket anyway. And so I'm curious if it's useful for the subcommittee to take a look at what's been filed in the docket on this question specifically.

Member Kubik: Sure. Rob Kubik. Yes, I think I'll speak for Mariam. We probably have both been following the docket very closely. Our companies are very active in this.

The one concern I think we're trying to hit broad goals here, broad direction, recommendations for a long-term plan for NTIA here, I'm not sure that what's being said in the docket will fully inform that, but I think we'll look at that and see if we can pull some nuggets out of there for recommendations if possible.

Co-Chair Alder: Paige.

Ms. Atkins: One more comment and this is related to the next generation of federal networks. One of the comments that I made in my opening remarks or my spectrum update was on dual-use technologies. And I think one of the unique aspects of 5G is in opportunities for dual-use technologies that could, in fact, enhance sharing. So just to think about that a little bit as you continue to develop the recommendations.

Co-Chair Alder: Okay, let's open the floor up for questions to the subcommittee. There's got to be some questions. Mark, come on.

Co-Chair Gibson: I just had a comment. This is Mark Gibson.

The subcommittee had struggled initially, and I'm not speaking out of school either, with trying to define 5G. Mariam did a very good job saying 5G means different things to different people. And I think this is a really good start at trying to get a recommendation in order.

A question I would ask is, do we need anything of NTIA at this stage in terms of guidance? I mean Larry made a good point to say that, you know, we wanted to have this on here because we wanted the NTIA to kind of get their ideas going on 5G as well, so do you think, is there anything you need from them at this stage in terms of guidance or anything like that?

Member Sorond: This is Mariam. We've gotten really good participation from Rangam. So we are having feedback from him on the call, but I think overall, it would be I guess helpful to give us a sense of relief that yes, we know this is going to be a sort of a preliminary thing. And it's an interesting question. It has to be ongoing. So maybe some guidance on do you want us to look at a particular phase? Because I know you gave this over -- this umbrella of differentiators, which is really nice and the unique concept of it, absolutely. That's the goal of it. But is there something more that could bound it on a deliverable in time for you as opposed to concepts?

Ms. Atkins: Let me think about that one a little bit in terms of how we could further bound it for the initial recommendations. I would emphasize a point I made earlier that in certain cases the recommendation may be teeing up future topics for the CSMAC, but this is one subcommittee in particular that I do believe it will continue in some form or fashion. So I would -- we will take the action to see if we can further bound it for this initial question, but I would also ask you think about recommendations in terms of the next set of questions or next question related to 5G that we want to tee up for the CSMAC at the next cycle.

Co-Chair Alder: I didn't quite see who put their card up first, but we'll go to Robert.

Member Pepper: Thanks, Larry. Robert Pepper. So first, Larry, I like the way you framed it so what's unique for sharing, but a question in that context then for the subcommittee is in terms of this definition of mapping it. Have you looked at -- I assume you did the next generation mobile network group, right, and that the evolving set of requirements, right? And then looking at that, mapping their evolving set of definition, set of requirements, and map it with the next generation federal networks in terms of requirements.

And then when you look at that, then I think it would give -- you know, provide a way to think about in that context what's unique about sharing because you're going to have the next gen federal networks and then the next generation mobile networks specifying through the 3GPP, et cetera, on the 5G work, and then looking at those overlaid, and then figuring out what the opportunities or not are vis-a-vis the sharing. I think, Larry, we begin to get your point.

Co-Chair Alder: Yes, I was just saying, just trying to remind people that the question did try and have some focus because I know it's such a broad topic.

Go ahead, Robert.

Member Kubik: Rob Kubik responding to that. We've done a very good job of documenting where the commercial systems have been put together and where they stand. I think we need a lot more information from the federal side to really make that comparison at this point, but if NTIA is able to provide that, I think we would be more than willing to look at it.

Co-Chair Alder: All right, we'll note that then.

Ms. Atkins: Let me clarify that. So when I think of dual-use technologies and sharing, the applications may not be exactly 5G-ish. You may leverage the technology for applications, aeronautical mobile telemetry, or other types of applications that would not necessarily be directly aligned with what 5G is traditionally thought of in a traditional network standpoint.

The idea of dual-use technology or capabilities that could then be reapplied in different ways for the federal requirements, but not necessarily federal 5G specific networking requirements, if that made sense.

Member Sorond: Can I get some clarification?

Co-Chair Alder: Yes, go ahead.

Member Sorond: Sorry, this is Mariam. So I think what Robert was pointing to is that -- the NGMN requirements, for example, are concepts that are the pillars of defining 5G. So one million connected devices per kilometer scored, as opposed to what we have today, this is delay, reduce delay of one milliseconds.

Is there -- and a series of broadband connectivity, machine type communications, massive machine type communications support, is there a parallel to that that the NTIA is working on per operation, per agency or per sort of technology that says that here's what future technologies of these bands would go to? And that's what we could do.

Ms. Atkins: Yes, there's nothing within NTIA working that. There may be multiple efforts spread throughout the agencies that are looking at their future requirements, of course, but we have not taken any action to try to roll that up into something in that vein.

Co-Chair Alder: Janice, you've been patiently waiting there.

Member Obuchowski: Oh, no. I'm fine. First, I wanted to compliment Mariam and Robert and the group. This is an excellent draft report. And in terms of putting something out there that educates policy makers on all the activity, and frankly the complexity of this, it's terrific. And it's in plain English which is great.

I guess the only other point I wanted to make -- in a way it bounces off what Mariam said and something I always remember that Dennis said in an earlier meeting, that when we look at 5G we have to understand the beauty that there are going to be so many more levers that are going to be worked into the system.

I think it's probably, I can't speak for the entire federal user community, but you have people coming from all over -- all different kinds of requirements, FAA versus NASA versus DoD. Those are some of the biggies. And then within those agencies, very specialized new technologies that people might be envisioning.

I think it would be useful to kind of go to my earlier point, the point of designing into 5G, and perhaps being somewhat explicit about it. These are some of the levers that can be designed in at this stage of the game that could be very helpful for sharing.

I mean I don't know if you're -- that kind of a sort of broad-based set of criteria, even if it's imperfect, I think would be very helpful to federal users. You've got to realize a lot of these people don't come right out of MIT yesterday. They may not know what the state-of-the-art is, but they could understand and be more comfortable with sharing going forward if, you know, part of the process was to say these are some of the most valuable levers and this is how the world can change and perhaps both sides could then design sharing at an earlier stage of the game when it's always affordable or more affordable and feasible.

So great report, and if you can apply the brain power you've applied to those levers, sort of articulating the levers going forward.

Co-Chair Alder: Thanks, Janice. Jennifer.

Member Warren: So I had a question because when -- and I forget who -- Jennifer Warren. I forget who mentioned about the mapping of federal networks. And it occurred to me having just listened over the last couple of weeks to speakers like General Hayden and Deputy Secretary of Defense Work, and their emphasis on the future role of commercial satellites as being integral to the Department of Defense's operations globally and that they are going to be, in fact, part of the way that the Department of Defense deals with resiliency for their network operations on a global environment.

The rest of the world isn't necessarily in line with how the U.S. is proposing to look at 28 gigahertz of Ka band and I wouldn't expect it will. So how do you plan, if you do this mapping, to look at regional and global systems that may not emulate how one either has to or chooses to operate domestically? Because I think that when you look at what is a DoD network, you have to take the whole and that whole is going to be very different, very likely, from what is domestic. Thank you.

Co-Chair Alder: Rob Kubik.

Member Kubik: Rob Kubik. Certainly, granted I think it's going to be different frequencies across the world and I think that's something we'll have to take into account. I think that's probably part of this ITU process. I know they're looking at bands that are in adjacent, nearby frequencies, also quite disparate bands. So I think that 5D process that they're working through will try to handle that somehow. As far as the recommendations coming out of this group, I think for now, I think we can focus on where we know systems are going to be deployed and maybe make some general recommendations from what we learned there on how they should handle this for other bands where these operations will occur.

Co-Chair Alder: Okay, great.

Member Warren: Jennifer Warren. I think when I look at the question and the question is what standardization challenges, technology and standardization challenges, I think this is a challenge that needs to be flagged even in the domestic report. I don't think it's something that is just to be dealt with in the 5D process. I think it has to be flagged here and highlighted as something that needs to be dealt with and understood in its full entirety, even domestically. So I would suggest that we find some language to at least note that, if it's not already.

Member Sorond: This is Mariam. I think there are two different things, right? And you're raising a really good point, but that's not a focus of here. This is in the context of 5G, so not so much sharing in general which is happening right now globally and whatever. It calls out specifically 5G. And just -- but it could be answered in a way for 5G to say that, for example, like you mentioned satellites, like 3GPP right now, the standardization bodies is considering actually integrating satellite and terrestrial, right?

I mean maybe in the future, technologies or something, these separations between systems, federal users, whatever, will go away. But that's our challenge. There's so many good ideas out there, future-looking ideas. Which one is going to make it and which one is going to happen, that's the question. So we were trying to keep the scope only limited to what's kind of like a future-looking technology as opposed to the problem at hand right now.

Member Warren: Jennifer Warren. I'm again just going off the question and the challenges unique to 5G is associated with federal, non-federal spectrum sharing. I would think that unique to 5G will be the fact that -- well, perhaps you won't think it is, but I think it's still a note that there is going to be a differentiated -- significantly differentiated band plan that might require different approaches. But we can talk about it in your next call. I guess there will be a next one. Thank you.

Co-Chair Alder: Other questions for Robert, Mariam, and the rest of this subcommittee? Any questions on the phone?

Okay, I think then that brings the end of the subcommittee reports. So the next -- we're well ahead of schedule which is probably good for a Friday afternoon.

# Opportunity for Public Comment

The next item is the opportunity for public comment. So I'll first ask do we have any public comment within the room? Not seeing any public comment in the room, I'll ask do we have any public comment on the phone? So I do not think we have any public comment today.

So we're down to the final agenda item, which is just closing comments from the chairs. I'll make a couple of comments and then pass it to Mark.

# Closing Remarks by Co-Chairs

Really, my closing comments are more administrative. It's just to remind folks that the path that we talked about in the beginning, I think there's been great progress. We heard great updates today. The subcommittees are at different phases of obviously writing the specific recommendations, but I do feel like everyone is on a path to have that and our firm goal. And I think Mark's and our job will be to hound some of the subcommittees a little bit to have actual written text for the May meeting and that May meeting is yet to be calendared. But that's our goal to have that text, bring it. Hopefully, have it finalized so that as Paige said in the final meeting of this CSMAC, which will be in the August time frame, CSMAC and NTIA can provide feedback on the recommendation. So that's kind of the schedule we're working to. So I ask all the subcommittees to try and hit that and I think everyone is doing a great job on that.

I think that was my only comment. Hold on, I wrote down here -- yes, I think that's my main comment.

Mark, did you have any other comments?

Co-Chair Gibson: The only thing I would add is I realize and I think I had a quick conversation with Paige about this, as well as with Larry, the five work groups or subcommittees, whatever we call them, is a lot, so I would just like to say thank you for all the hard work you're doing, especially with the work product that's come out. It's really excellent. So thanks again.

I also would like to thank Tom and the kind folks at Wiley for the space. I'm sure this goes for high dollar, so thank you again very much. And with that, I hope everybody gets home and go Terps.

(Off microphone comments.)

Co-Chair Gibson: Good point. Bruce, do we have any -- May 19th? Okay, so Bruce says around May 19th, is it around or on? Some folks have got travel arrangements, so as soon as we can put it out, especially -- is it going to be in the D.C. area? Okay, so it's in D.C. That helps.

Co-Chair Alder: Yes, there's not much time. We've got a couple of months. I think we're adjourning because I see people leaving. Thanks, everyone.

(Whereupon, the above-entitled matter went off the record at 3:19 p.m.)

# Adjournment