

TRANSCRIPT FILE

NTIA CSMAC Meeting - April 25, 2018

H. MARK GIBSON: Good morning. Whoa, hi everyone. [Inaudible] welcome to the CSMAC meeting. Okay, good. Welcome to the CSMAC meeting. We are a few heads down but we have a full agenda, so let's go ahead and press on, and those that aren't here have to play the reindeer games. So a couple things on logistics, as you will note, the microphones are somewhat sparse today. These microphones, Dave correct me if I'm wrong, are the ones that we need to be using? Okay so when you put your table tent up what we will do is try to identify your guys and get the microphone passed. Please wait until the microphone is in front because this is obviously being recorded as well as being transcribed. The little ones, what are the little ones for? Just the room?

[Inaudible voice off microphone]

H. MARK GIBSON: That's a little bit of logistics. The mic situation is what it is, so we will work with it. We'll work with it. That is it on logistics. Thank you to Mark and the law firm for, Morgan Lewis, I forget the last name, but Morgan Lewis sorry about that. Thank you. Thank you. I apologize. I thought I had in my head. No. But thank you anyhow. These are very nice digs, so thank you very much. Very easy to find. It's nice to be in a large space. So, thank you so much for this. I think that's a lot of the logistics to get out of the way. Anything else we need?

Okay so let's get...

[Inaudible voice off microphone]

H. MARK GIBSON: That's fine. Thank you. All right. Yeah. Let's do a quick around the table so we can do a rollcall. Carl, let's start with you and we will go clockwise.

[inaudible voice off microphone]

ALLEN MACKENZIE: Allen MacKenzie, Virginia Tech

RICK REASER: Rick Reaser from Raytheon

MARK CROSBY: Mark Crosby, EWA

PAUL KOLODZY: Paul Kolodzy, Kolodzy consulting

MARK RACEK: Mark Racek, Eriksson.

MICHAEL CALABRESE: Michael Calabrese, New American Foundation

DAVE REDL: David Redl, NTIA

LARRY ALDER: Larry Alder: [inaudible]

H. MARK GIBSON: Mark Gibson, COM search

PAIGE ATKINS: Paige Atkins NTIA

[inaudible voice off microphone]

DENNIS ROBERSON: Dennis Roberson, Roberson and Associates and Illinois Institute of technology

[inaudible voice off microphone]

BRYAN TRAMONT Brian Tremont, [inaudible]

[inaudible]

CHARLA RATH: Charla Rath, with Verizon

DALE HATFIELD: Dale Hatfield, University of Colorado

CAROLYN KAHN: Carolyn Kahn, Mitre

PAUL ANUSZKIEWICZ: Paul Anuszkiewicz, CTIA

H. MARK GIBSON: Okay and Steve Sharkey just walked in.

[Laughter]

H. MARK GIBSON: This is like last night's White House dinner, Steve Sharkey. Yes. Yeah. Okay so that is the CSMAC members in the room. Are there CSMAC members on the phone?

JENNIFER WARREN: Yes hi, Jennifer Warren.

H. MARK GIBSON: Hi Jennifer.

JENNIFER WARREN: Hi.

H. MARK GIBSON: Kurt, you on the phone? Okay. And Bob Weller, are you on the phone? Okay. Too bad. Okay. Then let's go around the room, same direction for visitors. Let's start...

[Inaudible voices off microphone]

H. MARK GIBSON: Okay, so that's it for logistics. Everybody should know where the restrooms are. I hope. If not, ask one of them. That I think is it for the logistics and the check in. So without further ado I'd like to introduce Dave Redl who's going to make some comments. Welcome, Dave. Thank you for being here.

DAVID REDL: Well thanks guys. Good morning. Welcome to the first CSMAC meeting of the year that also happens to be my first, which I'd have to say out front I'm excited to be here. I know most of you. I've had the opportunity to work with the vast majority of you over the last 15 years of my career, which has been entirely spent in some way

shape or form working on spectrum policy. So I'm really excited to be here and get dug in on the hard work that you are all doing.

I know we are at that point now where it's time to start looking at teeing up questions for the next CSMAC which we'll be constituting this year and the next cycle should be an interesting one based on all the work that this group has done and the work that has been teed up by Congress and by the administration going forward. I think it is worth starting off by noting that this group was ahead of the curve. And I thank you all for all the work that we've been doing that now has been memorialized in mobile now act, which was passed as part of Ray [Baum's] act in the Congress. The work you guys have been doing on finding ways to incentivize federal government spectrum users to get more efficient and finding ways to promote deployment on federal lands has been a good groundwork, a very good groundwork for us to get started from. We are now digging in with a renewed vigor based on these, at NTIA to make sure that we can comply with what Congress has asked us to do but also so that we can continue the good work of this group.

Among the other things we'll be working on beyond those few that have already been mentioned, identifying potential bands for repurposing in both the low and mid bands, these are priorities in the legislation and ones that this group has been working on not only for this cycle but seemingly for its entire history and we're looking for ways to streamline the deployment on federal lands by working through our broadband interagency working group as well. So the work you all are doing is helping NTIA and the real utility service in our cochairing of that group.

Also the administration, we are taking a big picture look at spectrum use. And on that front I'm happy to report that NTIA has been working with the administration on pursuing a new national spectrum strategy. We are working with the White House and other agencies to take a hard look at the existing spectrum memoranda that are part of the White House's approach to spectrum and trying to put an NTIA and certainly [those in] this group would find very familiar. We are working on that actively and hoping to have something coming out soon. But in that vein, I'd like to announce that we are going to be having a spectrum symposium later this year. We're holding it in June, Where we are going to bring in folks to the national press club from both academia, from the government, from private sector, to figure out ways that we can focus this work, bring in sort of best practices that have been working and really take a hard look at the approach that has been taken by the US government for the last 8 to 10 years and how are updating it can make it more resilient, make it a more flexible approach that more approximates the way that we really are actively looking at this every day at NTIA. It will be a half-day morning event and we hope that you guys will all be able to attend. I think I skipped over the date. The date is June 12th. And so as I see Anne Vital who does our public affairs nodding her head at me like please get the date out there, David, the one thing I wanted to make sure you got out there. We welcome you guys being there and helping us in the dialogue. Meanwhile we are continuing across a broad front to make

progress and making more spectrum available. As many of you know, we were happy to announce that the PPSG has selected 3450 to 3550 as the next candidate band for potential repurchasing. That's a band primarily used by the Department of Defense and we are happy to be digging in and doing the hard work of looking to see how we can make the systems in that band coexist with others.

We continue to work with the FCC on citizens broadband radio service, CBRS the 3.5 spectrum. ITS Boulder is hard at work with our both FCC colleagues and the private sector in trying to get to yes on the SAS and ESC. We are going to need in order to get that band deployed and get it out there and providing service to the American public. Also we are working actively with the commission, as many of you have probably seen, to make sure that as we go forward we continue to protect the Table Mountain site. I'm sure you're all aware Table Mountain is a quiet zone that ITS Boulder maintains outside of Boulder Colorado where we do RF, R&D maintaining that as a quiet zone is a priority for us as the hard work that they do, the important work that ITS does is dependent on a controlled RF environment. So I thank you all for your continued help in making sure that Table Mountain remains a place where we can do this good work.

Still working on frontiers as well as a number of you. And I think the most important thing to also add is the spectrum pipeline act work that we are doing. 1675 to 1680 and 1300 to 1350 have already been approved and the work to produce pipeline plans for those is ongoing. There are other bands that are in the works that we are hoping to get pipeline plans on very shortly and we are going to continue to work actively on all these fronts to make sure that the work we are doing here and the work we are doing at NTIA and in the interagency process continues to all work productively to make more spectrum available.

Other contributions we can make to help make the spectrum environment, as I mentioned ITS Boulder, you know, the area of interference protection, detection and monitoring is an area that we are very actively working on and working with the FCC as well. I suspect we will continue to try to find ways to collaborate with the commission on this effort as it's going to continue to be a contentious area as we try to squeeze more out of the low and mid band spectrum that we are already using in this country.

And on one last sort of initiatives front, I would note that if you have not seen, Sec. Ross has been very active in promoting the promotion of the office of space commerce within the department from a NOAA sub office to being directly under the secretary of commerce, to take a more active role in providing a one-stop shop for the commercial space industry, whether it be for satellite launch, or for communication services within the Department of Commerce. As you know, we continue to be the group within the federal government that works on both policy and spectrum when it comes to federal users. And we are working closely with the secretary's office to make sure that as we go forward we are all working hand in glove to get the best outcomes for our commercial space partners.

Last but certainly not least, many of you are active at the ITU and I would be remiss if I got to any public forum and did not mention the fact that we are running a candidate to head the development sector. Doreen Bogdan Martin, who is known to some of you but not all of you, former NTIA employee who has spent the last 25 years working in Geneva at the ITU on these issues in the Executive Secretariat there. You know, if you're going to run a candidate from the US for an international position it helps to have the very best candidate, and we certainly do. And so I urge all of you, if you have not been active in this to please do everything you can to help us promote her candidacy. Doreen is more than qualified and I think perhaps more interestingly, if she were to be elected to one of the five elected position she would not only be one of the first American elected to one of those five positions, she'd be the first woman in the 153 year history of the Union. So a big opportunity for us as we head into the plenipotentiary conference later this year.

So with having got the laundry list of things I wanted to mention to all of you out of the way, I thank you all again for all of your hard work and I look forward to joining you in it over the course of the remainder of this cycle.

H. MARK GIBSON: Thanks, Dave. I noticed from the agenda I jumped a little bit and did the rollcall out of order, so mea culpa. However, having said that we are at the point where would like to welcome our visitor Matthew Hussey. Welcome, Matt. Think we are now at the point where we kind of share our collective thoughts on things. I will get started. It looks like the work has been going well. I've been participating in some of them, particularly in the enforcement one [inaudible] has done, but it looks like we're getting to the point we will have recommendations in the timeframe we were hoping for. So thanks everybody for the hard work you are putting into it. It looks like it's paying off at least in terms of recommendations. So keep going. And we will be ready for the out brief I guess it is at Boulder. That's about all I have to say. Larry?

LARRY ALDER: I think this is the first time we got together this year to kind of reconstitute. Last year was a pretty big push to get through a one year cycle and I think it was pretty clear from David's emails we are on an even shorter cycle this year. So if it wasn't fast enough last year. So just to restate the obvious, we are shooting, as Mark said, for proposed recommendation in the Boulder meeting which will potentially be the last meeting of this group. There's a possibility of an if-necessary meeting potentially in the fall but we are shooting to wrap things up in the July Boulder meeting as Mark was stating. So thanks again. And we kept it, obviously we kept the same subcommittees, kept the same subcommittee chairs just to keep that momentum and add on a little bit to what was done last time. And as Mark said, the work seems to be going really well and at the few subcommittees I've attended the discussions have been fruitful.

H. MARK GIBSON: Great. Thanks Larry. I just want to add that I got an email from Bob Weller. Bob Weller is actually here but on the phone. Just, everybody should know that. So I think that's it. So now I think I will turn it over to Paige for the spectrum update.

PAIGE ATKINS: First of all, I'd like to thank Mark and Larry for kicking us off and I want to welcome my boss to his first CSMAC meeting. We are very grateful for his leadership and his wealth of experience on spectrum policy and I promise you I'm not just saying that because my midyear review is next week.

[Laughter]

PAIGE ATKINS: So, as is traditional, I'm going to start off with a recap of some of the major accomplishments and activities since our last CSMAC meeting related to spectrum policy and management. As secretary Redl noted Congress passed significant spectrum related legislation and the provisions of mobile now in the FY 18 appropriations package, and it really will set a large portion of our policy agenda over the next couple of years and beyond.

Some of the tasks, I won't repeat everything that David mentioned, but we are tasked to work with FCC collectively as we have done to identify an additional 255 MHz of spectrum divvied up in different ways. I do want to note that that includes any spectrum that has been identified since early 2016 I think. Yeah, 2016. February 2016. So we will be working with the commission to move forward. But it's much of what we have been doing day in and day out.

In addition, we will be looking at 3100 to 3550. We've been tasked to develop a report and determine if there are opportunities in that band. Of course we have already identified 3450 to 3550 for detailed study. And we will be supporting the commission in looking at 370 to 42.

Another element is the incentives that secretary Redl mentioned earlier as well. We will continue our work on incentives. We are ensuring the federal agencies are as efficient as possible in spectrum use, as well as supporting the commission on study and report on bidirectional sharing which we are all very much interested in.

And the last item I will mention is working with the commission to develop a national plan on unlicensed use and policy.

So, we have our work cut out for us. Luckily a large amount of this work represents continuity with what we have been doing and the ongoing and collective efforts that we all have been working with spectrum repurposing and incentives. And the work that CSMAC has done has been a large contributor to those discussions, activities and accomplishments. So again, I want to thank all of you for that contribution.

Meanwhile, we continue to partner with the agencies, the commission and continue to assess and identify the most promising bands for potential repurposing. As David mentioned, 3450 to 3550 has been identified. We continue to work with the Department of Defense as they develop a proposal, pipeline plan proposal to do a study to determine the potential for sharing or repurchasing of that band for commercial wireless services.

And we hope that as a result of this will be a true win-win and enable continued growth in the wireless industry as well as protecting critical radar operations that are critical to our national security and the adjacency to the CBRS band as well as the potential for international spectrum harmonization makes this a truly a nugget and a potential avenue for great benefit to all of us globally. So we are very excited about it.

And I want to highlight that the heavy lifting, when we talk about band prioritization and selection for repurchasing is really done through the policy and plan steering group, or PPSG, and for those that aren't familiar with the PPSG it's an interagency group composed of senior level government officials representing really I think the major spectrum users across the agencies and they advise us and particularly secretary Redl on spectrum policy matters. And the CSMAC's input on characteristics of bands for commercial deployments which we will continue to talk about today will help us refine and improve the PPSG's band prioritization and selection process as we continue to look at opportunities for repurposed thing. And I want to emphasize that process never stops. So we are continuing to look at opportunities regardless of what legislation or other mandates come out from the administration.

We also continue to focus on the transition of bands already allocated and I think in particular CBRS, we have partnered very closely with the commission, the Department of Defense, with [WIN form] and industry to make this a success. And this is a highly technical collaboration. It's been very successful. We've talked about that in the past. And it's really looking at fairly unprecedented technologies and approaches, such as the Spectrum Access Systems, the Environmental Sensing Capabilities and the related standards and equipment associated with that. And though the schedule has slipped a little bit from what was originally anticipated, we are still making good progress toward the eventual goal of making spectrum available and operational for CBRS specifically.

We look forward to the WIN forum completing their standards and software, work which is a key input to NTIA and in particular to ITS, our lab in Boulder, to move the path forward toward SAS and ESC certification and testing. I also want to remind folks that this really is not only novel in terms of the original three-tiered licensing approach, but we have also moved to dynamic detection areas versus the static exclusion zones as originally envisioned, and that is to not only protect military radar but make the most out of the band that is possible. And it is a significant pivot point to more dynamic spectrum sharing between Federal and nonfederal users.

Meanwhile, as was mentioned, we continue to work with the commission on frontiers. I will let Matthew speak to that in more detail and across all of these activities we have collectively discussed many times the need to address effective enforcement as an integral and essential component to successful sharing. And I tend to use the term enforcement very broadly, which we have talked about in this forum. So, we decided to come up with a new acronym. IPDR, interference prevention detection and resolution, which encompasses how we think enforcement, not just in the traditional legal sense, but how do we, how do we enable sharing across the board more holistically.

And so NTIA held an interagency IPDR workshop in February to facilitate an open dialogue between federal government spectrum users, NTIA and the commission on radiofrequency interference between Federal and nonfederal users. There was consensus that we needed to improve our ability to deal with interference and that our challenges would become even greater as we transition to a more sharing paradigm. It was a great dialogue. It mirrored much of what we've discussed here in CSMAC, topics such as data sharing, training, automation and interrelationships between interference and cyber security. So this was just the first step, and I will talk a little bit more about that when we get into our responses to your last set of recommendations. We're going to continue these interagency discussions over the next few months with the intent to then engage industry in the process in the future as well. And hopefully this may help us frame new topics or areas that we want CSMAC to focus on for the next cycle. So I'm really excited about this effort as well.

I have reported in the past about our efforts to study ways to improve efficiency of federal spectrum use. Since our last CSMAC meeting, ITS published a technical report that reviews more than 50 years of studies examining domestic and international spectrum efficiency. In this report really highlights the difficulty and complexity of applying generalize spectrum efficiency metrics across the similar systems and services, especially in a spectrum sharing environment, and by that I mean how do you characterize efficiency. And this report really highlights the difficulty and complexity of applying generalized spectrum efficiency metrics across dissimilar systems and services especially in a spectrum sharing environment. By that I mean how do you characterize efficiency as a result of sharing? What metrics do you use? And this report helps to set the foundation for us as we move forward and continue these efforts and help us hone future research areas that OSM and ITS will be working in partnership to address. So, these efforts will continue. They will also feed our mobile now response particularly in the incentives report that will be due, I believe that one is due in 24 months.

We also continue to flesh out an NTIA and industry collaboration plan, which we will use to guide our efforts to increase broad-based collaboration with private-sector. We hope this will drive the development of things like workshops, conferences such as the conference in June, as well as things like notices of input that we can leverage, all to increase the transparency of what we do and to build greater dialogue with industry groups and companies. A lot of this is credited to CSMAC and the feedback you provided to us some months or maybe a couple of years ago on this construct and CSMAC will continue to be a central point for us in terms of getting industry feedback and recommendations. But we are committed to broadening and deepening that collaborative activity across not only industry, but academia and other stakeholders.

A key result will be the symposium in June and it will be open to the public. It will be a discussion around key spectrum policy goals and initiatives and we will get more

information out to everyone. And I look forward to seeing hopefully most of you there in the process.

Now as we begin to wind up this current CSMAC membership term we are seeking recruits for the next term and the Federal Register has published our solicitation for membership submissions and I certainly hope many of you will continue. I will remind you that if you want to continue you have to submit your package as well. So don't assume that you will just continue without submitting the package. And I can't thank everyone enough. I have often talked about the collective wisdom of this group and the importance that we place at NTIA on your input and your recommendations and hopefully you've seen that as we reported out on actions that we've taken as a result. And you will see more of that a little bit later.

So before I turn it over to Matthew for the FCC spectrum update, I wanted to remind folks that the next meeting will be in July in Boulder, in concert with ISART and I encourage you all to participate in ISART if possible and I'm hoping that ITS will be able to give the CSMAC an update on their recently signed cooperative research and development agreement with University of Colorado, Boulder. This will result in a new spectrum monitoring test band providing mutual benefit to both CU as well as ITS and we're really excited about that activity and I think it will help fuel discussion in many of the areas that we have been discussing.

So, with that I think I will turn it over to Matthew unless somebody has any questions for me.

H. MARK GIBSON: Okay. I want to make one statement just to sort of amplify the spirit of cooperation that the CBRS community and the SAS community have had working with the teams from NTIA and ITS. It's been intense, but it's also been productive. And I'd like to specifically thank people like Rebecca Dortch, Ed [Drusella], Bob [Sole] and Nick [Lasortie] for the countless time they put into making this work. It's been great and we really depend on the work. So thank you for that. Matthew.

MATTHEW HUSSEY: Thank you. Well it's certainly been mentioned many times about the close collaboration between NTIA and to the FCC so I won't go into too much there. But the FCC does continue its efforts to make more spectrum available in the low, mid and high band frequencies as everyone is aware. Excuse me, as everyone is aware the incentive auction was held in 600 MHz, cleared about 84 MHz of spectrum. We are about a year in to the transition period and the first licenses were issued in June of 2017. In regards to mid band, we are working on the citizens broadband service at 3.5 and also initiated a mid band, excuse me... [inaudible] notice of inquiry of 3.7 GHz to 24 GHz. That was in July. And in that notice of inquiry we asked several detailed questions about three particular mid range bands and also asked commenters to identify other mid range bands that might be suitable candidates for expanding flexible use with wireless use. Then in the high band, as mentioned, the spectrum frontiers, looking at opening up spectrum in the 24 GHz. We had a [report] and order and further notice of possible

rulemaking in 2016 and then R and O in November 2017 and that actually frees up about 13 GHz of spectrum. Thank you very much.

[Inaudible voice off microphone]

MATTHEW HUSSEY: Yeah. See, there is great collaboration. Much better. Now I feel how Marco Rubio and Trump feel. I think so. Maybe not.

[laughter]

[Inaudible voice off microphone]

MATTHEW HUSSEY: Just thinking about it. So, but the recent 2017 order opened up 1700 additional megahertz as well as started initiating service rules and then we also initiated a spectrum horizons [MPRM] in February 2018 to look at opening up spectrum availability of 95 GHz. So, there's a lot of activity trying to free up, make more spectrum available for wireless use. Also the FCC initiated proceeding in examination of section 7 of the Common Communications Act as a way to expedite new novel technologies to market. If you're not familiar with that section, it is basically tells the FCC to examine new technologies and look at the public benefit and if there is to really kind of expedite it to the market. Haven't really, kinda was kind of not very detailed in structure. And so there have been calls to examine that, and that is one of the things of the chairman has looked into as a way to speed up new technologies and market to remove regulatory barriers for that effect.

The FCC also had officials participate in an NTIS federal workshop on preventing, identifying and resolving interference that was held a few months ago. Really good conversations between agencies and we are looking forward in participating in additional discussions and workgroups from that initial meeting.

And also with passage of the Ray [Baum] Act, there are several responsibilities in the areas of spectrum, several sections that FCC is tasked with which we will be working really closely with NTIA as mentioned to develop a national plan for license as well as a report on bidirectional sharing. And in regards to TAC activities, the first TAC meeting was held just a few weeks ago on April 12th and there was a lot of new different, a lot of new topics. One that was carried over was the mobile device theft prevention to continue work on trying to look at techniques, technologies that will mitigate theft of mobile devices, smart phones etc. All the other ones are basically new, such as the future of power working group, which is looking at battery power technologies as well as wireless charging techniques. There's also a computational power and stress on networks which is kind of looking at block chain, big data, bitcoin mining, gaming and the impact that has on network infrastructure and the stress that it provides. So they are going to look at technologies as ways, the effects of those new emerging services and technologies have on the network.

The other working groups that may be of interest to this committee is the 5G and IOT working group. They're asked with studying and reporting on the state and development

of 5G era IOT applications across various sectors, kind of looking at the relationship between 5G and IOT and kind of developing categories, performance metrics as well as use cases. They are also looking at market developments, if there are any barriers as well as kind of a comparison of domestic and international marketplaces. And then also an examination of spectrum use policy, maybe making recommendations to removing barriers as well as modifications to the spectrum policy to accommodate obviously the incoming IOT storm that is about to hit. But the goal is certainly to also establish and determine with the commission as well as other agencies can do to facilitate that. So that's one of the areas where there could be some opportunities for collaboration between the TAC and CSMAC in regards to that. Another working group is the communication strategies for UAS working group, unmanned aerial systems and they are looking at just basically spectrum issues for UAS, examining various frequency bands that UAS uses as well as what are some future bands that could be used as well as the possibility of harmful interference and ways to mitigate that and also one of the big issues is you have all these UASs, what is the impact on radar and they are looking at ways of examining that impact with regard to radar and whatever changes might be needed to accommodate.

Another aspect of that is possible changes to the FCC regulatory structure in spectrum management and the proliferation of UAS devices. Obviously that's a big issue with FAA and others so that's another possibility of collaboration.

And then finally there is an antenna technology working group. They are looking at emerging technology, antenna technology such as adaptive phaser ray, passive [MIMO], and multiuser MIMO and really reporting on the status and development of antenna technologies and their implications to FCC policy technical standards and regulatory issues as well as technical issues. This certainly could work with CSMAC's spectrum efficiency because honestly involving antenna technology is there to make more efficient use of spectrum. So those are kind of the recap. The next, excuse me, the next TAC meeting will be held in June. I think June 12th. That's my report.

H. MARK GIBSON: All right, thank you Matthew. Any questions for Matthew?

PAIGE ATKINS: So this is Paige. I just wanted to reiterate that both the CSMAC and TAC are doing great work and we want to look at opportunities to leverage these activities when there is synergy and we have several members that are members in both camps. But if, as we look at in particular the next cycle, if there are opportunities to, for the two committees to work together on certain topics or at least to complement each other on certain topics we would like to discuss that and see if that makes sense moving forward.

H. MARK GIBSON: All right, no questions for Matthew? All right, moving right along. So the next thing on the agenda is a response to the 2017 recommendations. Dave?

[Inaudible voice off microphone]

H. MARK GIBSON: Okay. It's out of singing in the rain. Okay. Okay so thanks, Dave. All right now we are at spectrum recommendations.

PAIGE ATKINS: Okay, so what I'd like to do now and hopefully everybody has a copy of the slides, I'd like to talk about our preliminary response to the last set of recommendations that were completed in November and again, we really appreciate the CSMAC's input, we seriously consider your recommendations and make a determination on what actions we should be taking, can take, or may not agree with or differ based on those recommendations. And what I'd like to do today is give you some insight at a high level. Just some select actions that we will be pursuing based on this last set of recommendations. We won't cover everything. Particularly as it relates to the 5G committee or subcommittee because there were so many recommendations, we just want to give you some highlights.

The good news is that most of your recommendations do align with ongoing activities, ongoing priorities. That's by design. As well as, will be very supportive to our response to legislation, such as the mobile now provision. So it all ties together very nicely. And I will caveat by saying that the actions that I'll talk about are subject to change Based on resources and evolving priorities, as you all know.

So, for 5G, and again, the 5G subcommittee had many recommendations to consider, and so we just selected a few key actions to give you a feel for how we are responding. In the first bullet, what we are going to do, and this goes back to many of the recommendations being aligned with what we are doing already, we are going to leverage our current processes and initiatives, including what we are doing to respond to legislation, both to the spectrum pipeline act as well as mobile now, to continue to look at opportunities and requirements for spectrum sharing. And this in part is related to how do we define our requirements that can then feed the standards process that will allow us to collaborate with industry to ensure that we are all doing the right thing to enable spectrum sharing between Federal and nonfederal systems.

This could include things like workshops, notices of inquiry, again, and we will continue to collaborate both with CSMAC and the stakeholders at large to determine how we move forward and how we define those requirements. That's related really to the second bullet which is around establishing a strategy to more effectively engage and influence standards. And in particular, from our perspective to again enable sharing between federal nonfederal entities and we want to thank the CSMAC for their input to date. We have drafted a strategy and its in with the subcommittee for review and feedback so we can home the strategy and start implementing it again for greater influence and engagement. So we are looking forward to that. And then we also want to continue to work with the agencies industry WIN forum to monitor the effectiveness of the 3.5 sharing mechanisms that are in place with the commission and start documenting best practices and lessons learned as though systems are deployed and we see how they actually effectively operate or not in the process.

And then the last item I wanted to highlight is we have started looking at probabilistic analyses for sharing. We started that about five or so years ago. And we continue to move down the pass, expand those approaches, implement those approaches and encourage others within the federal agencies to also adopt those approaches and what we'd like to do, the reports on those approaches have been, I will call them one offs on a case-by-case basis and we'd like to capture that more holistically and document something in what we are calling for now best practices handbook. So help bring the federal agencies and stakeholders together to move toward those probabilistic methods and approaches.

So, again, those are just some highlights in terms of what we plan to do in response to the 5G recommendations. Any questions on those before I move on?

So, for enforcement, we talked a little bit about our new acronym, IPDR, and you will see that in the slide. The new acronym. Yes.

[Inaudible off mic voices]

What we mentioned earlier we held the center agency workshop. It was great. Great dialogue. A good first step. And what we want to do is continue to leverage the I will call it the IPDR workshop methods, as well as other processes to investigate in particular automation. And again, I think broad definition of enforcement to include some of the things that the committee, the enforcement subcommittee specifically recommended, which you see on the slide. And these discussions have already started. They started in the first workshop. So we are collectively on the inter-agency side trying to get our arms around what we see, what the issues are, the magnitude of those issues, what we project for the future and how can automation help those challenges.

And as I mentioned earlier, in the future what we'd like to do is convene a workshop or some venue with private-sector to help us look across not just technology but also process and policy in terms of enhancing our ability to address IPDR challenges especially related to federal and nonfederal users and sharing. And high-level, any questions on that?

[Inaudible]

>> Sorry, okay back on the 5G one...

PAIGE ATKINS: Too late.

>> What's that?

PAIGE ATKINS: I said you are too late

[laughter]

>> You know, it takes a while sometimes. The one-off sharing studies that you mentioned, are those available publicly?

PAIGE ATKINS: Yes, so whether it was the earlier ones that we did, or other like even feeding the 3.5 assessments, all of those studies have been published. And so look on our website. And they would either be OSM and/or ITS studies, many of them jointly published.

>> Okay, thanks.

PAIGE ATKINS: Again, so we publish them kind of case-by-case and we want to look at things across the board holistically. Okay, key band characteristics. I mentioned the PPSG and our process, our band selection and prioritization process, and we asked the subcommittee to give us some feedback on how industry looks at bands and values bands in terms of its characteristics because what we try to do in our process is not only look at the federal side and say what is the art of the possible in terms of ensuring operations are protected and whether sharing might be possible or relocation might be possible. The flip side of the equation is what is important to industry as we look at prioritizing bands for potential repurposed thing.

And what we are doing is, we are continuing that work during the next few months with the subcommittee and we have asked them to try to develop a methodology around those characteristics that they identify, which included propagation and coverage, capacity, continuity, international harmonization and incumbency issues. And what I would say is our current process really includes all those things already. But we still need to fine-tune and refine the process and better understand how we would better integrate those characteristics and weigh those characteristics in the process. So we are looking forward to the additional feedback and recommendations from the subcommittee so we can refine the process which we are currently undergoing right now.

Any questions on that? Quiet group today.

And then, last item is spectrum efficiency and part of what we are doing this year is really wrapping up last year's activities. I think the subcommittee ran short of time in trying to get certain interviews and other data collection efforts underway. So they are going to be wrapping up and providing some additional recommendations, particularly in terms of policy and other types of activities that we might want to consider. But what we did get from the subcommittee was a list of some lessons learned or best practices in terms of how industry garners more efficiency in their own systems. And we particularly asked about methods to garner more efficiency across disparate systems, but this was also some of the input was for like systems as well.

Several of the lessons that were identified are already currently integrated into current federal policies as well as things like pipeline act. So, one of the recommendations had to do with, how do we look at either similar systems or systems with similar capabilities or technologies or characteristics and see where we can combine and reduce the footprint of spectrum use across federal agencies. And that is really what SENSAR is all about in terms of the spectrum efficient national surveillance radar program. It is about

collapsing and reducing the footprint across surveillance radars, DOD, DHS and FAA and then looking at integration of weather radars as well. Again reducing the numbers of radars, the footprint of the radars, while still achieving the capabilities and the operations that are needed.

So, we can always do better. And we will look at ways to do better. A lot of those recommendations are consistent with our current practices.

And then we continue spectrum efficiency activities, again in partnership with OSM and ITS and this year we will be focused on developing metrics and methods to help a user, an entity, federal entity look at trades and make better decisions from a spectrum efficiency standpoint. And I would say this is not an easy issue as many of you are aware, spectrum efficiency is hard to define, and again it is harder to try to generalize it across disparate systems. So we are looking at ways where it makes sense and it is simplistic enough that people can actually apply it effectively and then we continue to look at other market-based or other incentives that will again feed our response to the mobile now report as well.

BRYAN TRAMONT: Excuse me, Bryan Tramont, Wilkinson. You mentioned looking at the spectrum efficiency metrics as a foundation for looking at trades and I wasn't sure what trades you are referring to in that context.

PAIGE ATKINS: So metrics, I will give you an example say, a simplistic example, say a federal agency is looking at a terrestrial based solution versus an air solution to perform a certain function. And you may be able to look at those two and compare the spectrum efficiency as part of the decision points of which solution you would go with, or a technology on a platform. So, it's giving them metrics that they can use to compare alternative solutions and make a better decision as one example.

BRYAN TRAMONT: I think OMB A11 is trying to get from a financial perspective. Is it a different way to look at it, in other words it is a more technical...?

PAIGE ATKINS: So I would say OMB A11 in particular if you look at what is in there and the practicality of implementing it and leveraging it in an efficient and effective manner it is difficult. So, this may eventually help us refine A11 working obviously with OMB in the process.

H. MARK GIBSON: Okay thanks, Paige. No more questions?

[Inaudible]

H. MARK GIBSON: Okay well thank you. Now we get into the subcommittee out briefs. I'm going to sort of chair the first two and then I will hand the mic over to Larry to do the rest of the meeting. So without further ado, I think we're at the 5G committee and I think that's you, Mark, right?

MARK [RACEK]: Okay good morning. So the work within the 5G subcommittee is based upon the recommendation from 2017. So Paige went over that. Primarily that was a

recommendation that NTIA engage and lead activities with an industry STO, the standards development organization to get away from the acronym, to support standardization and spectrum sharing type of technologies but also with the related aspects of enforcement and database.

So the 5G subcommittee, I guess everybody's got a handout, the NTIA provided a proposed draft strategic plan for NTIA engagement with standardization development organizations. We've had three meetings where we have looked at the proposal. We have provided comments. We have had quite a bit of dialogue with NTIA. We feel for the most part that will be able to address all of the comments and as a matter of fact, one of our recommendations is that we would actually conclude the comment to cycle on the doc, on the draft document and address all the comments by our next meeting which is going to be May 9th. The feeling is that we would like to go ahead and get that document back in the hands of NTIA so that they can go ahead and benefit from engagement within the standards organizations right away. There was one particular comment that we feel like maybe we want to spend a little bit more time on. So that was sort of the feeling is that we don't want to hold up the document just for that purpose. And the other, the longer term recommendation that we see in the presentation is to go ahead, and we feel like maybe we need a little bit more of a formal process or engagement with NTIA. I think Paige, you sort of alluded to a little bit of that already maybe this can help sort of inform that kind of activity, but this is two, within this draft NTIA document for engagement there is a lot of interaction with the industry priorities, input documents. Those sort of things. But there wasn't really sort of a formal way of actually doing that. And so what we would be doing is is the first sort of activity we want to get into is to consult with ITS so we are looking to maybe have them at a conference call at the May 9th meeting to see how they actually engage with industry, to see if there's something that we can learn from that and maybe use that as part of our recommendation. We are sort of looking for openness, transparency, setting priorities, those sort of things from a more formal type of process so that is our longer-term view. We're not sure that we can necessarily get all of that done by the May 9th meeting. It might take a little bit longer than that, especially once we start maybe getting into the NTIA organization and seeing how a proposal would actually fit with the NTIA recommendation, but maybe we might be able to flesh out some framework.

H. MARK GIBSON: Okay thanks, Mark. That was good and brief. Any questions for Mark? Do you have any questions? Okay. Okay thanks. So I have one quick question. What do you think you're going to present in Boulder? You think based on how it goes with ITS?

MARK RACEK: A whole new process

[laughter]

H. MARK GIBSON: Cool.

MARK RACEK: I think in Boulder we should be able to talk a little bit more, maybe make a recommendation on a more formal group with some of the things that the formal group would actually be engaged in. A little bit more definition, I believe. But we'll also be able to conclude on the draft document that was distributed. We'll be done with that. So we can distribute that as a conclusion.

H. MARK GIBSON: All right good, good. Thank you.

PAIGE ATKINS: The only thing that I'd ask is that you keep in front of the discussion is the resourcing. Obviously we are all resource constrained and one of the areas we'd like to do is leverage industry as part of the process, not as just a feed to then a more heavy government process and engagement from a standardization standpoint. So, we need to think about how can we gain the most synergy across all the players involved and gain the best influence in those forms and processes.

MARK RACEK: That is where we feel that having a discussion with IT S to see how they actually engage and using that as maybe an example of a process will help us understand sort of what resources they actually use and then we can go ahead and translate that into the draft paper and see how we can improve the process there.

H. MARK GIBSON: Okay, thanks again, Mark. Okay, Charla, I think you are next.

CHARLA RATH: Yeah, thank you. I'm taking my cue from Mark and actually holding the microphone because I tend to turn around a lot. Otherwise I don't want to have the sort of Doppler effect of moving back and forth.

[Laughter, background chatter]

H. MARK GIBSON: You do it really fast, you'll sound like you sucked in helium.

CHARLA RATH: Okay, thank you for that. So Paige has already talked about what it is that this group is doing this session. But just to remind people, what we did last session is we identified key characteristics that we thought should go into the process of identifying spectrum for sharing. And they include, you know this is all in the deck that you have before us, which by the way is a very short deck as it is I think we may even win on the shortest deck. But propagation and coverage, capacity, contiguity, international harmonization and incumbency. Those are not in any particular order because one of the things we are really challenged by last session was in fact that depending on the service that you might be considering sharing with and depending even with in services, the type of services you might be offering or even particular companies might have a different idea or different approach. Those things may actually take on a different level of importance.

What we were asked to do this session was in fact two develop a methodology to help assess federal bands for potential sharing using these characteristics. Which I have to just say from the outset the difficulty we have is the same difficulty we had last year when we were asked to rank them, which is how do you develop a methodology when

there are so many different potential uses and ideas. So what we started out doing, and we do have a draft paper that is looking at this, what we started out doing is to look at it in the context of the bands that we identified last time. And what we chose to do is actually sort of take those bands and put a little bit of a finer point on them, low-frequency below 1 GHz, medium low, one to three, medium 3 to 6 and then we did sort of take all the high band and above six which of course might not actually work for certain services as well. But that said, what we started to do is to see if there is some, you know, is there a methodology that can come out of this. So that is what we are working on now. We've actually had a couple of, what we did is we identified a sub group early on to work through these things we probably met more frequently with the subgroup and Tom and I plan to hold a meeting in a couple weeks with actually with a larger group to work through all of this.

What I'd like to do at this point is actually go a little bit off sub committee because one of the things we felt like we wanted to do here was to get feedback from the larger committee on this issue that might be helpful to us moving forward. So I'm going to throw out just some things that I've been thinking about. And this is not representative of the subcommittee. And I'm actually thinking maybe what I should do first is just asked members of the subcommittee if they have anything to add to, you know, the dialogue that we had internally, if there are things that they'd like to add to what I've said here. So several of you are here. I open the floor. Anybody want to add anything?

So one of the things that has come up and actually Larry is the one who mentioned this, but we probably should have thought about this. There's also an investment component. To this. And in fact I like to point out that a couple of probably five or six years ago your chief economist Julia McHenry actually wrote a paper that talked about the impact of sharing on investment in a particular industry in the wireless industry when you're actually talking about auctions. So I do think that that's an interesting thing that we ought to be thinking about. The other thing that I throw out to the group is whether or not this methodology might be just a series of questions that you should be asking. Not as simple as what are the propagation characteristics but may be more along the lines of, are you actually, what is the use of the band now. Is this a use that would benefit from being moved or is it one where you would share more like CBRS? Maybe questions like that and again I'm just throwing these out to sort of generate I hope a little feedback. I don't know if those are the right questions. We haven't even talked about this within the subcommittee.

So, and as I look at my notes that's basically where I wanted to end, and again I just throw it out to both members of the subcommittee since some of this is new information as well as we had all talked about this that we really do want to open it up to the larger committee to see if there are any things that folks could give us some thoughts or guidance and things we could take back to think about. Any first thoughts from the subcommittee? And then I open it up.

H. MARK GIBSON: I see Rick up first and then Donna. Okay Rick?

RICK REASER: If the subcommittee wants to go first that would be good. Are you on the subcommittee?

FEMALE SPEAKER: So, I have a couple of questions on that. The first is the impact of auctions. I wasn't sure what that point is, if you could sort of delve into that a little bit so I can think about it, and the other is when we think about the use of the band I think that is important and I think that is sort of maybe like a public policy idea and when we look at that I think that when we look at what can be done by the incumbent service the first thing is you know, would a benefit from moving and I guess when you look at that you look at the cost and the efficiencies and like who deals with that and the other is what does the sharing look like and I think there is there is a third point which is where is the technology going and maybe if the technology that is already in there is going to use the band in a more efficient way as opposed to growing the spectrum they need they are developing or they are already developing technologies that will use the spectrum more efficiently and therefore be more susceptible to interference I think that is also something we should look at because I think we should not stifle technology that is in development or already developed because I know certain types of technology as they become more efficient so that they can use more bandwidth and put in more users actually are more susceptible to interference. So I think that that is one that I would add to our other two points

CHARLA RATH: And actually you in a way answered the question you asked me. Because really it's a question of, if there's a cost to moving, is it then a band where you might want to be looking at auctioning it because you actually generate revenue that can under law be used to help move. So that was really all, the point I was trying to make.

FEMALE SPEAKER: And, you know further to that point, and we can discuss this in the subcommittee so we don't have a meeting here, when you look at auction there is a cost to the user. It's not you know, just the physical cost of equipment, or the timeline to move it out. I think that is the auction going to make enough money and does the person who is buying the, I mean is there a point at which you by the spectrum and that's not enough money to move users out, so that's not, you know I think that if we are going to look at those relationships we should sort of delve deeply into it to make sure that we have all bases covered assuming that we decide that that is a road that should be looked at.

CHARLA RATH: And I appreciate this but just so I'm clear, my thought wasn't that we should actually work through what all the question should be here. I was really actually just posing the question of whether that would be a useful methodology to actually look at questions that we can agree to in the subcommittee. And in a way I'm looking at Paige because I think that's really a question for you. So.

PAIGE ATKINS: So I will say that we didn't provide you our process today because we didn't want to buy us your thoughts and I would say that also some of this dialogue

mirrors some of what we actually do in our process in terms of investment and value and, would it garner enough potential revenues to cover costs etc., as well as things like is there a possibility of relocation or just sharing and how does that affect the dialogue. So I think thinking through the questions could be helpful and ensure that we are not missing anything or that we are framing the related process, or the process related to those questions in the appropriate manner. Did that make sense?

H. MARK GIBSON: Okay Rick, are you up?

RICK REASER: Yes. I'm Rick from Raytheon. I wanted to sort of turn this a little bit on its head. One of the things that's interesting about this group and one of the reasons I didn't participate in it

[laughter]

RICK REASER: Is because I think you need to think about all the parties. So in addition to just saying okay this is what I would like to have in this house that I want to move into or whatever and part of the thing is that you're going to be roommates we've got to find out a little bit more about what the incumbents, what they would take a look at in terms of sharing, moving and all those kinds of things because it's sort of great to set a here's my last territorial demand kind of thing but I think it's also important to understand in this process like what can the incumbent do. What would be good for them and what would they, and then you'd actually have a dialogue about that. Because ultimately after you go through this process you will end up having this dialogue anyway. So it might be useful to sort of understand from the perspective of the person, because they might be open to sharing, oh but they have these conditions met and there are certain things I can give on and so forth and I can't move or maybe I can and have both parties kind of lay that out. And maybe part of the process could be setting up what those questions might be for the people that are already there.

H. MARK GIBSON: All right, put your table tent down. I had a question and it's obvious to me, but maybe it's not an obvious question, and that is the sharing paradigm. I mean take a look at for example the 3.5 gig band, the CBRS band, the sharing paradigm is a SAS. Similar sharing paradigms have been proposed or suggested for sharing in other bands, so what impact does the sharing paradigm have on the likelihood of the band to be shared. If it is final command-and-control frequency coordination does that make it easier than using an automatic sharing process like a SAS or IDSA process? It would seem... Yeah?

[Inaudible voice off microphone]

CHARLA RATH... The question I have about that is that isn't the sharing paradigm somewhat determined by what's already in the band?

H. MARK GIBSON: Yes but we could be doing right now for example in the CBRS band we could be doing command-and-control frequency coordination. There's nothing that says we couldn't do that. In fact, as you probably are well aware that was the

paradigm in the bands at least before the CBRS came along. So you know the question I think would be, and what made me think about this was the investment component. You know, you don't have to invest a lot of money to do a command-and-control frequency coordination process there are lots of companies out there like ours that do that. But no one has built a SAS yet. Well I mean, you know we are doing it, but I mean and so if a command-and-control frequency coordination, I'm just using this to juxtapose against another automatic or automated paradigm if it's going to take a substantial amount of investment to build an infrastructure to effectuate sharing over just using what is out there now, does that have any impact and I don't have an answer to the question, but I'm asking is whether that question is a question worth asking. That's all.

PAIGE ATKINS: Just to add, I caution that you don't get too far into the details. Because this is, think of this as the first filter. So the process that we are using helps us, excuse me, select, prioritize and select but then that selection like 3450 to 3550 then has a much more detailed analysis on relocation versus sharing and more detailed costs and more detailed assessments on incumbency issues etc. so, think of it as again the first filter that helps us select the most promising bands that then we can collectively study in much more detail, if that make sense.

H. MARK GIBSON: Okay. Any more questions for questions?

[Laughter]

H. MARK GIBSON: Okay. Good. Is that helpful?

CHARLA RATH: I actually found it helpful. I don't know if any of my [inaudible]

H. MARK GIBSON: Let me go back and ask the same question I asked Mark and that is what you think you're going to have to brief and... In Boulder?

CHARLA RATH: Our intent is to actually have recommendations and to move forward. Hopefully we will be able to share the draft.

H. MARK GIBSON: Okay good. Great.

CHARLA RATH: I'm looking mostly because a lot of my, they are like lined up there.

[Laughter]

CHARLA RATH: That is our intent at this point. We will keep you posted if we are really having problems.

H. MARK GIBSON: Okay great. Thanks. You want to get that mic? I want to keep this one for Paige.

LARRY ALDER: Before we move on I did actually have a question on that topic because we say methodology, because you said come up with a list of questions and to me what I was thinking is, we did the characteristics. Now it's a methodology. So what

comes to my mind is some kind of almost scoring system or a way to prioritize and assimilate the characteristics to make decisions. That is the intent. Okay.

CHARLA RATH: Well, and that again gets back to my initial comment is that we have found very difficult to do because it is so dependent on, you know, what the endpoint is going to be. I mean, you know I'm sitting across from people who do satellite and I suspect we might agree on some things but then there are other points that are much more important to the satellite community than they are in our community. So that has put us in a position where we do not feel like we can come up with that kind of methodology so we are looking for other ways to be helpful. And in fact I wouldn't necessarily think that asking a series of questions is a form of a methodology. It is a different way of looking at it than what you have said. But let me, again, you know, I we have had a lot of conversations about this over the course of not just this CSMAC but the last set of questions. So, I don't know if anybody has any thoughts.

FEMALE SPEAKER: Yeah, as I think that as Charla said, the challenge that you sometimes have when you have technologies that don't mirror one another like [UTEN] and terrestrial systems in a specific band tend to all be the same and satellite systems can operate in the same band, and the designs can be very different. You know, it's just up to the you know, operator. So I think that you can't necessarily look at it in the same way. Thank you.

LARRY ALDER: I didn't want to throw a wrench in that work. I guess we got some directional guidance from Paige on keeping it a first level filter. So that was good. So I guess we will move on now to the next topic, which is going to be the enforcement topic. And I guess, who, is it Mark, you're going to?

MARK CROSBY: I will start and turn it over to Paul. Who knew that such a simple question could be so complicated.

LARRY ALDER: We have an acronym now.

MARK CROSBY: Actually, I want Paige to note that we synched this up with IPDR, so and thank you to Mary Brown who said this, we probably need to split the initial question into three pieces, what are the technical capabilities of the SAS systems and what are the legal and policy issues. So Lisa got that all synched up. And so I'm thinking of Mary Brown and we've had a couple meetings and I think we are making progress. But again, it is a tough issue. And we want to obviously provide some value to the full CSMAC and NTIA. So we have met a couple times. We will meet again. I can't wait to answer your question, what are we going to deliver in July. At this point I will turn it over to Paul.

[Laughter]

PAUL KOLODZY: I thought the answer was whatever Paul says. I hope that was caught on tape. That was brilliant. Thanks, Mark. What a team. So I will go over a little bit what the status is of the IPDR process and what we have been thinking of. I think that in some respects being an enforcement group we sort of need to enforce ourselves

to try to be a little bit cognizant of what we are trying to accomplish and so we've had some initial inputs from folks which is excellent. We are trying to get some more inputs from people. They have been very busy and trying to understand what some of the challenges are. We have a challenge in respect of trying to, and this will be helpful from you, Paige, to try to provide the whole subcommittee some ideas. People tend to lock in on what current SAS, or what has been expected by current SAS. And so therefore, people tend to lock in on that, this is what current SAS is doing and therefore we are not going to do that and the idea is I think we are trying to get the subcommittee to open up a little bit. It is the SAS concept. It is the SAS capabilities that you have been discussing, not necessarily the exact implementation of current SAS systems. In fact there is no current implementation of an SAS system yet in the sense of being deployed. And so that is one of our challenges. Because what most people are going at is listen, the current SAS systems don't do a lot of the sensing that we are talking about and so therefore how does it apply. So there have been some questions on that. There have been that the SAS systems don't directly control the communication come the devices themselves. And so therefore how are you actually going to have the kind of feedback. But they do have a feedback and so the mechanism is there's a feedback mechanism but the question is, is it a direct one, so the question is is that a limitation and there's a policy limitation associated with that and possibly a legal limitation associated with that. Ergo, what Mark just mentioned about the three categories.

The couple comments that also came up were in some sense that how are you doing the deputization of the enforcement process if you go down that, so that is a nice legal, actually more of a legal question on how you deputize particular SAS or these kind of capabilities to do enforcement. And so what are the challenges. So we are trying to walk through some of those issues as Mark was saying.

And finally is the participation in this, so this goes back to the current SAS systems versus a future SAS system, Mark actually came up with a great statement, which is, is this a voluntary process or is this going to be a requirement. So when you are thinking about capabilities out there are you looking at trying to deputize to the point where now you are forced deputization meaning if you're going to be part of this process you have to actually provide these functions in addition to your current functions. So there's been some challenges there where people were trying to me under through that. As a techno geek I have no problem at all. I just don't really care about any of that stuff. I look at what is possible and move on. But I think the committee could use some help in the sense of guidance as to is it really the current SAS systems or, if you actually read the question, the question does say SAS systems and technologies. And so it does not say current SAS systems. It does not say CBRS SAS systems. It says SAS systems. And so I'd like to put back to you, Paige is how do you foresee us trying to go at this.

PAIGE ATKINS: And that wording was crafted in a way particularly the addition of technology, systems and technology so it really is conceptually not tied directly to what we have today and limited by what we have today.

PAUL KOLODZY: Right. Okay so good. That will help us as we are trying to formula some of these, these ideas. And again I want to bring it back to the whole subcommittee that after I go through this that if you think I got something wrong... Brian says I'm ready here. But he's thinking. The next steps is even though it is about the systems and the technologies and from a generic point of view we want to learn a lot more about what is going on in the SAS community and the SAS developers. We have a couple people in our committee from the SAS community, but we want to maybe try and do a more full not review but questioning of them and trying to figure out where everybody's coming from because and I'm not going to go through this but if you go to the last four pages, I think, three pages of the presentation, I actually cut and paste it out some pieces of the CBRS rules and some of the things that the wind form has been trying to do and commenting on that I think there are some different perspectives there are some measurements that are supposedly going back and forth and people say no they don't make measurements but actually they don't make measurements but they get measurements and that is a different process in itself and so I think we need to open up our aperture as a community to ask what does this kind of technology enable us to do. And so I thought we needed to take a look more at those things.

We need to look at still, though, what is the current level of technology. So we want to look at two pieces. Look at where we are today and what can happen with the SAS technologies and then what could be happening in the future. So I think we want to kind of separate those two pieces because we don't want people to get confused like, oh you are saying that the SASs today can do all this. I think we are trying to make sure that that is definitely separated. So we are going to basically go out in these next few months and try to understand a little bit more about where everybody is that and then try to, with that good new guidance, I think try to wrap in what the possible future might entail. And I want to open it up to the rest of the subcommittee if I got off script too much. If you have any comments.

H. MARK GIBSON: I will take the cone on it. This is a hard question to answer because I think the fact that you are looking at SASs and what they conceptually can do. I mean you had a really well-established here with these three questions along the technology, the legal and policy issues. I mean, you asked me to answer the question as a SAS provider on the call and I said no problem and when I sat down to try to answer them I was like whoa, this is like an essay question kind of thing and I think from a SAS perspective I think we get the willies a little bit when we deal with enforcement in a situation. And I think this is the deputized enforcement thing. We brought this up in a meeting a while back where SAS provider is providing a commercial provider pursuant to a set of rules that are established by the regulator, in this case the FCC. But our customers are the end-users. If you put a SAS provider in the position of tattling on customers, ratting them out or whatever you want to say, that freezes out or chills out the market. So we have to kind of figure out a dividing line between what, and I don't know whether this is a policy discussion or commercialization discussion but I think it overhangs this. Of putting a SAS in the position of doing ex ante versus ex post and I

think we have some of those issues going on as well. We are right now doing ex ante enforcement. For example we have to verify FCC ID. We have to verify that the power that a device gets is the maximum certificate of power, not the maximum allowed power. And a couple of other little things. And I think for all intents and purposes though we are getting to a rather difficulty we are getting to the point where at least the SAS providers and I will just speak for us, adopting it. It's causing a small amount of consternation among us because of the potential for a slippery slope. Because if you can do this, you can do other things that I think we have to kind of come and maybe this is something in common on the SAS providers working in the form we have on the wind form and other discussions we have, finding the line that we don't want to cross and I don't know where it is. It's a little blurry. But I know it is somewhere out there and it's somewhere along the points of if I'm offering services to somebody and I have a responsibility of either turning that person in for violation or disabling that person, the ecosystem is going to collapse to some extent. So.

PAUL KOLODZY: So let me see if this clarifies it. I think where you are trying to get the dividing line is what is meant by the word enforcement. Meaning, if it is a self enforcement, which is what SASs are doing in some respect by telling people turn this power down or whatever because you have a possible interference issue, that's one area. If you are talking about a legal enforcement where you are getting a regulator information associated with it. That is another one. So you are looking at the dividing line which is a good discussion point to do that. I just don't want to lose it so that everybody thinks it's the one. Maybe what we need to do is distinguish, assuming this, what can you do, and assuming that, where is the uncomfortable feature. Is that a reasonable...?

H. MARK GIBSON: Yes and I think the other problem you had which is probably the reason for the dearth of responses is that the SAS providers are knee-deep if not neck deep in everything else going on. And so I think it would be really fruitful because a couple of us are already on the CSMAC to have a Q&A or an interview session or something because I think a lot of this is really, I think the questions need to evolve based on the answers and I think it is worth having a dialogue on this within this context so we can work on this together. And I said this, you know, a year ago when we broached this discussion that SAS providers really need to be helpful. I did my job.

[Laughter]

H. MARK GIBSON: But I'm on the committee. But and I think also this question needs to keep, we need to continue considering this question the context as SASs develop because they touch two of the key regulators which is NTIA and the commission. So there will be a lot of lessons learned as we roll this out as to how this gets effectuated. And so it would really be good to keep this going on because I think this could sort of bidirectionally influence, not influence but at least inform what's going on in a lot of regulatory bodies.

PAUL KOLODZY: I think it would be a good enabler if we can do it right.

LARRY ALDER: So, Paul why don't you finish up because we've got a lot of interesting questions here.

PAUL KOLODZY: I'm finished up.

LARRY ALDER: Oh you are finished up.

PAUL KOLODZY: I opened it up to the committee if they actually want to make comments.

LARRY ALDER: We've got five questions. Let's start with Mark down there.

PAUL KOLODZY: All the questions will be dealt with by Mark.

[Several voices]

MARK CROSBY: Mark. Yes.

CARL POVELITES: Mine is maybe just a suggestion [inaudible] I think one of the things you would probably want to look at, and this goes to Mark Gibson's point is incentives in participating in a SAS and that kind of thing to the extent that I see this come in here, one of the bullet points says SAS today do not directly control devices. There may be some entities that don't want the SAS to directly control devices and that may be a disincentive to participate in that band. So I think incentives may be something else you want to look at.

MARK CROSBY: Thank you, could the incentive also be economic?

>> Yes.

RICK REASER: Rick Reaser from Raytheon. I want to sort of draw this back to some of the comments that Paige made at the beginning because ultimately it kind of moves in some of the directions that NTIA has been talking about in terms of monitoring is one of the things because I think one of the thoughts was when we saw the SAS out there will gosh, that's going to be the ultimate monitoring system. And maybe there needs to be a dividing line between SAS functions and general spectrum monitoring functions. But I think that would be something that needs to be thought of in terms of what to the overall construct and architecture is for how that might work. Because one of the things that may come out of this is the issue of having some sort of monitoring system within the US for multiple purposes, not just for SAS and so forth. But a thing that will kind of drive that I believe is the technology for monitoring. And I think, we have talked about in our group and I want to encourage that maybe we should talk to some people that do monitoring what kind of technologies are out there and the issue of a small spectrum analyzer that can be remoted and those kinds of things and what kind of information it might report. Because at the end of the day in the last meeting I sort of mentioned yeah you can drive all the way now from the airport to Boulder and never see a tollbooth

anymore. I mean it is all remotely monitored. Everything. Paying, keeping track of stuff. So at the end of the day we may be headed down that path so maybe we need to look at the technology and maybe the SAS provider is not the one that's going to do that. Maybe they are. But what's going to drive that is the ability and technology to monitor.

PAIGE ATKINS: This is Paige. Just a quick follow-up. If you want to talk to folks about monitoring I will offer, though they are not my organization, ITS you know, would be a great start and working with Keith and his team

>> I've already reached out to Keith, so yeah

H. MARK GIBSON: Michael?

MICHAEL CALABRESE: Okay, thanks Paul, Michael Calabrese. Two things, first just, I guess a response to what Mark Gibson said is I think that that is certainly a valid concern although I don't think it's the primary consideration. I certainly don't think the subcommittee should not look at options because of its commercial impact on SAS, [inaudible] SAS operators. For a couple reasons. One is that ultimately the SAS is just a sort of outsourcing of the regulatory function by the FCC primarily. So it is simply doing, it is simply stepping into the shoes of the commission and doing something presumably more efficiently than the commission would otherwise be doing if, in an ideal world and similarly in terms of NTIA. And so as long as the rules are clear up front you know, all the stakeholders know what, for example in the CBRS context, this is what the commission is seeking to accomplish and the SAS is simply effectuating that as a proxy for the regulatory agency. It's not about the SAS making money. Although obviously it has to be balanced enough so that somebody can, somebody can make a sustainable, you know operation out of it. And then secondly, here we are primarily concerned with what NTIA's interests are which could be enforcement even if that means kind of pushing the envelope in terms of what the FCC or SAS operators feel comfortable doing. So I just think you should look at all the options. And then secondly I would, and the reason I put my card up initially was actually just second what Rick said essentially which is that we are looking at systems and technologies more generally including going forward I would think things like crowdsourcing spectrum measurements would be a great thing because base stations are in communication with the SAS anyway, they could be sharing what they are hearing in the environment, and that in turn could inform enforcement.

H. MARK GIBSON: Okay I need to respond

[laughter]

H. MARK GIBSON: I know we've got others waiting but I can't let, if we want to have SASs run by commercial people it is absolutely about them making money. It has to be. Otherwise you won't get commercial people to do it. And we won't get into whether they can make tons of money or a little bit of money but if a commercial entity is going to be running a spectrum access system it's going to be about the commercial entity being

able to do it, otherwise it becomes a noncommercial exercise and that has issues associated with it. And I appreciate where you are coming from, but if this were not about ability of a commercial entity to run this in the context of not just the rules, but all of the working against other SASs in competition then it would be done by the federal government or somebody else you know, that would be the only one and that's how they would do it. So I need to address that. And the other thing is, and I think to the monitoring question I think that was touched on, you have an excerpt in the rules here, I will tell you, and I think this will be resonated by some of the device folks, that's really difficult to get a lot of device manufacturers to allow other data coming out of the devices. There's good reasons for that. And we can get into that when we talk about this. The set of information that the devices report back is not the same thing you're getting from an ESC. And so we just need to keep that in mind. So, anyhow. I yield my time.

>> All right, thanks.

[Inaudible voice off microphone]

BRYAN TRAMONT: Yeah, thank you. This is Brian Tremont from Wilkinson. A, I would like to endorse that Mark should make money. I want to stipulate that that should happen. However, I did break out in hives when he was talking for the following reason, it cannot be the case that SASs compete against one another based on how much or little they enforce. It cannot be a product differentiator. There has to be a baseline that the commission enforces against. There has to be no discretion from the SAS about when they act and when they don't and there has to be no discretion across them. So that's a critically important part and I thought you were saying they were competing on how much they were enforcing, and I was yeah, ooh, very scary for a moment. The second piece I wanted to flag was the legal piece. And I like the construct of the three questions. What I struggle with a little bit and maybe it's answered with Paige's response on the technical side, is it assessment of the degree to which private parties can enforce rules writ large, the degree to which current SASs can enforce in the CBRS context or some future case of what the idealized enforcement legal model is? And then as a somewhat remiss member of the committee, has there been, is that a legal assessment that we are doing as part of this, or how does the committee leadership view all of those things viewed together?

PAUL KOLODZY: Okay, so I think actually I should give it back to Mark but anyway I will jump and say this is how we tried to a little earlier divide the enforcement. Right, as to what is in a sense the normal legal type of enforcement where you are actually trying to have regulatory agencies or somebody be involved in trying to take action versus an enforcement that is actually part of the operational system who try to prevent interference.

BRYAN TRAMONT: Like ex ante versus ex post.

PAUL KOLODZY: Right and also one of this is are you actually doing a legal construct or are you simply doing something to make the system work better and you are actually enforcing.

BRYAN TRAMONT They are both legal, but go ahead

PAUL KOLODZY: Right, we have to ask the question of where is that line. And the question I think we were trying to do is just say given this is the line, what could you do? Given this is a line, what could you do? And I don't think we're going to try to make the, I think the subcommittee should not try to make recommendations as to where the line is. I think the group is trying to make recommendations as to if you had this line, what could you do

BRYAN TRAMONT: Is the line the CBRS line?

PAUL KOLODZY: No. In fact...

BRYAN TRAMONT: That was the technical question.

PAUL KOLODZY: No, that was... oh I'm sorry.

PAUL CROSBY: We were advised to stick to 3.5.

BRYAN TRAMONT: So it is CBRS, not just current staff

PAUL CROSBY: Not going all over. 3.5...

BRYAN TRAMONT: But not the technology of 3.5

LARRY ALDER: My understanding to clarify is we are focused on the 3.5 band, but it's not just discussion about what the current SASs and ESC can do because they already have certain limitations about them. So we can project what they might do in the future and, but we are staying in 3.5.

BRYAN TRAMONT: From both a legal and technical perspective or just a technical perspective?

LARRY ALDER: That's an interesting question. That will be a question for Paige and the group but my understanding is sure, the only restriction is 3.5.

PAIGE ATKINS: So I think the reason for 3.5 is one, it is here and now. That is the most mature activity. The band is conducive, as we understand it, to these kinds of technologies and concepts and it would be most relevant to us to understand what we can do or not do in the near to mid to long-term you know, future. But we don't want to constrain ourselves to specific implementations as we see them today.

PAUL KOLODZY: Let me just say, I'm a little confused as well then, because if you're talking about what the legal and policy issues are, there are already legal and policy set down by the commission rules, so do we use those as the basis of that or do we say, is it a possible other policy and legal issues?

LARRY ALDER: Let me take a crack at that. So the example that I think is relevant is the ESCs. My understanding is they have a very tight function in the 3.5. And they are restricted legally and regulatory to do a very specific thing, but the concept of a sensing network could be quite broad. So I think what we are thinking about is, what could a sensing network evolve into and that is both illegal and a technical question. So I think they are both open. That's my interpretation.

BRYAN TRAMONT So one result might be recommendations for changes in the rules on 3.5 on enforcement?

LARRY ALDER: Exactly.

H. MARK GIBSON: The other thing I would add to that is while I said ESC and sensing capabilities that are defined in the rules are different, one of the reasons the sensing capabilities other than ESC are defined in the rules, the function of the ESC versus the sensing capabilities in the rule are separated. ESC is one function as Larry said. And the only reason the ESC is developed is because you can effectuate and function by the sensing capabilities that the rules identify. However, to the extent that you want to put a SAS-like concept in another band absent the ESC, you have a defined a sensing network by the devices themselves and I think that is the intent of it. So if you think about the distributed sensing network that's provided by the devices that gives you, that is why that is there, is to make better decisions on the spectrum grants based on ground truth. So that should be helpful.

LARRY ALDER: I want to get to Dale because he's been externally patient over there. That is you, Dale, right? With your...?

DALE HATFIELD: I just had a couple of thoughts here. One, I'm concerned, I think Paige just said this is here and now. We are about to deploy some of this. I think there's experimental licenses out now for some of this. So I'm really concerned about the timing issue. In other words if we haven't resolved these things we are going to be turning on a system fairly quickly, if I understand what the industry is saying. And there's just issues that I am uncomfortable with. Probably the major one that I'm uncomfortable with currently is there's going to be interference in this band that has nothing to do with the systems that are under this control. And how does that, who is responsible for that if you pick up information, for example that says there's something drastically wrong in downtown you see someplace. There's some problems. It may not be because one of your devices is misbehaving or something. It may well be the interferences coming from may be an adjacent band. It could be my colleague here will immediately say... But my point is there could be other interference in that band. And it's just not clear to me what the interfaces between that and the FCC and if you are collecting information and so forth I think there's issues of how well you maintain the evidence and what evidence you turn over to the FCC and things like that because, or what if I'm thinking what if somebody just plays, doesn't want to play by the rules? And refuse to do what you kind of tell them to do. That seems to me, that is when the person has to come out with the proverbial

gun and start enforcing it as the regulator what. So that part of it still bothers me. It bothers me. Quite a bit. Monitoring I've said enough, of course the monitoring would go a long way, but again, who pays? Because, to look at some of these interference things that I'm talking about requires a different sort of monitoring than what is set up.

>> You want to address?

LARRY ALDER: Did you want to address you want to respond a little bit more

H. MARK GIBSON: One thing, Dale to give you a little bit more comfort is the whole notion of interference reporting is evolving within the context of this discussion at the commission. SAS administrators are actually meeting with the commission on Friday I think to talk about that and we are going through a lot of that. It is a work in progress. We are responsible to report interference but how is that done? Is it a common interface? There's all of that stuff. The whole notion I think of collecting information is really, I think that is where I get the willies because if we've got to maintain, and we talked about this on the call, if we have to maintain data in a fashion that is subject to evidentiary proceedings, that puts a whole different standard on the SAS with respect to the data that we maintain and everything we have to do. And you know, so that is a bit of a concern I think as well. And so, and I think the other thing we have to do is define the line between what is the role of the commission versus enforcement versus what is the role of the SAS and I think that is evolving as well and I think again, I think we are learning things as we are doing this, but nobody can say with clarity what exactly that line is and that's what I was talking about earlier. That's why I think there will be lessons learned as we embark upon this path called SAS and there will be lots of opportunity to share that as the commission is going to require it to fine-tune what you are talking about and concerned with.

DALE HATFIELD: Is there a proceeding that that is taking place in at the commission? Is this transparent?

H. MARK GIBSON: It is just with the SAS providers and the commission under the auspices of our conditional authorization that the commission expects us to come in regularly to discuss topics of note with respect to our certification. And so the rules require that the SASs do some level of enforcement although we don't call it that so the big question now is the one about interference reporting and how we do that. And other things. I would suggest if you want to be part of that contact Paul Powell or even Matthew and your involvement would be well received. And I say that personally, not from the staff standpoint.

DALE HATFIELD: I take back everything I say if it's going to be more work.

LARRY ALDER: Again, Dale because I know I have been on one of the calls with you, and Paige will comment but I do think in terms of the scope, the scope of this committee is not really to comment on the current proceeding and advise on the current proceeding. The scope of the committee is to talk about the extent that SAS and ESCs

could facilitate automated enforcement, which we now call prevention detection. IPDR. Yeah, so I hear your concern, but actually think that is beyond the scope. Paige?

PAIGE ATKINS: You have said it, so I was just going to mention that is not to say that SAS and ESC is the end-all be-all for this process, but again to the extent that it can be leveraged to satisfy the needs of IPDR.

H. MARK GIBSON: Okay I think Janice...

LARRY ALDER: Other questions on this very active subcommittee? Janice has a question. I didn't see that.

JANICE OBUCHOWSKI: So I guess this is the lawyer at the table. I can't imagine having a circumstance where the SAS does not report abuse to some government entity. Otherwise what is the point of even having an SAS frankly? Because if something is going wrong and the SASs go no I'm not responsible then you're going to have a redundant system the government, and obviously that's, that probably undercuts a lot of what the SAS said they are going to do. And I think at least, you know you talk about Rick's tollbooth deal, that's already happening in the big world. You know, some private entity is running the HOV lanes and if I mess up I get a bill from them. It's all privatized. And then if I complain, then I go to the government. And I think that's kind of an inevitable model that's going to have to exist in the spectrum environment.

H. MARK GIBSON: One thing I'd say is that there are, the SASs are not responsible against protecting against rogue operations. That's kind of where the commission comes in because they have the wherewithal to do all of whatever is needed to do to enforce that. And again, this is the line we are talking about. You're right. But what we have got to do as we are working through here is find where that line is, because there are certain things that SAS can report on that we have to report on, but when you've got a bad actor out there that's intentionally being a bad actor it doesn't matter whether there's an SAS or not. There's going to be a bad actor. So what is the role and responsibility and I think that's probably beyond the scope of this discussion. It's an academic discussion and indeed probably technical as well. But it is out there. So.

LARRY ALDER: Mark and Paul, anything else?

PAUL CROSBY: So when you asked me what are we going to submit for July...

[Laughter]

PAUL CROSBY: We will have a lot of recommendations. I'm not sure the subcommittee will be in violent consensus with everything, but we'll have good recommendations for the CSMAC's consumption.

>> Mark and I will be in agreement.

H. MARK GIBSON: It doesn't matter right?

DALE HATFIELD: If I could add one thing, some of this assumes that the FCC is resourced to be able to do something. And I think my understanding right now, their enforcement is largely focused on pirate radio and so forth. So I think there's a real resource. It is theoretically the FCC can come out and help, but I'm not sure at the current resource levels. Now that's way above of course our current thing, but realistically I think there are some real challenges in their ability to do what we are asking them to do.

LARRY ALDER: Okay, with that I think we will close that subcommittee. And we will move on to spectrum efficiency and Brian are you going to present?

BRYAN TRAMONT I am indeed. All right. So thank you, and Carolyn is going to help me through this year. So this is the spectrum efficiency subcommittee. We had two different questions so we had two different tracks of work. Carolyn is waiting on the average and recommendations on improving efficiency without harming effectiveness with the interviews with the agencies. She'll report on that first and then I will pick it up from there and discuss the mechanisms and barriers task group. So with that, Carolyn?

CAROLYN KAHN: Thanks, Brian. So, for the federal agency interviews, as part of this, we've been reaching out to federal agencies to get their input into the subcommittees, thoughts, considerations so that we can make good recommendations in this area. So, we have conducted several agency interviews. We interviewed DHS, OMB and ITS. We also have some upcoming agency interviews with DOD and FAA. There was a schedule change with the FAA interview, but we anticipate getting both of those interviews completed in the next couple of weeks. We have also requested some additional agency interviews with DOJ, NASA, NOAA, OMB and IFPP. So, hope to get as much input from the agencies as possible because that will help to improve the recommendations that we can put forward. We also reviewed the ITS report on spectrum efficiency studies that Paige and others have mentioned earlier. We are circulating meeting notes, so if we have approval, can incorporate those into our final report as well. So our next step with group one is to complete the interviews and to fold that information into our input and recommendations.

BRYAN TRAMONT: Yeah, that is task group 1. Task group 2, and we've had these three subcommittee calls between February March and April, roughly once a month breaking up both sets of tasks in addition to the interviews that Carolyn referenced. I'd like to stress as we go through the next group of slides, these are all very tentative draft conclusions. Our committee, there's a little bit of an American Idol component to this in the sense that we have very different views on which proposals have the most promise and what have you and we try to do blended recommendations. But this is still a work in progress. We have tried to be inclusive in our calls in terms of reaching out to everyone on CSMAC who would like to participate because I do think, particularly when we get to the possible mechanisms going forward, more is better in terms of more contributions about which seem the most promising going forward. So the first step that we asked everyone on the committee to work through was identifying the barriers to efficient

secondary market or efficiency type transactions. We, those barriers fell into four rough buckets, legal, structural, information gaps and then other, because we had others. And the legal barriers we identified include the miscellaneous receipts act, the antideficiency act, the scope and funding mechanisms for the SRF even after the reforms and then the inherent limitations of the Congressional appropriations process.

Structurally, we identified that we'd like for NTIA to have more authority and resources. I'm sure we'll get a big fight out of you guys on that. Yeah exactly. We know our crowd. Additional staffing and the general resources from an economic perspective and then additional administrative burdens because to the extent that we have wonderful ideas, they still require resources on the government side in order to implement those economic mechanisms. On the information barriers, lack of updated comprehensive data regarding federal spectrum use so that it's a little more turnkey as opposed to a seemingly more labor intensive process and less transparent process and the lack of transparency on federal spectrum pricing issues, tying back a little bit to the A 11 conversation we had earlier. Other barriers identified by the group include the inherently high transaction cost with facilitating these types of market mechanisms and then a lack of trust in the technology and the regulatory interference resolution processes, which had echoes in our conversation of 3.5 in the last committee report. So we identified all of those as barriers.

We then solicited from the group a list of mechanisms that could be deployed to facilitate more efficiency and additional market-based mechanisms here. We leaned heavily on the institute defense analysis report that was issued in January 2014 which is quite a good paper if you have not reviewed it, admittedly somewhat dated now that walks through a number of different possible mechanisms and then we had additional mechanisms that were recommended by the committee and then we had, this is the American Idol part, we had a matrix that went through how everyone had ranked them to the extent they participated in that and we had them tier the most promising, promising and least promising with the theory being that the NTIA would pursue as a first order the most promising ones and the next promising etc. And to be clear, it's not one over the other. Our suspicion is that these tools would be used at the same time and perhaps adapted to different bands. We didn't get into which band for which mechanism, but I think we all agree that you'd want to experiment and maybe a testbed sort of way with each of the mechanisms particularly the most promising ones. Once again we broke these into, and we have, I should mention this as well we have a draft report but that report is still a work in process and we decided it was much easier to get these slides approved than it would be to get the report approved coming into this meeting, which I regard as a good decision. But we do have a draft report which walks through these. And the most promising on the list included funding. So, predictable and flexible funding to support development implementation of sharing options to increase efficiency, including possible modifications to the SRF. So that is one bucket of things. Increased spectrum property rights. So, giving a rights database that would allow property owners to clearly define the rights they have, this is federal users, make

ownership transparent, allow licensees to identify neighbors that may be encroaching upon them and identify potential targets for negotiation with respect to spectrum use as well as facilitating market transactions. So a more transparent property rights model for federal agencies, including the possibility of transferring and retaining monies which we know gets into the controversial part.

Third, bidirectional spectrum exchanges or barter swaps, once again empowering federal spectrum users to engage the private sector on a bit more, well, in cooperation with NTIA of course, in coordination in NTIA to engage in these types of exchanges or indeed have the private sector approach federal agencies and have them be able to engage in a dialogue around barter or exchanges that might be mutually beneficial in the marketplace. And finally, as I alluded to in our barrier section to increase NTIA authority to allow it to more actively support federal agencies including managing spectrum through audits, enforcement and critical examination of spectrum requests. So we'd like to make David the king of the world.

PAIGE ATKINS: Can I ask a question before you get to the next slide? So on spectrum property rights you are looking at establishing property rights because they don't have them today.

BRYAN TRAMONT: Right.

PAIGE ATKINS: Okay.

BRYAN TRAMONT And I suspect it would be property rights lite, even lighter than the commercial side, but something that gives them a little more efficacy around how they managed the resources obviously in partnership with you all, was the theory. Then there is the promising mechanisms. Administrative relocation with an overlay. So this is the model, and Charlotte can check me on this, that I don't think has ever been tried, a straight overlay licensee over a federal user with the idea that it would give essentially the private sector in that testbed the right to negotiate with the federal user around their use and indeed engage in commercial transactions to facilitate continued a compliment of the federal mission while still facilitating some private-sector sharing. So, rather than having sort of this group transaction cost notion, you would say okay for this band and this location, which commercial entity is most interested in that spectrum. They would bid, they would win an overlay license without essentially secondary rights to the existing federal license holder and then they would engage in a market-based conversation with no pressure on the federal agency to do anything. But if the commercial provider came up with an economically rational proposal for relocation or for different kinds of use or geographic limitations or what have you, then that transaction would be allowed to move forward. Once again, not clear it would work, but it's another proposal that is out there and might be worth a testbed.

In addition, there's a spectrum auditor notion, which among many of the proposals elicited a robust response from some members of the committee and it builds on prior CSMAC recommendations regarding A 11. OMB would assign a value to spectrum

usage and conduct an annual review of agency spectrum holdings requiring agencies to justify their spectrum needs and pinpoint spectrum to be made available for sharing or leasing. CBO could score the spectrum repurpose it in a way that promotes sharing. administrative challenges obviously because the role of the auditor would be fairly resource intensive and there's also information and balance in terms of agency and the auditor. But, it does have the advantage of relying primarily on existing institutional relationships in the sense that we audit other resource use of the parts of government. Third, dynamic federal spectrum secondary markets. This is something I think, well, my perception is has had limited success in the commercial context so I think there's some question about the level of demand. But they would be an ability for federal agencies to make their spectrum available on a temporal basis for short-term lease and it could be dynamic, real-time option kind of component. Once again, maybe here too it is a testbed kind of idea. Which I view 3.5 as a similar example of. And you'd have to find a mechanism to do that, but the idea would be, would there be, and maybe this dovetails into the work that Charlotte and the committee are doing, are there bands where there's enough commercial demand that a spot dynamic market would be economically viable and technically feasible. And so, that was another idea.

And then finally a greater access to auction revenue. And the notion would be something more robust than the existing spectrum location fund, that federal agencies would be allowed to retain some portion of auction revenue. The problem of course is, does that result in offset of appropriated funds and if it does the whole thing does not work at all. So that is a big challenge on this one. But I think the idea of creating an economic incentive for people beyond the existing SRF is a worthwhile goal to pursue. I just I think everyone agrees this one has some challenges because of the appropriations process. And then last but not least, the least promising, I guess they are least actually, the least promising mechanisms, and I should say that two things were so promising that they did not even make least promising. That's how bad it got. Rental fees, shared spectrum superhighway spectrum currency, this is building off the P [cast] report, and I think an oldie but a goodie, the [Brak], the modeling spectrum management after the Defense base closure and realignment commission approach. So it's a one-time reallocation of agent of spectrum and, anyway, many barriers to that one.

So this is where our, as I said, our American Idol voting is currently at the moment. But we do want more people to participate, including at this point adding additional mechanisms if something is not here. There's also, I suspect there will be some parsing of these proposals, because some of them have multiple levels in them. So it's a little bit of a work in progress as well. As I mentioned we do have a draft report that is in reasonable shape, but the biggest variable is which bucket the various proposals are going to fit into. I'm hopeful that we can circulate something well in advance of the July meeting that would give the take on the buckets. I think it will be important though to get input from the full CSMAC in advance of the July meeting on where things fall so that we are able to produce a final report in July. That's the one barrier to July, because alternatively we would produce our committee's recommendations for what is in which

bucket and then we could vote on them in September but if we are trying to get to final in July we would need to have the full CSMAC engagement in the month leading up to the July meeting in order to make that work. I got Mr. Redl to put his tent up. That's scary.

DAVE REDL: You brought up NTIA and you brought up Congress. You had to know I was going to chime in.

BRYAN TRAMONT Dave Redl bingo.

DAVE REDL: Exactly. As you guys are looking at these have you considered how you would square, some of these would have potentially contradictory outcomes with CBO. The idea of property rights, squaring with your auditor function squaring with greater access to revenue, CBO will look askance at the way those might play together. Are you guys looking at that as you go to figure out which are most promising at the end?

BRYAN TRAMONT: It is a good question and I think Mary identified the question about how good are these ideas and how achievable are they and how do those things work together.

DAVE REDL: I mean I didn't even get to achievable. Achievable and CBO are almost never in the same sentence.

BRYAN TRAMONT: That's a fair point. Anne is having a heart attack because that's the com daily headline for tomorrow.

[Laughter]

BRYAN TRAMONT: So I don't think, and the committee members can weigh in on this, I don't think we pretend to be experts on how CBO works or necessarily being able to always predict how they will view certain proposals. I think we have to enfold that into one of the barriers on issue ability but I don't think anyone on the committee is really expert on this, so it's a problem for what we are trying to do. All of these ideas are so multifaceted legally, politically, technically, even before, and then, so it is hard to figure out how to, what metric trumps the others.

DAVE REDL: Fair enough.

LARRY ALDER: Michael, do you have any, are you ready for questions?

BRYAN TRAMONT: Yes.

LARRY ALDER: Michael?

MICHAEL CALABRESE: Yeah, Michael Calabrese. I just wanted to also note that it's difficult to look at these completely as standalone. They need to be, I think we also need to work harder at putting them into a context. For example I'd be very concerned about notions of spectrum property rights for agencies or secondary market transactions, unless it is part of a policy framework administered by the NTIA in collaboration with

FCC. So, something we've heard here in past years is that ad hoc transactions may not be feasible or desirable especially if we are thinking about leaving that to individual agencies. Most obviously an ad hoc lease could preclude a framework for more general and flexible use of a band in the future. So, what if the Navy had just decided to lease to Midwest utilities to use the CBRS band and that just put it out of play for the general flexible use that it's going to now on this very intensive basis. For that reason and others, NTIA and not individual agency should make the decisions about commercial access. For one thing, as we have heard many times from Carl, and in particular over the years, is that there's hardly any federal bands that are not occupied by many agencies. And so there's not one agency that should, has or should have any say, any specific say and you have many different technologies, not just many agencies crammed into the same bands for efficiencies sake. And also there's the moral hazard of one agency being able to strategy [inaudible] secondary market transactions [inaudible] and so again the Navy might like that utility in Iowa to have access to the band and thereby put it out of play for a broader public interest purpose. So the context is going to matter, policy framework is going to matter for each one of these and we should make sure we are explicit about that.

BRYAN TRAMONT: I guess as a quick reaction, one is that I do think it's, well it was not part of our charge, but I at least internalized the idea that we were making a proposal for possible testbed use and I think identifying the bands where you would experiment with these tools is very important, consistent with what you just described. So, clearly you shouldn't identify a band that is a prime and identified for reallocation for sharing for one of these testbeds, but I do think it's worthwhile to try to pursue these tools to see what works much in the same way we are doing for the 3.5 because I think government has to be more comfortable, policy, government, commercial entities, all have to be more comfortable experimenting with different tools at this point and I think if we can get data on something that doesn't work, that's useful too.

LARRY ALDER: Go ahead, Rick.

RICK REASER: So, this is Rick Reaser from Raytheon. I wanted to just mention two things. I'm a big favor of the spectrum property rights idea, me and Hannah Montana both are on board with that one. So anyway, and I think it plays into this other issue that you get into with other committee which has to do with the key band characteristics because if you could define sort of the rights of the incumbent and what their baseline is I think that helps open up the idea about what come it makes things favorable or not favorable for sharing or reallocation so I think those two things play together. The other thing I wanted to bring up was going back to Paige's comment about the OMB circular and the metric in there. And in our interviews and will probably get this from the other people we talk to we've not found anybody who's really found much use in the metric that's in the current circular although the Navy did implement it in their new instruction it has absolutely no, there is no value to it in terms of what they look at in terms of a metric because it's based on basically a commercial wireless you know, cell phone idea.

Which is not something that they are kind of into. So, one of the things that I would say is that I would hope that one of the things we're going to do is make some recommendations about that, or some observations about the current that we have, that is part of our questions and asking things, one of the people didn't even know there was such a thing to be honest with you, that we talk to, so the whole idea of what that metric might be is something we're looking at, that you mention in the OMB circular. So.

LARRY ALDER: Okay Janice did you have your tent up from last time? Oh, Dennis, go ahead yes.

[Inaudible voice off microphone]

DENNIS ROBERSON: Okay...

LARRY ALDER: Got to point it right, got to eat it.

DENNIS ROBERSON: I've always struggled with this one. Now you can hear me. Because trying to assign, and I struggled with it when we were doing the P cast report as well, trying to assign the same characteristics to government that are very natural in the commercial sector is very hard. In a situation where you have budgets that are assigned from on high, that the individual agencies don't have real control over, makes this all very very difficult and there are certainly lots of mechanisms that we can explore and I think it's useful to do so in some respects but when you get to the bottom line it really is just fundamentally different. And I will tell a little bit of a homey story about myself. And way back when at IBM I had responsibility for technology for a division and I wanted a group of my people to do something in the UK and they said unless I funded them, they would not do it. So I funded them. And the next budget cycle I took precisely twice what I had given them out of their budget for the coming year. And the message there is that that works the same in Congress. Since the organizations function based on monies that are put into them, not based on their revenue, or some metrics that are in their control, it really is difficult to use these market-based mechanisms and apply them to the government. So, just a word to put in on that.

LARRY ALDER: Thanks, Dennis. Any other comments, questions for this subcommittee? Okay. With that, I think thank you, Brian and the rest of the efficiency subcommittee. I think we are at the end of the subcommittee portion. So now we have an opportunity for public comment on any of the things today so the first thing we will do is ask is there any public comment in the room? So, seeing none I think we will move on to, is there any comments from the public on the phone? Okay. Also hearing none, I think we will move on to closing remarks, by the cochairs. So I will say a few words and I don't know, Mark if you have anything to add as well. Again, thanks for the good work. It's a lot of work in a short period of time. And I know it's going to be a big crunch between now and July to get these things done. But I have confidence based on what we heard today that we will have a good outcome in July. The only remark that I have today, and I've consulted with David, is we are going to have our ethics training, which is always exciting. We are going to do that right after the close of this meeting. Then

we'd like to do one other thing. Since this may be the last meeting in DC, which is always the best attended meeting, but maybe, we'd like to take a picture. So if everyone could stick around and maybe gather up here and I checked with David that we are okay with the FACA rules on this.

[laughter]

[several background voices]

LARRY ALDER: So everyone who is a member, we'll do a picture of everyone who is a member and all the NTIA representatives liaisons that would be great.

H. MARK GIBSON: Other than what Larry said, thanks for all the work. I know that pulling all this together is hard. Thanks for all the work that you've done and this has been a lively discussion and I'd like to give an opportunity for David to make any comments he would like to make. Paige do you have any comments? Awesome.

LARRY ALDER: So with that we will close the meeting and we will turn it over to Eric for the ethics training.