COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE

(CSMAC)

PRESIDENTIAL MEETING

July 27, 2011

The above-entitled meeting was held at Institute for Telecommunications Sciences, 325 Broadway, Conference Room 1107, Building 1, Boulder, Colorado, at 1 PM, before Martha Loomis, Certified Shorthand reporter and Colorado Notary Public, Court Reporting Office of Agren Blando Court Reporting & Video, Inc, 216 - 16th Street, Denver, Colorado 80202.

APPEARANCES:

KARL NEBBIA, Associate Administrator, NTIA
BRUCE WASHINGTON, Designated Federal Official

CSMAC WORKING GROUP:

DR. BRIAN FONTES, Co-Chair
DR. LARRY ALDER
DR. DAVID BORTH
MR. MICHAEL CALABRESE
MR. MARTIN COOPER
MS. SUSAN CRAWFORD
MR. MARK CROSBY
MR. THOMAS DOMBROWSKY, JR.
MR. DAVID DONOVAN
MR. GARY EPSTEIN
MS. MOLLY FELDMAN
MR. MARK GIBSON
MR. DALE HATFIELD
DR. KEVIN KAHN
MR. DOUG MC GINNIS
DR. MARK MC HENRY
MR. ROBERT PEPPER
MR. CARL POVELITES
MR. RICK REASER
DR. CHARLES RUSH
MR. TOM SUGRUE
MR. BRYAN TRAMONT
MS. JENNIFER WARREN

APPEARING BY PHONE:

DR. HAROLD FURCHTGOTT-ROTH
MS. JANICE OBUCHOWSKI
MR. DENNIS ROBERSON, Co-Chair
DR. DANIEL STANCIL
DR. GREGORY ROSSTON

(Whereupon the following proceedings were had.)

CHAIR FONTES: Okay. Before we go around the table and introduce ourselves who are members of the committee, I'd also like to find out who is on the phone. Let's just do phone roll-call.

We know Greg's on the phone.

MR. WASHINGTON: We can't hear them, Brian.

CHAIR FONTES: We're having a hard time hearing at this end. I don't know if there is something they can do with the phones here, the volume on the phones.

Okay. So we heard from Harold. Let's just keep going until we try and figure out a solution so we can actually hear people.

Anybody else on the phone? We're going to have to wait a second until we get the phone to where we can actually hear people.

Having said that, let's just go around the table now, and everybody introduce themselves, who they're with. Then what I'd like to do is introduce everybody else that's in the room.

Go ahead, Karl.

MR. NEBBIA: Karl Nebbia. I'm with the NTIA Office of Spectrum Management.

MR. REASER: Rick Reaser, Raytheon.

MR. CALABRESE: Michael Calabrese, New American Foundation.

DR. MC HENRY: Mark McHenry, Shared Spectrum Company.
DR. ALDER: Larry Alder with Google.
MR. GIBSON: Mark Gibson.
MR. TRAMONT: Bryan Tramont, Wilkinson Barker Knauer.
MR. EPSTEIN: Gary Epstein, Aspen Institute.
MR. POVELITES: Carl Povelites, AT&T.
MR. SUGRUE: Tom Sugrue, T-Mobile USA.
MS. WARREN: Jennifer Warren, Lockheed Martin.
MR. PEPPER: Robert Pepper, Cisco.
DR. RUSH: Charles Rush, CMR Consulting.
DR. BORTH: David Borth.
DR. KAHN: Kevin Kahn.
MR. HATFIELD: Dale Hatfield, University of Colorado.
MR. MC GINNIS: Doug McGinnis, Exelon Corporation.
MR. COOPER: Martin Cooper, me. ArrayComm.
MS. CRAWFORD: Susan Crawford, University of Michigan Law School.
MR. CROSBY: Mark Crosby, Enterprise Wireless Alliance.
MR. DOMBROWSKY: Tom Dombrowsky.
MS. FELDMAN: Molly Feldman, Verizon Wireless.
MR. POWER: Tom Power, DIA.
CHAIR FONTES: For those on the phone who can recognize voices, I'm Brian Fontes. I'm with the National Emergency Number Association. Greg and I are co-chairs.

Now, there are people seated around the room here. I think it's nice that everybody knows everybody, so let's do the introductions here.

(Visitors introduced themselves.)

CHAIR FONTES: Great. Now, I'm just looking at the folks in the control room back there.

Could somebody on the phone speak so we can see if we've improved the sound quality? Greg? Anybody? Harold?

DR. FURCHTGOTT-ROTH: This is Harold.

CHAIR FONTES: Okay. This is not very good.

THE FLOOR: We can't hear them. I guess Greg, somebody on the phone, can you hear us?

CHAIR FONTES: Yes. For those of us seated around the table, those on the phone, can you hear us? For those on the phone, can they hear the people in the room speak?

(Inaudible.)

CHAIR FONTES: Some of the folks may not be speaking into the microphone. If you have a microphone in front of you, please press the button to speak.

Great. And we're hearing that the quality isn't very good; it seems to be breaking up. So is there any way that we can --

DR. ROSSTON: If the people on the phone could all put their mutes on that might help.

CHAIR FONTES: I hope everybody heard Greg. If you're

on the phone press "mute." Of course, unmute it when you want to make a comment. A little levity.

Okay. I hope that, you know, we're not going to delay things too long here while folks find out what's going on with the phone and the microphone system.

So at this point I just want to provide a few opening comments.

I want to thank everybody for their work. And I know -- I've been trying to sit in on the committee phone calls, and simply can't do them all because there's a lot of phone calls going on. I know a lot of work has been done in a very short period of time.

The approach that we have taken in this session at this point has been questions and answers. Hopefully you find that focusing and allowing you to achieve some specific movement on the issues that you're addressing rather than our approach previously of having to address it kind of toward the end or periodically throughout the two-year cycling.

It's a change, and with change there's always some adjustment to change. But I hope everybody has found this to be a productive process and a focusing process.

Again, I know that there's a lot of folks who did a lot of work that went into this. I just wanted to say thank you.

There's going to be substantial presentations that you

will hear in a few minutes. So at this point I would just like to turn it over to Karl.

MR. NEBBIA: Thank you. I also would like to thank everybody for the work that's going on. I know there's a tremendous amount of effort that's been put in over the last couple of months.

We did break out the work into four specific works areas. The search for 500 megahertz broadly with an initial focus on the 1755-1850 band that's of course the NTIA's focus at this point. And Gary Epstein and Carl Povelites both agreed to chair that particular group.

We also set up a group on license. We had a group previous to that, but we decided there were enough unanswered questions that we reestablished a subcommittee to deal with that. Michael Calabrese and Janice Obuchowski agreed to work on that area.

Another one we set up dealt with spectrum sharing. Once again we had previously had discussion on that area, but felt like there was some more specifics that we needed to get into.

Larry Alder, not Adler -- we keep working on that. I think we have fixed it and then somebody thought, Well, this isn't right, so then they turned it back around or something like that. But and so Larry and Mark McHenry agreed to work with that group.

The Spectrum Management Improvement area was the last area. Mark Gibson and Bryan Tramont agreed to work with that area.

In this case we sought to supply some specific questions for you to answer. We recognize that for the 500 megahertz search, and specifically that look at 1755 to 1850, we did not have a lot of time so that group more or less took on all the questions that we had at once.

On the other hand our intention for the most of the ongoing activity was to focus on one or maybe two questions at a time. And I really want to encourage you to do that.

I know when you see the whole list of questions in front of you it's easy to try to take them all on in one big package. But we're really not looking for you to kill yourself over this session, and then we're going to pick all new members for the next time around.

So we've particularly broken it up with the purpose of focus on one question, have the discussions in-depth, and come back with the specific answer or answers on that issue.

But please, for your own sake, do not try to take them all on in a short period of time. We'll -- you know, I've been here a long time; I'll be here a little longer.

And so it doesn't all have to be solved by September. I know looking at some of the materials, you guys have really been champing at the bit to get into the full range here.

So that's how we've broken it out. We've gotten a significant commitment I think from members to participate in those subcommittees and that's been terrific and the work has moved forward.

Our plan then was that we would deal with a question the first meeting that we came to we would go into where we stood on that question, what issues had come up. We'd have dialogue here, and we would select the next question to work on. The first question then would be finalized at the subsequent meeting, and so on. We'd be kind of creating this rolling effort.

So we hope we're able to fulfill those type of goals, both for your sake and for our sake. And we're really excited to get into the discussions today and see where everybody is.

CHAIR FONTES: Great. There's one matter of business I forgot to raise with everyone. Usually at the end of our meetings there's a little bit of open time for individuals to provide comment.

If you know ahead of time that you're going to be making a presentation or providing a comment at the end, if you can let know now I'd appreciate it; that will give us an idea of how much time we can allot to any individual.

So I know that there's one, Pierre. Where are you? I know you're going to make a presentation. Any others? On the phone? In the room? Great. Thank you very much.

Okay. So thank you, Karl, for kind of the rehash if you will of the how we got to where we are today and where we're going. I think the key message in all that is really pacing yourself.

I know the rather hectic pace, particularly from the first group we're going to hear is made up of a lot of work, a lot of time and talent and energy that went into this presentation.

I would just like to open it up for our first presentation. This was the Search for 500 Megahertz subcommittee's report.

MR. EPSTEIN: Thank you, Brian, and thank you, Karl.

Just as a preliminary matter, the fact that we got questions this time around was immensely helpful to us, and really helped guide our deliberations.

Secondly, all those kind things that Karl said about pacing ourselves and taking it easy appear not to apply to our group. We were told we really had to be done by now with all our search. And we have done our utmost to do so.

I'm not going to take a lot of time. Carl and I are going to make a couple of preliminary remarks. And then we're going to turn it over to the real subject matter experts for reports.

We were driven not by anything arbitrary. But we were driven by NTIA's commitment by the end of September to really

make a report on the fast track evaluation. And the initial bands in April 2011 did not make a recommendation on the 1755 to 1850 band. And so I think to be timely we have to provide input now at this meeting.

And so immediately after the May 25 CSMAC meeting we formed, we had a mandate to provide this input within 60 days. We formed two subgroups.

We formed a technical subgroup under Tom Sugrue. Tom immediately enlisted Steve Sharkey to help work on this. And we had an evaluation subcommittee under Molly Feldman.

And each group met weekly. We had full participation. There were at least two conference calls each week. And they were deep and they were substantive. The subgroup chairs and members really deserve a lot of credit for producing a lot of work in a short amount of time.

As Carl will explain, we actually focused on 1755 to 1780 originally for good and obvious reasons, which you'll hear about. Given the background and the timeframe it was an important thing to do. We will look at the rest of that band perhaps after this meeting.

And you will see a lot of very good and interesting material. Let me call your call your attention to two things very briefly. When you hear the presentation from Steve about technical focus on Slides 14 to 21, which talk about where existing government operations are, I found that very revealing

and very interesting. And in particular Slide 22, where we talked about possible relocation bands.

The evaluation subcommittee, which Molly headed up, looked particularly at Slide 26. We tried to provide some quantification in the evaluation area; very difficult to do with a lot of assumptions. But I think we made some progress in that area. But the assumptions are very important.

And Carl.

CHAIR FONTES: Carl, introduce yourself again so everybody knows who's speaking.

MR. POVELITES: Carl Povelites, AT&T.

How we going to change the slides?

CHAIR FONTES: Carefully.

MR. POVELITES: Go to Slide No. 3, I think. This slide is talking about the 1755 to 1850 band. As you know, we were asked by the NTIA to look at the entire band, reallocating that band for commercial mobile service.

Importantly that band was globally harmonized. It does build upon the DCS band but primarily AWS spectrum. We recommend that that band or portions of that be licensed for commercial use.

As Gary said, we really decided to look at this in piece parts, one being the 1755 to 1780 band due to the fact that that does hold some really near-term good capabilities with pairing with the 2155 to 2180 band that the FCC already has

available for commercial use.

It has harmonization with global allocations. And it does provide economies of scale, which helps with the economies of scale in the facilities.

We decided to look also at the 1780 to 1850 band. To a certain extent a lot of what you'll hear from the two subgroups will have impacts or relationships with the 1780 to 1850 band as well because the NTIA operations go throughout the band.

So what we did, as Gary mentioned, is focus our efforts on the 1755 band.

Bruce?

The recommendation really are to reallocate government operations outside of the 1755-1850. And primarily focusing on the 1755 to 1780.

If the entire band is not feasible to relocate we can hopefully work to limit government operations to other parts of the band, such as 1780, 1850, or some portion in between.

We really want to try to avoid replacing equipment for short-term migration. Don't want to run into the problem we ran into with 1710 to 1755 where they just pushed open the band, and then we have to do this again.

So we really tried to look at that from a long-term perspective, what we can do, how we can help NTIA and answer their questions, and move the entire band forward. But we'll

start off with the 1755 to 1780 band.

With that I'll turn it over to Steve to talk about the technology.

MR. SHARKEY: All right.

CHAIR FONTES: You want to come up here?

THE FLOOR: If you sit there you can see the screen.

MR. EPSTEIN: One other quick process question.

I'll ask Steve and Molly, we have an hour. We budgeted about 20 minutes for each of these. And they both thought it would be fine to ask questions during the presentation.

MR. SHARKEY: I'm Steve Sharkey with T-Mobile helping out Tom on behalf of the committee. So I'll run through -- I mean, there's a lot of material to cover so I'll go through it pretty quickly. But certainly jump in and, you know, and ask questions if you've got any.

We tried to go, the first part of this is going through some of the more technical questions that NTIA asked us to answer. And the first one was a question about what commercial wireless technical characteristics should be used in that sharing analysis.

I'm going to turn it over actually to Tom Dombrowsky, who put together a document that's been included, you know, in some of the material back here, a list of characteristics.

MR. DOMBROWSKY: Yes. What we attempted to do is we

had some outreach to a number of equipment manufacturers, folks who are very involved in the standard bodies, for instance for LTE, and tried to put together LTE transmitter receiver characteristics based on current standards as they stand now. That's been provided to NTIA as well through this group and through other avenues as well.

We expect it to continue to morph a little bit to sort of meet what NTIA actually needs to do the modeling they need to do. But this is all based on standards work and all directly derived from the standards box.

MR. SHARKEY: Thanks. So that's available. You know, you all have it. If there's questions let us know.

Next slide, please.

The next question was a question about what percentage of time that industry can live with interference in the band if sharing is necessary. And is there a way to estimate the impact of increasing interference of spectrum value.

I think, you know, as we discussed it, there really is no simple answer to this question. I mean, it depends on a lot about the area of interference. Is it in New York City or in the middle of Kansas? You know, how great is the interference? How often does it occur?

And the answer is going to depend, it may depend on the technology that's being used, shared protocols that are implemented. Some carriers may be more able to accept higher

levels of interference than others, or more disruptions to their services, and have other ways to shift traffic into other channels, onto other channels, or carry the traffic in other ways that can help work around, work around interference.

I think the one thing that we, you know, would say, you know, though is that limiting, limited interference and sharing would be, is preferable to exclusion zones.

So, you know, where often in the past when a spectrum is made available and it's a government operation and there's just the exclusion that says, you know, No, you know, no operations in this band or in this area, it's not a good way to make that spectrum available.

We would prefer to have some access to it and to work out either accepting interference and to work around it, or working out some sharing mechanism with the government so that it's more useful for both sides.

I think the bottom line is really that it is a case-by-case basis, and that we need a very rich dialogue between industry and the government agencies to figure out what the best solution on a case-by-case basis is, and whether we get a tipping point of an unacceptable level of the interference or not.

The next question was Question 1-G.

MR. NEBBIA: I guess my question is, a couple -- I mean, we're moving through the material pretty quickly. We

really appreciate the characteristics information; that's critical to any type of analysis, interference analysis we're going to do.

One of the questions I had from that, there are portrayed a number of different signal bandwidths related to LTE. One of the systems we've been having to work with a lot recently has I thought been talking about LTE technology, but on the basis of doing 20 megahertz, but having to separate the 10 megahertz pieces.

Is that, is that what we should be expecting normally from all of you? Obviously I'm referring to one of our favorite subjects where they have two 10 megahertz separate pieces that then multiplies into an intermod product that has other issues related to it.

So in all of the information we're getting here makes it sound like you're looking for single pieces for somebody to operate. And it's not double pieces of transmitting two 10 megahertz portions equaling 20 megahertz, it's just 20 megahertz segments. Is that right?

I mean, I'm not quite sure I understand why that other technology's being done that way. But it's become a major portion of that debate. And I'm kind of interested here whether that's what we're going to see.

MR. SHARKEY: Well, you know, I think this is done on a single channel basis.

MR. NEBBIA: Right.

MR. SHARKEY: You know, there are channel bonding technologies. We are moving towards channel bonding so we can combine multiple channels to get to essentially larger channels.

MR. NEBBIA: Okay. But there's no essential need here with LTE of having -- you're going to get 20 megahertz -- of having two separate 10 megahertz pieces that are separated in some way? That's what we're seeing there. I just want to make sure that's what we're seeing there.

CHAIR FONTES: Say who you are, please.

MR. COOPER: Marty.

Most LTE systems are TDD or FDD paired spectrum. But there will also be single channel TDD LTE systems available so we'll find spectrum either way, and it should be useful.

MR. NEBBIA: In this stage we're still dealing with FDD. I mean, there's an upside and a downside. On the one side they've still broken it up into two 10 megahertz pieces. And that's not necessary, I assume, in your work, correct?

MR. DOMBROWSKY: That's a -- it's not necessary. I think it's a case by case to some extent. It's kind of like one spectrum if you have it, where you have it.

If you're a licensee and you're going to try to use your spectrum assets how you can in terms of the characteristics we looked at, what the standards are looked at for particular carrier sizes so you have an idea of what those characteristics

are for those particular bandwidth sizes, if that makes sense.

MR. NEBBIA: On the dialogue you're talking about, where do you recommend that that take place? You know, that can't all happen here obviously. But, I mean, how do you want that to go forward?

The agencies are looking at this, you know. They're anxious about what they're going to get into; they only have so much in the way of staff to participate in it.

So where, what's the right timing and the nature of that type of dialogue?

MR. SHARKEY: I think, you know, I know you've got some information that you're looking for for the agencies. You've got your September report. I think if we can have some dialogue as soon as possible it would be helpful for both sides to understand that.

We don't want to slow down the September report; you know, we want everything to stay on track on recommendations. But maybe from some initial discussions, building on that, you know, after the report and after recommendations.

But I think the key is getting some of the real technical experts in the room that can really look at what is the, what is the real impact of interference, and can do that analysis.

And then what are solutions to that? What are the ways that cooperative mechanisms can be put in place, or if

there is a need for a cooperative mechanism that could work?

So I think both sides feel more comfortable with, if it's interference with the commercial system, that the government guys feel like there's a way to deal with that, the industry recognizes that, or if there's interference with the government system what's the right way to protect the government system.

MS. WARREN: Jennifer Warren.

Steve, when you were talking about that some operations and operators can accept more interference than others, how should that factor in? If the band is chosen to be shared, how should that factor into the technology if specific technology should be prescribed because they're more conducive to sharing than others?

I presume the group looked at that.

MR. SHARKEY: First, I don't think, you know, you want to prescribe a specific technology. I mean, the analysis has been based on LTE as the technology that industry as a whole, that's the trend in technology.

You know, it goes more to I think carriers may be in different positions in different areas of the country from a total spectrum holding perspective, and do they have ways that they can help mitigate the impact of interference on their customer and ability to serve their customers.

And I think, you know, that part of that then is going

to just be what would a carrier be willing to pay at auction, you know? What is that, you know, what's that spectrum worth to a particular carrier in the market?

MS. WARREN: Okay. I was just reacting to the part that said it could be technology dependent. It sounds like it's really not technology dependent; it's basically just how much capacity they have in a given market to tolerate.

I'm just trying to figure out the part that was emphasized there. And it sounds like that's not really a relevant factor.

MR. SHARKEY: It could be a relevant factor, you know, depending on their, their, you know, certain carriers in existing network system. So, you know, an ability to shift traffic, what effect that would have.

MS. WARREN: Okay, thanks.

MR. COOPER: Let me comment on the issues that Karl brought up.

We keep talking about technology as though it's a static thing. And it really isn't. When you talk about interference, what is interference today five years from now is going to be solved.

So I would suggest that in this process that you talk about what Karl asked the question about, there's got to be another input, and maybe from the academic community.

I suggested last year that the National Academy,

somebody that can do some prediction of what the characteristics of these systems are going to be five years from now, because I think your assignment is a ten-year assignment; is that right, Karl? So in ten years there could be a huge change.

You asked about TDD versus FDD. The only reason we have FDD today is because you couldn't build a TDD system 20 years ago or 30 years ago. And if we were starting our system today they'd all be TDD.

So having that time element in all of our considerations -- and that applies to every committee -- I think is very important.

MR. SHARKEY: I mean, you know, I think it's a good point to be forward looking on the impact. You know, a lot of this is of course aimed at can we get to a comfortable place in the short term for the September report to help facilitate making the spectrum available, you know, in a shorter timeframe. But obviously technology changes.

MR. REASER: Rick Reaser.

So the bottom line though is that you're sort of saying that there's interference that could be acceptable, but it's on a case-by-case basis. It's not like there's ten million things. So some interference will be acceptable.

It probably will be mitigated though by having other spectrum available. That's what he was getting into, how big a bunch of bands you'd have to write off once you got interfered

with, and --

MR. SHARKEY: And shift traffic to other channels.

MR. REASER: -- other channels or other bands.

But that's really not, you really can't accept interference; you need more spectrum to make up for it. It's not a technology issue.

There might be some technology issues. You could have, you know, some small amount of interference. But you're going to make up for the interference by more spectrum. That seems to be what I got.

MR. SHARKEY: Yes. I mean, the system can accept some level of interference and, you know, you'll end up with lower data rates on the channel.

MR. REASER: Yes.

MR. SHARKEY: But, you know, there would be a fairly limited amount of interference. So there's some availability there, but it's the nature of interference we're seeing.

CHAIR FONTES: To your point I think in many respects it's also an issue that must be addressed by the FCC in terms of licensing size, amount of spectrum which we discussed earlier today, and that they have some mitigating variables, if you will, for the interference issue.

MR. SHARKEY: Okay. So question 1-G asks, you know, if there's, you know, if there's interference with industry at some location or time, then an agreed sharing approach and what

it would mean in terms of Service Rules would be incorporated in the interference in terms of license and licensees' expectations.

Again I think this is, you know, it's another one that will vary on a case-by-case basis depending on the systems that we're looking at and the sharing that's agreed.

I think, you know, the key here is that there is sufficient information available from both parties to know what to expect both for the interferer and interferee to have some clear expectation about what, you know, what kind of operating conditions they're going to need to live with.

There is, you know, again you prefer to not see pure exclusion zones, but to see some kind af a sharing mechanism put into place. Cooperative sharing is certainly going to be the best case on managing interference.

There are cases where we've done uncoordinated sharing, something like 5 gigahertz, you know, which is unlicensed but those same principles can potentially be applied here. We use sensing to determine whether the government system has come up and then you take some action based on that.

But, you know, again you come back to the need for information from both parties, getting the parties to sit down and understand the systems and how they operate, and then develop the best approach to either sharing or accepting or working around interference.

I put in one, you know, reference to, you know, the rules on defining expected interference level and the relative responsibilities of sharing parties. There's an example from 800 megahertz rebanding that I thought was worth noting; not that 800 megahertz rebanding was a success overall I would say.

THE FLOOR: We don't know yet.

MR. SHARKEY: Okay. We don't know yet. It wasn't as smooth as people anticipated.

But I think one of the things the FCC did there was in coming up with a going-forward solution they did define, if you're a public safety system, they said, you know, You will get protection if you've got certain signal level and your receivers perform with certain characteristics as a Class A procedure. And if you still get interference then the interferer has to resolve that or make some changes to fix that.

If you don't meet those minimum levels then, and you receive interference, you have to take an action to fix it. So it does impose an onus on the incumbent to have some minimum level of system quality.

And it's a system approach, not just standard. But it looks at how the total system is deployed to help solve that problem.

So it's things like that that I think we can be a little creative as we sit down and work through some of the problems.

MR. TRAMONT: This is Bryan Tramont.

To what degree did the group talk about the flexibility to have the two parties negotiate outside the context of rules?

And then if and when they have reached an agreement to either bake it in or not? In other words, does it envision an ongoing dialogue that might be different from the rules? The rules going forward?

Building on what Marty said, in part, right, over time interference characteristics change as well as the needs, and sometimes rules can lock them. So I was just curious in thinking about the sharing and some of the issues on 1-G whether -- how the committee thought about those problems.

MR. SHARKEY: I think that's right. I mean, we view the rules as providing kind of a baseline to work from. And then if there is -- then there should be continued opportunity for dialogue to improve the situation for both parties.

Tom was talking about one of the exclusions we had in North Carolina that, you know, originally in the 800 west band there was a 100 kilometer exclusion zone.

We were able to sit down with, you know, with the impacted party and reduce that from 100 kilometers to 50 kilometers. So a huge impact for us without having a negative impact on the government user.

MR. REASER: Was the experience that the government

had the flexibility to do that? Did the federal government user generally have flexibility to --

MR. SUGRUE: Yes. This was designed to protect from some systems. And then those exclusion zones were probably of some use in some regions.

But we don't need that much protection after all now that we see the characteristics of the system.

MR. REASER: I guess in some reports there wasn't always the flexibility at the operational level to cut those kinds of deals or to accept the compensation. That's what --

MR. SUGRUE: That's a different issue. It turns out you can't give the government money. The government can take money from you, but you can't give the government money. We tried that too.

MR. HATFIELD: I'm still a bit curious. Who actually approved it?

MR. NEBBIA: As far as I know, all of these arrangements were arrived at at the local level between the company that was trying to get access and the organizations they were dealing with in those local cases.

CHAIR FONTES: In that situation is there any other governing authority that would validate that agreement so that if that agreement were in fact violated they could go to the government authority for relief?

MR. NEBBIA: I think there was certainly, I'm not sure

if there was any MOUs written along those lines; there may have been. But nonetheless I think the interest still would have been there if they reached this agreement and then started experiencing interference. They would have been back talking to each other once again.

I think it was, you know, certainly a great deal based on the willingness of the two parties to work, to work together.

MR. POVELITES: That wasn't one of the issues that we really dwelt on. We'll leave that for the next session as to what -- you know, it's an implementation type of a question.

MR. EPSTEIN: The illustrious sharing.

MR. TRAMONT: I was just building off the flexibility.

MR. POVELITES: We really do. Again, these are great issues and interesting issues.

We've got about five more minutes for this presentation and then we need to move to policy issues.

CHAIR FONTES: Every time somebody goes to the microphone would you just state your name again? It's primarily for the record and then for the people that are on the calls that actually cannot recognize your voice.

MR. SHARKEY: Steve Sharkey again.

The next question really goes to with band pairing of 1780 and 1850 and looking at separation requirements.

So, you now, if we get access to the entire 1755 to 1850 band what would we do with it from an implementation

perspective?

And, you know, we run down -- I won't go through -- you can go to the next slide. I won't go through in detail here. But some of the general principles that we've worked with I think as a CMRS community that we do prefer paired spectrum. That's how it was initially implemented, and we continually prefer the approach.

We are very mindful of interference issues. It all depends on what your neighbors are on. You want light services next to light services to minimize the potential for interference. Spectrum that helps minimize the equipment design issues so you have consisting band pairings, duplex spacing.

Spectrum harmonization, spectrum that can be as closely harmonized around the world as possible to help build economies of scale.

DR. KAHN: Kevin Kahn.

I'm just a little nervous about baking too much FDD into these recommendations. I mean, the reality is anyone who looks at the traffic going out over broadband networks these days will see that that traffic is not symmetric; it is highly asymmetric.

Now it could change; it could all become symmetric. But the reality is in almost every broadband deployment, whether it is wireline or wireless, nowadays as you see content consumption being the dominant aspect of this it's asymmetric.

I have no problem if the carriers all decide all they ever want is FDD. That's fine. But quite honestly -- I'm sorry. No, if all they want is FDD that's fine. Quite honestly I think a lot of carriers are looking in their rearview mirror right now because the traffic doesn't correspond to that.

And, you know, I think it's dangerous to sit here and say, Ten years from now we're all locked into a, you know, a mechanism that leaves half our spectrum sitting idle because we said, The world shall be paired.

So I don't have any problem if that's the choices they want to make. I mean, you know, if they buy the spectrum it's theirs to buy. But let's not bake it too deeply into the choices we're making as we go forward here.

MR. POVELITES: This is Carl Povelites.

I would add that there are FDD opportunities also that are asymmetric as well.

MR. CALABRESE: Michael Calabrese.

Yes. I just want to second what Kevin said. We have to be careful that this isn't the CMRS committee in a way. We got to make sure this is about opening capacity for whatever competitors come along.

One thing that seems maybe to be missing -- and I'm on the committee but I missed some of these meetings, particularly the technical group. But there is a point when you talk about 1755 to 80 is one thing 'cause that seems to be very

much on track towards clearing it sufficiently for LTE; at least that's the conventional wisdom.

When you talk about the entire band up to 1850, and especially if the interim solution is to move some of 1755 to 80, some federal into the higher portion, then I think at some point you get to a situation you have to consider that you may have for example exclusion zones that when you, if you looked at the band for an alternative use such as low power you could use it much more efficiently than just assuming it's going to be high power LTE.

So I think we have to at least, you know, also bake in the consideration that we want to look at what's going to be the most efficient use depending on what can happen with the federal users over what timeframe.

DR. RUSH: I'm Charlie Rush.

I just want to point out that while I agree that we shouldn't just be focused on FDD I think that in the past few years there has been an appreciation that the traffic isn't necessarily going to be as asymmetric as has once been thought.

You see this time and time again on things like Facebook and that kind of a system of service I think that the advantages, without getting into technology issues, about having an FDD approach is that it allows for more flexibility in that if you want to move away from, an operator wants to move away totally from an FDD equally paired spectrum, he or she could

have, should be able to have the right to take part of the uplink FDD and make a downlink FDD. You can do that in terms of their license without causing interference.

I think that may be one of the reasons why people are still tied to the FDD approach as opposed to just embracing TDD.

MR. SHARKEY: These are all good comments. Sorry, this is Steve Sharkey again.

All good comments, and I think these are kind of guiding principles that we've worked from. And, you know, there is some flexibility on a case-by-case basis for getting solutions. But this is kind of putting out that target.

And, you know, based on the principles, 1755, 1780 -- and I won't dwell on this because we've talked about it a lot already -- but it is a band that's, you know, ripe from our perspective to be made available.

There is spectrum that can be paired with it and be auctioned in, you know, the relative near term assuming that we're able to, you know, get cleared with federal users to work out sharing arrangements with those users.

You know, the question then really goes to for 1780 to 1850, what would we do with that consistent with those principles? And, you know, here's a band that is right between an AWS uplink band and a PTS uplink band. You know, we do want to see if we have an opportunity to get FDD use and paired use in this we would like to pursue that.

There are potential downlink bands that are under consideration either at the FCC, or other bands have been identified by NTIA as part of their search. Those include, you know, 2 gigahertz in the test band, 2200, 2290 band.

So while there may not be a clear band right now that you would go and auction with, there are certain bands available that are worthy of studying, look like they're potentials for pairing within there.

But I think that, you know, and from an interference issue because it is right between a PTS uplink band and an AWS uplink band that an FDD pairing and use of this band for a mobile uplink makes sense and creates, you know, eliminates some of the interference problems. We are trying to use this as a TDD band between the mobile uplinks.

So I will just touch on this. I know I'm well over time here. So we'll go through this really quickly.

This section is an overview of some of the government systems. Carl gave a good view of systems in the band at the last CSMAC meeting. And this is some of our -- what we tried to do here is kind of go through system by system with some of our thoughts of where there might be potential for, you know, for changes that could help make this band available and some avenues that hopefully, you know, NTIA or industries working with NTIA can pursue.

Fixed point, the point is throughout the band there

are bands that are available for relocation. You know, point to point is, you know, fairly straightforward. We relocated, we have done relocation for PTS and for AWS clearing. And I think to transition there should be feasible and well understood.

Tactical radio relay systems, which are really portable microwave systems that provide backhaul, go through -- there are a few questions that come out of looking at some of the reports that, about use of this band and the amount of spectrum that is needed.

The 2010 report talks about needing a minimum of 95 megahertz but it looks like it's being paired with 40 megahertz in another band so there may be some potential to use some spectrum in this band and restrict the use to 40 megahertz per pair.

You know, one of the questions on the just the efficiency of how these systems operate, so the reports talk about them operating at .64 bits per second per hertz and that compares to a minimum FCC requirement of 1 bit per second per hertz.

So, you know, if they're operating at 64 percent of what a minimum FCC requirement would be, you know, it would seem to point to a need to upgrade the system to something that's more efficient. Of course, that can either be done through auction proceeds or a long-term, you know, refresh.

MR. REASER: One of the reasons why the effect is

different on military systems is encryption and anti-jam and, you know, a lot of other requirements that cause the megahertz to really go down to account for other things.

MR. SHARKEY: And I recognize there's not, you know, it's difficult for us to have a lot of answers for these; so they're questions we have and, you know, that look like they're worth pursuing.

But it does look like there are probably some bands that we can look at relocation of these systems also. And we'll cover that a little bit later in the presentation.

A satellite TT&C, telemetry and control uplink bands for DAD. NASA and NOAA use a different band; they use the 2025 2110 band, which is also a noncommercial band use for ENG operations.

So, you know, looking at a long-term move of those systems up into that band, recognizing that that's a long transition and the systems are in there, then there are a series of questions here that look at the potential for sharing through any transition.

And I think, you know, we just don't have quite enough information to know the impact of these systems, how many satellites are in there, how do they actually operate.

I have seen information on kind of worst case power levels for these systems, but we don't have good information on how they operate on a day-to-day basis, what kind of power

levels. And that, you know, will all come out in a full technical dialogue.

PGMSs, precision guided missions, which are airborne systems that obviously impact large areas of long line of sight airborne systems, again the number of questions about how long, how many of the systems are in there, how do they operate, what kind of frequency agility do they have to operate in a more limited portion of the band.

Air combat training system, again another airborne system. This was looked at back in 2001. And it was a different system that, you know, at the time the DOD noted that it would be replaced by another system, another system that seemed to be more frequency agile, and so more ability to limit operations into upper portions of the band, 1755, 1780 short term. So, you know, free up some more information about the status of that, where those possibilities exist.

The video surveillance systems are one of the most difficult ones because these are US&P assignments that go across the whole country as a result of clearing activities in 1755, 1710 to 1755. They're transitioning to digital equipment that uses less than half the bandwidth.

Carl talked last time about some of the difficulties that they're having finalizing their equipment. But I think they're continuing to move on that, and also looking at other bands for relocation in order to open up the entire band up to

1850.

Aeronautical mobile telemetry, you know, another aeronautical use that will have widespread implications. There are 383 assignments in the band.

I think in some other discussions we've had it sounds like it's another one that would be a long term and difficult relocation. So looking at, you know, long-term relocation, but there are sharing scenarios that we can develop in the meantime.

A sharing scenario developed in 2360, 2390, medical body area networks may be built off of.

MR. GIBSON: Mark Gibson.

Steve, before you go on, we need to clarify the last point. The band isn't being reassigned to medical body networks; it's being shared pay.

MR. SHARKEY: Shared pay, yes.

And then there are a number of other systems that are airborne, I think, that we've got very limited information on, especially from UABs that are relatively new on this band and others.

Finally we included a list of relocation bands. And this is actually a list that NTIA is working from. But I think the important point here is that there are a number of bands that can be looked at for relocation.

We need to find the best way to help look at these bands and figure out the viability of moving systems and

timelines for moving them.

One thing we'll note though is that they are, a number of the bands have also been identified as bands being considered for nongovernment use as part of the search for 500 megahertz.

So, you know, we are doing this 1755 to 1850 band right now and looking at these relocation bands. But we also need to keep in mind that bands like 2200 and 2290 or some of the other bands that are also on the list NTIA put forward as being bands that could be studied for relocation. Or, I'm sorry, reallocation.

There has to be that kind of cohesive picture of where all the pieces fit together and we're not moving government systems into other bands that are just going to eventually be reallocated, so at least we go in with eyes open.

So that's the end of the technical section. So Gary, do you want to say anything? Or Molly?

MS. FELDMAN: This is Molly Feldman, Verizon Wireless.

Our subgroup looked at the evaluation questions. And the first of them we looked at was how should the spectrum, how should the impact of exclusion areas in the value of the spectrum of commercial services be measured.

The team first considered what are we talking about, exclusion, is it permanent or partial exclusion. So partial exclusions can be by time, it can be by altitude, it can be by power limits.

We looked at examples of exclusion areas, which are are Auction 66 and AWS spectrum and Auction 73 to 700 megahertz spectrum. Both had some type of exclusions.

Go to page 25, just looking at the value of the spectrum in general, there are some key things that we look at. First is the number of pop covered in spectrum density. You also look at highway miles, vacation resorts, and places where you're going to have a lot of traffic.

And then you can't just -- the Brattle report, which I think you may be aware of, which is a third party report which T-Mobile had done, notes that, you know, in one case that they looked at there was a 41 percent difference between the value of the spectrum, megahertz, pops, and exclusion areas.

The other thing that we had to look at was not only the exclusion areas but the areas surrounding the exclusion areas because they thought there would be an impact on those values as well.

If it affects not only the, if it affects the nonexclusion area and if it requires a change to a device, that affects the value of all of the remaining spectrum nationwide. The Brattle group did look at that and came to the conclusion that about a three percent increase in device cost replaced about a 2.2 decrease in overall value. We kind of looked at our own models and validated that that's about right.

And then all of this really depends too on whose eyes

you're looking through, whether it's an incumbent or a new entrant. An exclusion area has a much bigger impact for a new entrant who doesn't have any other spectrum or any other -- or any other carrier to provide service in the area.

Go to the next a page. These are kind of the caveats. We did take a look at those two options I mentioned. They're not scientific; I'm sure someone can poke holes in them, but they do show that there is an impact to the value of spectrum. And if NTIA thinks there's some value it will look at it further.

Go to page 27. The examples that we looked at, there are three exclusion areas in Auction 66. And we looked specifically at first at the smallest licensed areas in the auction. They are similar market areas. We looked at the smallest licenses because they were theoretically impacted more by the exclusion areas.

The three I have listed here were pretty much very impacted by the exclusion areas. When you get to the next size license, the economic areas which is much bigger, there's a much smaller impact because we have a bigger denominator.

Then when we get to the regional licenses, which are gigantic at the very end, the exclusion areas are immaterial to those licenses.

And then Auction 73 you have the A Block, which is right next door to Channel 51. And there's huge interference

issues with that block. And sometimes it affected licenses more than others depending on the pop covered or by the square mile area.

So what we found was, page 28, that of the three exclusion zones, when we look at the very small license areas, two of those licenses didn't receive any bids at all. The third one received a bid at a very large discount. Then when you get to the larger license there were impacts as well.

Now, a footnote that there were other licenses that didn't receive any bids at all either that weren't impacted by exclusion areas, so whether that was the sole reason they didn't receive a bid or not we don't know.

And then for the adjacent areas around the exclusion areas we looked at those also and it looked like those licenses were discounted as well.

And what we did was just look at average, we looked at average prices for similar markets, and compared those to what those licenses got in auction.

Then in Auction 73, if you just look at the A Block overall compared to the B Block, both were six by six licenses. There was a 57 percent discount for the A Block compared to the B Blocks.

MR. TRAMONT: On the permits at auction -- I'm sorry. Bryan Tramont --

MS. FELDMAN: The ones we looked at--

MR. TRAMONT: -- all three forever?

MS. FELDMAN: That's right, yes. There were many other encumbrances that were 36, 48, 72 months. We tried to look at those but we couldn't really draw much of a conclusion.

MR. TRAMONT: So 73, the adjacency issue would presumably be solved over time.

MS. FELDMAN: Right.

MR. TRAMONT: Thank you.

MS. FELDMAN: Yes. So the conclusion here, I mean, to the extent we have exclusion areas, we tried to limit them to less dense areas, limit the spectrum that's affected, and try to have that exclusion over a period of time instead of indefinitely.

Then the next question, 1-C was kind of the inverse of 1-B which was, you know, given the need for spectrum in the high density areas, what's the value of the spectrum in the specifically limited geographic areas?

It really all boils down to economies of scale. Because if it's a spectrum that's only available in one city, two cities, 20 percent of the nation, it's not going to add value to at least incumbents that are looking for nationwide spectrum.

The problem is they're trying to get devices. A band added to a device just for this limited geographic area would be very expensive.

The other things we'd look at for the economies of scale is, you know, the adjacency to current bands, and a band device to include the frequencies with the limited geographic areas wouldn't be as expensive.

International harmonization is another consideration. Timing is a limitation, if the spectrum in the rest of the country would come on board at a later point in time. These are all factors in how to valuate these.

To borrow a comment that Steve made earlier, all of this, 1-B and 1-C, where is the tipping point where there's value or not?

When you look at the small licenses that were almost totally encumbered they were toward the tipping point where they were not valuable to anyone.

But if it's encumbered based on all the factors, if it's going to be interesting going after that spectrum and that has a full value, but that's without the encumbrances to get to that tipping point.

Then question 1-H, the group kicked around does staged release mean that it's available now but you don't auction it until a future point? Not -- it's available now. Sorry. Auction it now, but it's not available till a later point in time? Or do you only auction what's available now now, and auction what's available later later?

And the group really couldn't come to a conclusion

that it's going to have more value one way or the other. But we did think that having -- auctioning it all up front would have the benefit of setting a point in time where the incumbent would need to transition off.

So that was basically the valuation questions. The last two questions, implementation questions, Mark Gibson will cover.

MR. GIBSON: This is Mark Gibson.

I helped Molly with this content, so I thought it would be easier for me to take it on.

These next couple slides are really based on the efforts that we actually all underwent to relocate or deal with the 1710 and 1755 AWS operations. So the question was what's the impact of moving federal operations to other bands?

These questions could be answered from moving any operation to other bands; in fact, it's the same issues incumbents had to deal with in the 1.9 gig relocation as well as the 2.1.

There's a cost to move the operation. That cost was made well-known by virtue of the act, the commerce spectrum whatever act. Whatever. Commercial spectrum. Thank you.

There was, you know, there was a threshold that had to be attained in the auction before that could happen.

There was a timeline associated with moving them. And NTIA, as a virtue of the act, had to go back and identify the

timeline for each of the assignments and classification.

There was some thought when we first got involved with this that could we, you know, increase the cost and shorten the timeline. And that wasn't necessarily the case. We might try to do that next time around.

There are also some considerations on technology. One, for example, the US&P assignments for video surveillance was an example. When the costs were put out for the relocation of those device the consideration was that they would relocate to digital devices for doing covert operations.

The trouble with that was there were no digital devices available for them that had the battery life necessary for them to function. And so the timeframe for the relocation was I think going to be five years, pretty much the entire timeframe.

And as you well know, the US&P assignments, you know, were nationwide, and took much spectrum. So when we looked at that we thought, Well, is it possible that they could be relocated using analog operations in a spectrum, and indeed that was the case.

So we, you know, went back and made a suggestion, and in fact that's kind of what happened. There was a cost consideration on that. I think Tom alluded to that. How that was covered I think was there was monies made available still as part of the fund. So, you know, that's one consideration that

we did in the past.

The obvious, they wanted to maintain comparable capabilities, and in fact I believe that was codified if not in the act in a public notice that was associated with that that the FCC and NTIA issued jointly, which also is a bullet with the new Service Rules.

The Service Rules for this were obviously part of the FCC's rules. But the rules I believe, if they didn't refer to it specifically, they were abstractly referred to and that was the public notice I was talking about.

After the rules were issued, the public notice was issued jointly, like I said, between the FCC and NTIA establishing the cooperation framework how the data would be shared, what data would be made available, and actually how interference analysis would be run for certain types of operations.

Then there was a regulatory consideration that kind of go with Service Rules with respect to more or less the assignments and some of those issues.

So that was the impact of moving federal operations. Go to the next one.

Yes, Jennifer.

MS. WARREN: Jennifer Warren.

This looks really more domestic, the impact on the federal operations until I see the international regulatory

consideration.

I wonder where the consideration of impact on allied interoperability as far as UAD comes into play, and whether or not -- I mean, this is more the practical side domestically as opposed to the operational missions impact considerations.

So where does that get factored in? Or does it not? And should there be a bullet to have that factored into the mission impact?

MR. GIBSON: That's a good question. Actually, I think that to some extent that was taken care of in the regulatory considerations where we're talking nationally and internationally so we have a harmonization.

If you think there needs to be a bullet specifically calling that out --

MS. WARREN: I think there are some of the government operation, not all --

MR. GIBSON: Right.

MS. WARREN: -- but some of them that have a mission interoperability, mission impact that should be called out.

MR. GIBSON: Okay.

MS. WARREN: Actually, can I ask a process question? Maybe this is a good point.

How did the, what is, what's happening with this today, given if --

MR. EPSTEIN: Jennifer, we're going to talk about that

later.

MS. WARREN: Well, that kind of helps phrase it.

MR. EPSTEIN: This is Gary Epstein. May I address that?

MR. GIBSON: Go ahead, Gary.

MR. EPSTEIN: It's a good question. I asked that question earlier today too.

And so given the fact that we're on a very short timeframe now we're not in the position to have the committee vote on the report today.

We've heard some good comments. I think what we are, for example, we have heard maybe we need some more flexibility, the 1780s and the 1850s, and there's some typos and other things that we need to fix, and your very good comment comes in that context.

As soon as we finish here -- we talked a little bit among ourselves -- NTIA is very appropriately strong on having us make specific recommendations.

And I want to bring up perhaps three or four of them that come out of the group today for comment. And I think ultimately then the committee would be asked to, in short order, not in months, but we'll find some way, some process for the committee to act on those.

MR. GIBSON: Which we'll get to in just a minute because I'm about done.

These next couple of slides are, what happened during roughly the middle of the 1.7 degree relocation effort CSMAC actually dealt with this question, and actually had, like I said, a set of lessons learned.

So, you know, plagiarism is the best form of art I suppose in some regards. We just took those comments and actually verbatim put them in here more or less.

The other thing the NTIA did a year after that, there was a notice of inquiry dealing with the same thing, what were the lessons learned? And a handful of companies filed comments on that. We pulled some of that together for this as well.

So this is really based almost solely on that effort, which is good anecdotal information.

I don't want to dwell too much on this, but I want to call your attention to some that I think are a little more pertinent.

The third bullet there essentially addresses the information dissemination and information flow. Essentially it says we need to get better with working with agencies and with -- between industry and agencies on sharing data.

The public notice described the process. Certain agencies had different interpretations of that process.

When approached, there were disconnects between what agencies thought they should release versus what industry thought they should get, and it set up a lot of consternation.

So that could've probably been dealt with. Since now we know that that's a problem or could be a problem we can probably address it a priori.

The other thing was, DOD developed a portal. Essentially it was a data interchange portal. The DOD used it and I believe the DOJ used it.

DOD had an analysis procedure behind the portal. DOD chose to use a different analysis procedure. But the crux of the portal was, it was, it made a very simple online filing of coordination requests for DOD review.

The portal was used not only for filing requests but also for providing information on results. And it was modeled after the general part 101 frequency coordination processes and procedures.

The top bullet on this next slide speaks to a process that's actually in place now for coordinating assignments in the millimeter bands, the 70, 80, 90 gigahertz, where some of those assignments are classified and so industry can't know where they are.

But given the nature of these what they call pencil beam or giga beam type operations it lends itself to an online almost immediate type analysis process.

So what happens is there's a database that exists. And when requests are made to file links in that database the data are automatically sent to NTIA, and they run an analysis to

determine in realtime if there is a problem.

If there is a problem you get a yellow light. And if there's no problem you get a green light, and that's how it works. We should be able to set something up similarly for sharing spectrum moving forward in your bands.

The second bullet up there speaks to the role NTIA sort of played in a de facto sense for the 1710 to 1755 band where they were sort of the clearinghouse for information dissemination not just for the agencies and industry but also for NB. And whether that was intentional or not, NTIA sort of acted in that role.

Whether that's the way it needs to be done moving forward remains to be seen. But we generally felt like it was important to have some central location for clearinghouse dissemination of information; how things are done, how things are going.

Like I said, NTIA played that role and continues to play that role sending that information out.

The third bullet up there speaks to agencies being able to do some analysis before the funds, relocation funds are made available. Again there were asymmetry in dealing with agencies in the 1.7 gig bands.

Some agencies were cocked and ready to go. DOD did a great job -- thank you, Bruce -- on that. And other agencies were not in a position to do anything. They didn't have funds

set aside, and they just couldn't handle it.

So when we go to those agencies we kind of ran into some problems. So this bullet speaks to the idea of having some funds made available somehow -- we're not really sure how -- to help the agencies get going.

The last two bullets essentially speak to specifics about actually how to do this. I don't need to dwell on it. In fact, the last bullet on here is incentives for agencies. That kind of goes to the bullet just above it.

I'm not sure if the concept of bonusing will resonate in the federal space but there may be other ways to incentivize through some other means. We have to study that.

I believe that's it.

MR. SHARKEY: That's it.

MR. GIBSON: Two minutes early.

MR. EPSTEIN: Thank you. It's Gary Epstein again.

As I said in response to Jennifer's question, we talked about where we go next here. And obviously we defer to Bryan and Greg on the process.

But let me emphasize again that in this 60-day time period we were focusing short term, 1755 to 1780. Even though the presentation makes recommendations more broadly we have a little bit more time to consider those.

But with respect to this report I think there were, and we talked about this this morning, there were about four

general recommendations that we are working our way through. They are in rough form now; they may be modified as a result of the discussion today.

But they go something like this. Comments are welcome on them.

No. 1, that the technical paper on LTE characteristics be formally recommended as the technical characteristics that NTIA should look at from the industry perspective.

No. 2, and this is softer. And you've heard a lot about this and everybody brought this up again is, we would like to have some sort of informal technical process between now and September, and maybe even after September, to exchange information so that -- on the uses in particular in government band and some of the industry concerns, and vice versa.

So we want to keep an open dialogue, to the extent we can, with NTIA in order to make this band understood better and make this band work well.

No. 3, and this came out of the discussion that we've had internally at the committee, and that is what do we look at after we look at 1755 to 1780? What kind of staging?

The preliminary thought was that we would build upon that, and maybe look at the next build-on potentially on paired spectrum, and look at the next segment of spectrum up beyond 1780.

And the fourth, and you heard a good discussion of

this today, is that we support making available spectrum subject to sharing, you know. The preference, and you heard this today, was that the government operations will be moved out.

If that's not feasible for various reasons, such as long-term satellites and other uses, that we do want to consider sharing, particularly where the commercial users accept reasonable and defined levels of interference.

It has to be a concept which is crystalized; in other words, industry I think, you know, feels comfortable about utilizing spectrum where the interference is from the government users into the commercial users, and feels that with sufficient information, and if you can get some definition and specificity that that that would be a preferable operation, preferable to having broad exclusion zones.

Again, these concepts, these recommendations need to be discussed internally and then presented to the full committee here. And I think that will be the action item.

So questions or comments on that? Sue?

MS. CRAWFORD: Susan Crawford.

So I understand that you're going to be suggesting these recommendations later, but one of them temporally, now, which is some kind of a process to learn more when there's so many questions about the government uses.

Would it be helpful for this committee to say something strong about that to ensure you get real information

between now and September that makes the job more realistic?

MR. EPSTEIN: I think it's an excellent point. But by "later" I mean within the next week.

So I couldn't agree with you more. To the extent the committee wants to go on the record now I think I support that.

CHAIR FONTES: That's one of the things that I, in just going through the presentation, one of the things, you know, key elements in any type of sharing environment is to know what the information is.

What helps facilitate that, particularly from the commercial side, if you're dealing with one entity that would have that information rather than having to deal with a variety of entities, each with perhaps varying degrees of information.

So that would be another way of trying to improve the process, if you will, in disseminating information by having a point of contact, whether it's NTIA or some other designated entity that would be the place commercial entities could go to to obtain information about a specific band.

I think there is a lot of -- the whole time I'm listening to this, if I were a policy maker -- and I can sit down and play that role because it's such a dramatic role -- if you were a policy maker sitting there and listening to this information, what do I want to know that's new? What's moved the needle in this process?

And there's things that I heard today that I think are

relatively new that have moved the needle a little bit. I mean, from the notion of exclusions to the notion of sharing zones to the notion of a variety of variables that have to be taken into consideration that would facilitate the opportunity to share in some areas that were previously exclusive.

So there is a lot of information going back to that point, and a lot of opportunity that can be made in terms of the maximizing use of spectrum in a shared environment, and also mitigating the risk that a commercial entity would have from a commercial entity's perspective.

Risk is always not the best thing; you want to have more certainty than perhaps risk.

So I think there are a number of elements to this presentation that provides that process just by raising the questions, and also the opportunity from the government sector to recognize that there perhaps are possibilities of sharing where previously we were comfortable with exclusive zones.

So from a policy maker's perspective, you know, you sit down and say, Well, this is great. What have I learned from this experience as a policy maker that would enlighten me and enable me to make more sound decisions?

MR. SUGRUE: This is Tom Sugrue. Jennifer said, Your name is Tom Sugrue.

Just along the lines of time is of the essence though, we have a deadline, which is good because it focuses, you know,

attention.

And time is not of the essence for all 500 megahertz. But, you know, we've looked quite a bit at that 1755 to 1850 band, particularly at the lower end of the band. I hope we're in a position to make a recommendation on that; NTIA wants to be in a position.

But they said they were going to report on it whether we make a recommendation or not, so I gather there's opportunity for input there.

There's also under the present law an option of that spectrum can't take place. When the NTIA reallocates, the FCC identifies for auction, a series of letters goes back and forth, an 18-month time period then ensues by which there's a lot of work done in communication.

But it's not like if you add, you know, probably the fourth quarter of this year would be the earliest that the FCC letter comes over to the NTIA, which means you're talking about late spring or early summer before the auction would start. It would be really two years from now before an auction might even be wrapping up.

That's a fair amount of time to have a focused, you know, learning curve on those two bands. So I just hope there are a lot of good questions and a lot of good issues. I hope on some of this we can move forward.

One clarity on the spectrum. We did discuss the

difference in exclusion zones and sharing zones, the difference between interference from a commercial system into a government system, and vice versa.

AWS 1 was largely concerned with the latter, commercial into government. And there are different ways you can handle that.

You can understand exclusion zones where they're saying, We don't want you guys interfering with our mission-critical, you know, uses.

What we discussed a fair amount this morning was the opposite scenario because some of the more difficult uses, some of the uses in the 1755 to 1780 band, are interference from them into us.

And the last principle said, We think we know enough about it and have done some spectrum sniffing and looked at it, and we can tolerate that; doesn't mean we'll be always happy about it but we'd rather have the spectrum available.

We also think, you know, tolerance for interference improves over time, and we'd be able to do certain things, you know, that could mitigate that.

So we're pretty confident that we go ahead and yes, we have to adjust our bidding prices based on what we see there in more detail. But quite confident that that price would be a substantial positive price, which means it has the potential for positive value for society.

That's sort of the context for that.

CHAIR FONTES: This is Brian Fontes.

Another thing too that I think is critically important in the ultimate execution of the ability to share spectrum is the ability to resolve the interference issues in a timely fashion.

I can hear the voice of Janice Obuchowski in my mind here saying, Okay, so what's the enforcement mechanism to ensure that the agreement is in fact the agreement that's in operation?

And if there is in fact interference that's occurring, even though the agreement is in place, how is that resolved and mitigated in a timely fashion?

I'm sure government users would want to have that resolved quickly, likewise the commercial users. So that too may be a type of recommendation process is to make sure there is a mitigating a body if you will that complaints on interference can be taken to.

Jennifer?

MS. WARREN: I was thinking about this since you raised this. I assumed when -- Jennifer Warren. Thanks for the reciprocation here.

I thought when you-all were talking about the, you know, defining acceptable interference that the concept was, actually what you were thinking would be defined by the FCC based on the agreement between the FCC and NTIA users would

actually be in the Service Rules, and theoretically the FCC would be the enforcing body to ensure that, you know, whoever bought that spectrum actually adheres to the interference rules that were defined there.

Is that not what you-all had discussed?

MR. GIBSON: This is Mark Gibson.

The FCC rules generally don't put out specifics on what is considered harmful interference, and leaves it to the industry to decide because -- because that's just one of those things. So for example -- one of those things.

You know, I refer to the Public Notice 650 I think it was where what they said it was to use an industry standard guideline called TSB Bulletin 10-F for identifying interference between mobile and fixed system.

So they sort of alluded to that in the public notice rather than saying, Interference is defined as a CI of 10 degree or something.

Go ahead.

MS. WARREN: Jennifer Warren again.

So I guess I'm not quite sure what the purpose of clearly defining what is tolerable interference, acceptable interference by the wireless industry if it's not captured somewhere, that is back to Bryan's point, enforceable, it's back to kind of fuzziness.

So I'm hoping that as the dialogue goes forward on

this in the next week is it, Gary? that we can, we can talk about that. Because I think kind of guidelines, you know, other than that neutrality, they don't seem to be enforceable.

MR. GIBSON: I think that -- this is Mark again.

Your point's well taken and Steve can probably take this on. But I don't think, while I think that it's important to have rules that are flexible, you know, our experience has been working for years in microwave bands that the references to industry guidelines, which can change in time a lot easier than rules can and there's a lot of flexibility that's built into those things.

For example, let's say you had a, you know, CI matrix in the FCC rules and new equipment comes on, you have to modify that. So what we have is a set of guidelines that we've used historically in addressing interference with these situations. And those were referred to by reference in the rules.

You're not happy with that?

MS. WARREN: Government doesn't change out equipment as fast as industry does. Government and industry is the problem. There may be more value with longevity.

It's just a comment. Something for us to discuss.

MR. SHARKEY: Steve Sharkey.

I think there is a real difference between if it's interference in the government system versus interference into us, right? We can be more flexible, you know, more willing to

accept that interference and work around it, and recognize that there needs to be some definition about how we're going to do it so we'll provide the government some certainty that we have the mechanisms how to do that.

It probably needs to be more closely defined on interfering in the government side though for their protection.

But I think one of the keys is we did want some flexibility to continue to work with government users to refine that model, what that means.

Like we talked about before, you know, you have a floor that you can work from and feel comfortable with. There's some room for, you know, to negotiate or to define that as things go forwards.

I mean, because some of these federal systems, I mean, you may put an exclusion zone around to protect the government system. But they may not be operating all the time or even very often.

So are there mechanisms that we could work out with them to allow us greater access and a little more time? But, you know, recognizing what defining the interference criteria might need.

MR. NEBBIA: We're going to have to go to our break time; otherwise we're not going to have a second half of our meeting here.

But I did want to say I certainly appreciate the

characteristics recommendation. With respect to the dialogue we'll do what we can to try to set that up.

I just want you to recognize that the, even the time that we provided for this review is really short for them to look down all the way through their organizations.

Some of the organizations are pretty homogenous in the systems that they operate. DOD of course has -- most of these things are all down into different groups and so on.

So I'm sure at this point they would not be comfortable sitting down and having that kind of dialogue because they need to be able to come into that dialogue having a sense of what all those subgroups have told them their place is and how they are doing to have a reasonable conversation now. Certainly after the decision gets made.

So they're going to want to make that decision with as much information as they can, but it's going to be questionable whether they can get down into this kind of detail.

Continuing the discussion afterwards though I think is another excellent idea that we need to look at. And certainly if we're going to get away from exclusion zones, which is what the government is comfortable with, we're going to have to I think look at that carefully.

And they are going to want to define what it is we're doing in there at least to say, You're signing off. If you get interference you're not going to complain about it. That might

be the bottom simple line as opposed to something very technical. But that's going to have to be discussed.

And I think it's also important for us to understand what Molly talked about, the impact of those areas. They do impact the value that somebody's going to be willing to put up.

Although we're not specifically into this just for spectrum revenue, we have to recognize that that's the case. If we go past whatever that tipping point is that the spectrum just isn't worth using, then we're not, we're not coming out of this ahead.

I think the goal here in the end is to accommodate wireless systems, protect the government systems, and obviously you have to still come out in the black; it has to have, you know, value. So we'll look at that.

We're going to leave --

CHAIR FONTES: One last comment.

MR. CALABRESE: Short one. Michael Calabrese.

On this last point about the interference, government interference into the private sector use, I mean, I think, because that's about, you know, the government concern is about political risk, like you have with the garage door opener, you know, people going right from the condos doesn't -- isn't in the weeds on this stuff.

So but I think in that case it's probably more important to define the coping mechanism than it is to define

the interference itself because you could also have certain users -- in fact that's talked about in Slide 8 -- that have, you know, multiband frequency hopping systems where the interference could be terrible, can be intolerable, but if the device can get off that band as soon as it's being interfered with, then that shouldn't matter.

That should put the government guys at ease more than if we define what the harmful effects is.

CHAIR FONTES: Let's take a 10-minute break.

(Short break.)

CHAIR FONTES: Okay. I think we're ready to begin again.

We're going to pick up with our next presentation is on Spectrum Sharing and the subcommittee's report.

And Larry, Mark, are you guys tag-teaming it? How are you making the presentation?

DR. ALDER: Yes, we'll tag-team. I'll start out.

We can flip to Slide 2.

What we're doing is we're trying to follow the process that was laid out by Greg and Bryan where it's kind of a two-meeting process. So at this first meeting we're not coming with recommendations; that's not the objective here.

We're going to try to lay out the issues, have some discussion, and then have recommendations at the next meeting, and also tee up a new question for this meeting.

The first question that the group is working on is question 4-D from Carl's list at the last meeting. The question is, How do we set up sharing arrangements when the primary service continuer has the right to continue to evolve? So this is about giving some flexibility to the incumbent user.

The case that's been cited is the 5 gigahertz wi fi example with the detecting of the radar. And the idea is what happens if the radar wants to change? Do they have flexibility and so forth?

We wanted to look at this question because we think it's a very important question to give certainty to both sides, both sides of the equation.

The incumbent needs some flexibility to evolve. But yet to be interesting to a new entrant, the entrant has to know there's going to be something there that warrants the investing.

The secondary question we've chosen is Question 4-A, which is really the meaty question here. It's a very simple question. It's what kind of sharing is workable for the industry in the long term?

And we're going to translate that question down to be a little bit more specific into what kind of sharing arrangements would the industry consider as workable as part of the 500 megahertz plan.

So the objective was to come up with a set of recommendations that NTIA and the industry could have that would

hopefully allow them to find some spectrum that they can go to and say, This is part of the 500 megahertz plan that's going to be shared; it's not cleared and exclusive.

It's a high hurdle to do. There's two key communities really because of the unlicensed community. And there's some intuition that the unlicensed community is a little easier to appease in kind of a sharing environment.

And then theres the licensed community, and it's really appreciated to have people that are in the licensed community. We have a number of colleagues on this panel to participate in this group. I've appreciated we have had some good participation from some folks from Verizon.

I'm using this time as a call-out to welcome other people who've been in the licensed community that want to help understand what kind of sharing arrangements would be workable in the long term.

And that doesn't necessarily mean you're going to use it as licensed, but this would be bands that you think would be useful as either complimentary or primary to what you guys are doing.

So the method that we're taking to attack this first problem, we're going to try not to boil the ocean, but we are going to list kind of some key requirements. And we've done that.

We've prepared a document here that are working notes.

Unfortunately when I sent this to Bruce, somehow in the formatting the changes are still on here, but it's okay.

This is our notes that we have. And it goes to some of the requirements. Very high level. We're trying to work with very short documents.

We want to identify how the incumbent use changes could impact really the two primary sharing mechanisms we've identified: Geolocation type of approaches and sensing based approaches.

We're trying to look at all the different types of use changes we can imagine and if they can be accommodated. We've done some work. We'll go over that today.

Then we're going to kind of rank the use changes from easiest to most difficult to accommodate, and we've done some of that.

What we're not going to do is we're not going to recommend some new, one-size-fits-all spectrum sharing technology that is going to allow total flexibility to incumbents, and so forth. We're not designing a new sharing technology; we're more evaluating current sharing technologies, and how they can perform with various modifications.

If there was some specific system and sharing technology that would have to be done band by band. With that, turn to Slide 3, which is a chart.

So we've got on the chart -- I'm going to let Mark

walk through this. He's done the primary. But this is a chart that tries to encompass what are the different use changes that we might expect a new entrant or incumbent to have, and how they could be accommodated by geolocation and spectrum sharing.

I'm going to jump ahead to the conclusion before I turn it over to Mark.

So the conclusion is, there's almost no use change that cannot be accommodated. There's certain use changes that fail, that are very difficult to be accommodated by any one approach -- spectrum sharing alone, those are in the red -- but they always can be accommodated.

And so we'll get all of that. I'll let Mark kind of walk through the charts.

MR. GIBSON: Okay. So this chart on the left column is, Incumbent agreed to the deal. Then he says, Oh, what I really meant to do is change my waveform. That's the results that arose. He said, he made a promise to do X or commitment but changed his mind.

The second column is, Oh, I have a geolocation approach. Now what's the cost for me to go back and retrofit my system? So we have four that are colored there.

So if you're a sensing based thing, and the guy says, I want to go back on the waveform, that's very expensive to go back and mess with that.

Or if you promised to tell them where the transmitters

were, your receivers, and later you renege on that, the database location really wouldn't like that.

There's others here. Some of them are highlighted as kind of damage to the equipment. There's some in there that are kind of damage to both, which means the spectrum goes away.

All of a sudden they went from a 1 watt transmitter to a 50 kilowatt transmitter, the spectrum would shrink, and that would bug everybody.

Last column that we're still working on is, How would you get certainty for the entrant? What would the incumbent, commitment he would have to make? So like the waveform it could be you have to give a range of waveform, like radar. You have to give some range. If you went beyond that range, that would not be allowed. That's kind of what the end product will be.

Some things we don't care about. Changes in receiver sensitivity is not really critical. It doesn't take the spectrum away or costs. Some of them are, would qualify, and have to have an agreement. That's this chart. Any questions?

DR. ALDER: I want to make one more comment on the charge. This is Larry again.

The little numbers you see in columns 2 and 3 are the difficulty. So if it's a 1 that means it's pretty easy to accommodate. If it's a 2 it's a medium. If it's a 3 it's --

MR. GIBSON: Very painful.

DR. ALDER: -- very painful.

MR. GIBSON: A lot of you just changed the database. Transmitter power went up, receiver sensitivity went down, it's a minor change. Then it might affect the spectrum. The low cost would have high impact to the value that's available for the amount of spectrum.

MR. REASER: This is Rick Reaser.

One thing is, it's really easy for us to talk about this. But some people are listening that don't quite understand one of the things.

There are actually two strategies for sharing. You might want to explain those, Mark, the two majors.

MR. GIBSON: Geolocation based?

MR. REASER: The claims that people --

MR. GIBSON: Oh. You know the position of the incumbent receivers, the entrant knows his position and he does a calculation and the incumbent says, I won't cause interference. It's a open loop thing.

If he's sensing the presence if they're there he estimates the pop loss and then he decides whether to go or not.

You could mix the two; I'm not saying one is better than the other.

DR. ALDER: On the geolocation we put the word "database" so that the geolocation can be dynamic; it doesn't have to be completely static. It can be completely database.

By the way, I want to thank Rick. He's been a big

contributor to helping the group.

MR. REASER: One other comment about the idea. There might be some other ideas about sharing. And those will be things we want to hear about.

There are some other traditional methods of sharing but they're actually incorporated in the two general models that we have in terms of geolocation and the sensing thing.

So the things about assigning different frequencies and distances and all that, those are actually accounted for in these two models.

Typically we think about sharing in a different way, the technical sharing in terms of modulations that are compatible, frequencies that are different, or times where you get the frequency this hour and I get it next, all those are actually accounted for in these other systems. You can actually embed those things.

I think that's sort of important, but if there are other ideas about how you might share let us know. We kind of, you know, boiled it down to these two categories to account for all the other methods.

DR. RUSH: Charlie Rush.

I don't have any ideas necessarily as to how to improve this. But I do have a couple of questions perhaps you could clarify for me.

When you say, Impact to both entrant types, what are

the two entrant types?

MR. GIBSON: One guy's using a geolocation database.

DR. RUSH: Oh, okay. I see.

When you talk about the method to provide certainty to the entrant, when you say things like decrease the amount of available spectrum for sharing based on the band. And then you go on to say, Entrant agrees to limiting to minimum or maximum transmit power --

MR. GIBSON: If they had a 100 watt transmitter they had -- kilowatt, that would be -- they want flexibility. They can't make such huge changes. You can't go from a fixed system to mobile.

How could someone build a spectrum system if they could change any parameter at will? Fixed, mobile power; there's got to be some limit to what an incumbent can do.

DR. ALDER: One of the theses that's emerging is that if the incumbent user can change anything, powers, ground, air, mobility, if they can do anything, there's no certainty that can be offered to the new user because the incumbent can do anything.

We wanted to try to set some reasonable bounds to, Look, yeah, there's certain things that you can change that have very low impact. Receiver sensitivity might be one of them. Transmit power might be another.

We wanted to evaluate bounding some of this to provide

some certainty in both directions.

DR. RUSH: One last question, if I may. Charlie Rush here.

Would it be safe to assume then at time T equals zero the new entrant feels he or she can coexist with the incumbent?

MR. GIBSON: Yes. They made a deal.

Robert?

MR. PEPPER: Robert Pepper.

Question. Are you making a distinction between opportunistic sharing, or sharing that is actually part of a set of rules and requirements?

MR. GIBSON: Doesn't -- wouldn't matter, I don't think.

MR. PEPPER: The reason I think it may is if it's opportunistic sharing --

MR. GIBSON: What's that?

MR. PEPPER: -- in the sense that there's a secondary or new entrant that is going to use spectrum because at the moment the incumbent either isn't using it or is using it in a way that might be below their authorized power limits, so just opportunistically they're coming in and using it at their own risk.

That's very different then because there the primary licensee may choose to actually go up to their authorized power even if they started at a lower power.

Or as they build out a network and start at one geography and have it built out from urban to rural or covers the city there is a roadmap to do that, which would not be toward changing anything, right? As opposed to where there's a formal agreement for sharing.

DR. ALDER: We lump those two together because we believe that when you're making a decision to invest and develop a band or technology, you're going to look at the band and say, What are the parameters of this band, okay?

So even if there's not -- there's going to be some rules and guidelines going to inform your decision-making process. You're going to say, Wow, it's not being used in these geographies if I go to these power levels.

Then you're going to have to question, Well, it's not being used. I can use it in New York. How long? Is that for six months? A year at these power levels?

We're trying to say what -- we're lumping those two together. And trying to analyze this, how would we allow the incumbent to move with the greatest amount of flexibility and still be enticing to entrants to invest and develop.

We don't think there's a difference if it's contract, a set of rules, or just something that goes on through an evaluation.

MR. PEPPER: This is Robert Pepper again.

But it implies there would be an agreement, an

agreement between the incumbent and the new entrant, that there would have to be some agreement.

DR. ALDER: It could be just a set of rules.

MR. REASER: I just have a comment.

Where this came from was this whole idea of the 5 gigahertz where basically a set of parameters were laid out and said, Okay, as long as you can live with these parameters you can be in the band.

So then what happens is you get in this business about, you know, the other incumbent, the new incumbent that came in and shared with you.

And then all of a sudden they have like a bazillion devices out there. And the primary user says, I'm changing stuff. Now their box isn't working anymore with the guy who is sharing. So how do you deal with that?

What's going to happen is there's going to be a whole sort of uproar about, You changed something, and I have all this installed base and I can't -- so in essence there has to be something written down someplace. It could be an agreement; it could be in rules; it could be lots of places.

But the problem is there's way too much uncertainty. And what happens is the primary user says, Okay, I have a permanent easement on my band, on my technology. I can't do anything. I'm hamstrung. The question is, How do you deal with that scenario? That's kind of where it is.

If it's opportunistic, then you have the same type of issue but if it's opportunistic sharers can get an installed base issue where they can limit the guy who was nice enough to let you, you know, live in the back room in your house, and the next thing you know, the guy's wanting to put his car in the garage and taking over the kitchen.

You know, it kind of gets into that. What started out just being -- because I think people like, I'm being a good guy, a good citizen, a good spectrum steward by letting people share with me, and now they own my house. It happens.

MR. PEPPER: I totally understand and agree, you know, with the concern.

But I guess all I'm saying is that it appears implied in this -- maybe it needs to be explicit -- there's either, you know, a requirement or, you know, regulation or whatever, rule, or an explicit agreement, because it does not apply to implicit, you know, below the radar opportunistic uses by which the incumbent --

DR. ALDER: There's rules for that, right? I mean, you can't just use it; there's always rules.

MR. GIBSON: You keep saying there's a third type of sharing that's found on this list and I don't understand it.

If you are using sensing you are hiding below the radar. That's what sensing is. I call it sensing and you call it opportunistic. I think it's the same thing. It is the same

thing.

DR. KAHN: There's still an implicit --

CHAIR FONTES: Identify.

DR. KAHN: Kevin Kahn.

Yes, there's still an implicit contract. "Contract" I use loosely in the sense that if I go to that band I'm going to opportunistically, to use your terminology.

The incumbent has some regulatory structure that limits what he can do with it presumably. Now, it may be unlimited, right? Maybe the rules on the band say he can go up to 50 kilowatts, in which case if you're coming in here opportunistically to look at that band you may say, Hmmm, you know, I think there's a realistic chance that he might do that to me and it's probably not a good band to try to sneak into.

But, I mean, there's some, there's some set of rules whether they're written down as a contract between you and the guy you're sharing with, or whether they're implicit in the regulatory structure that made that allocation originally.

MR. PEPPER: Yes. But I guess maybe some of the questions, the examples that were used were going from, you know, 1 watt to 50 kilowatts, which is frankly a nonrealistic --

MR. GIBSON: No. There could be a crude jammer out there.

MR. PEPPER: As a practical matter, what we see is, you know, licensees coming in over time, you know, building out

geographic. And that's something that should be anticipated and expected. It's in the rules.

When entrants come in and build out networks they don't always start with full power, right? They come in and move up in power. Again, it's within the rules.

But what I was sort of responding to was, you know, whether it was implied or you actually said, Well, maybe what we need to do maybe someone has the ability to go to a higher power, but by allowing sharing we're now going to actually change the rule, and change what their, you know, authorized power limit would be.

That would be a change in the rule, which I'm not --

MR. GIBSON: That's what's being proposed.

MR. PEPPER: That would be a change in the rule that would be implicit because of an essentially -- could be like a squatter's right as opposed to an actual explicit change in the rule.

Again, I think this is recognizing just very pragmatically how networks get built out over time, over geography, and also in terms of, you know, power lines. Maybe there's some variation on what you're saying.

CHAIR FONTES: Let's wait for a second. Susan and then Mark.

Susan?

MS. CRAWFORD: Susan Crawford. I'll be really brief.

I think that we're just having two different conversations here. We're all, you're both talking about rules. Mark and Larry are proposing a broader, broader understanding of rules ab initio; that's what they're talking about. And you're saying, But if I had a rule that was very narrow don't change it on me.

I think what they're suggesting going forward, if I'm right, we have a more generous understanding of what those parameters are to permit sharing.

MR. CROSBY: This is Mark Crosby.

This will only work if there's significant and effective communication between the person coming on the band and the incumbent.

I don't quite agree with you, Rick, because I think they will take over the house. It's inevitable. Whether you start with -- it's technology. You won't know they're in the house, right? But they're going to be there: Kitchen, garage, attic. It's inevitable.

CHAIR FONTES: Kevin.

DR. KAHN: Kevin again.

This is actually a topic that came up in our working group on spectrum management. One of the things that I continue to see kind of, it's kind of an assumption that underlies all of what we're doing here, but I don't think we make it explicit, and that's the problem.

The reason -- this is a 98 percent statement. So if somebody wants to pick on the other two percent, feel free -- the reason that we are all searching for more communications spectrum is for communications; it's not garage door openers, right? It is communications.

The interesting thing about communications devices, they communicate. What that means is that there are technical structures that I think can limit, for example, the issue of, Gosh, the guy now owns my garage because he's been parking his car there.

One of the things that I suggest, and I think we put it in our report at least to take a look at is to say, Look, if you are a sharer in a band there's nothing that says your devices shouldn't have to reauthorize at some reasonable interval against a known database, right?

I mean, the whole 5 gigahertz thing where, you know, we suddenly have people interfering with radars, would have been relatively easily handled if we had simply said that all the routers out there once a month they have got to go ping on the Internet, the database, and says, Are you, this model, still authorized?

And if that problem had come up, you turn them all off in the database, figure out which ones were actually the problem, turn the others back on, and you tell people, Look, if you can download a new pattern -- this is a waveform issue -- if

you can download a new pattern and prove that in the test-bed, then you can reauthorize your device; otherwise you can't.

That kind of approach cuts a couple of things. One is it gives some assurance to the incumbents that in allowing spectrum sharing to happen they're not going to wind up with the guy squatting in the garage with no way to deal with it.

Two, it makes it very clear to the sharer that he has responsibilities; that it's not a one-time thing where he shows up and says, Oh, cool. I've got some spectrum to use, and never has to think about it again, because he realizes that those devices are going to be constantly going back on some interval.

I mean, the interval, pick your favorite interval. But, I mean, it's not an interval that's going to cause any problem in terms of traffic. Not every second.

You have tools here that I think actually can make it very reasonable to manage these kinds of contractual relationships.

MR. PEPPER: But Mark, it isn't the management. It's that if he wants to fly airborne jammers and never did that before, you got to -- you can't do that.

You can manage it; you can get off. But you won't want to own a spectrum and do everyone's jamming every month.

MR. NEBBIA: Jamming is not a radio service. So that has a whole set of rules.

But I think what we're talking about here I think is a

significant deviation from our history. I mean, we used to put radio location in a radio navigation band.

Of course, neither one of those things is very finely defined. The radio nav people, generally the FAA senses, This is my responsibility, and I'm going to kind of protect that radio location often with DOD.

And we did in fact internationally write some allocations where we allowed radio location as long as it did not hinder the development of -- and there was some long standard footnote that we wrote.

I mean, that's how we've operated in the past. And I think that some of those kinds of bands, those particular agencies or groups do sense that this is radio location. I have a right to do any kind of radio location in this band that I want to do.

Now we're considering sharing in those bands in a way that really makes that not quite possible anymore. And we have to at least fess up to the fact that as we get into this kind of sharing we are creating some limits that we've never done before.

I think we've got to begin to talk about how we are going to define those limits, whether it's, you know, once again, we can create a thing where we tell the commission, We only want you to license in 3.5 outside of these areas; that's the geographic sharing mechanism, but it's very static. We come

up with some other approaches, but they are significant variations.

In the case of 5 gigahertz essentially all the FAA wanted to do is they wanted to move on with the next generation of wind shear radar that was going to do a better job than the last generation. And they found themselves hemmed in by the fact that people were looking for specific characteristics and they felt like they couldn't do what was next.

In the radar community, one of the things that's happening now is they've lived for years on the fact that their duty cycle is extremely low, and they were even able to share with each other, not bother each other on that basis.

Now they're finding as they go to solid state devices they're bringing their power down, and their duty cycle is growing significantly.

This is all just part of the evolution of their technology in the same way that you guys have evolution in your technology.

So I think we've got to look at this closely. It is a significant deviation from where we've been. But I think you're right. I think we've got to look to define it in a way that's reasonable because everybody that participates in this has to have some sense that they know what they're getting into.

On the other hand, if it's so restrictive, then why would any agency or any group ever want to agree to it if that's

the way it was going to be?

Let's face it. The stuff the DOD has deployed in the radar world in the last ten years is significantly different than what they were deploying 30 years ago.

So, and to be honest, once again, there's the band. The radar world right now is the spectrum. That's where the spectrum is. And if we get in there we've got to realize those things are going to change.

We would have loved in 5 gigahertz to have stuck by the original agreement. And that was, when you sensed a certain signal level you just moved off; you didn't care what it looked like, you didn't care what it smelled like, you just moved off. But then industry couldn't work with that and went down a different path.

Anyway, I know we got to get on to our next subject. But I appreciate it. I think that discussion is the kind of thing we are wanting to have at the midway point.

CHAIR FONTES: Do you have one final comment?

DR. ALDER: No. I wanted to say I think that there's a lot of violent agreement here. We're just trying to put some structure around that, the last message, that you think there's hope here to really, really find some common ground here.

We're welcoming new participants. Feel free to contact me. We'll add you to our e-mail list for our meetings. Try to come back with your recommendations.

CHAIR FONTES: In listening to your presentations and reading the documents it seems to me that you're trying to figure out how to provide maximum amount of certainty for those who are sharing the band with the great degree of flexibility in technology so you don't lock out or freeze-frame technology in time. Very interesting.

Appreciate your work; comments that have been provided. I do agree. I think there's a lot of violent agreement here.

But nonetheless, I think exploring very reasonable and rational ways to begin thinking differently about sharing capabilities and whether I'm keeping -- every now and then looking over just to see some guidelines in formulating rules and regulations or policies that would enable this to become a reality. So thank you.

Our next presentation is unlicensed spectrum. The subcommittee's reports. Michael? We have Janice on the phone.

MS. OBUCHOWSKI: I'm just listening in, guys.

CHAIR FONTES: Thanks, Janice.

MR. CALABRESE: Yes. I was going to say, Janice sends her regrets for not being here in person. And it's probably a good thing you're not, Janice, because over the phone it sounds like a bit like you're in an echo chamber or something.

This is the unlicensed subcommittee. And we had -- change that. Okay.

So anyway, we had three categories of questions, most of it on enforcement. Some of the same issues that, you know, we've heard about that, you know, could be recurring, things like so-called political risk issue with something like garage door openers where the general public believes, you know, it should be able to just use its device, and has no idea that it's subordinate, for example.

So the questions are in the categories of enforcement, dedicated bands, whether unlicensed needs dedicated bands, and so on, and then what method should be used to inventory unlicensed devices.

So I didn't need to read through all those because we can do it now.

Enforcement. The questions were how should federal agencies deal with complaints of interference received by unlicensed users. Again, the classic garage door case.

How should federal agencies deal with interference from unlicensed users in the hands of citizens who don't understand the rules? And that would, you know, could be a similar situation.

How should we prevent software modifications that alter the compatibility characteristics of a device? Or it could be hardware characteristics too, presumably, as we saw in the 5 gigahertz band with some of the devices that had a switch inside.

And with widely distributed products, what's the best approach to enforcing rules when the number of offenders may be significant?

So we have five tentative recommendations that I'll just run through. And I should say that we unfortunately didn't either didn't know or didn't heed Karl's advice to bear down on one of these and take our time.

So we didn't go in the weeds on going through any of these so much as we went through all of them and got some tentative sense that we thought we should, you know, that part of our job was to tee up here what some of the tentative recommendations were, get some feedback, and then go back and dive into the weeds a bit more.

MR. NEBBIA: In the interest of time, if we could limit ourselves to the discussion of the enforcement issue today.

I know you got a lot of other materials on the other questions, but if we do that as the single subject.

MR. CALABRESE: Okay. That would be fine. There are five just on that.

So No. 1 is that NTIA should put in place regulatory requirements that reduce reliance on post hoc regulatory enforcement of interference by turning more to technology based solutions for connected devices.

That's very much, you know, what Kevin, who is on the

subcommittee, was talking about just a little bit ago, that really increasingly the devices who are trying to accommodate for communications they can, presumably in most cases, connect. So that we can use technology increasingly to build in the means to avoid these problems.

So as Kevin said earlier, some of the examples are if you, you know, if you use a geolocation database or even any database method, if you have access to the Internet, the device can ping the database or its own network periodically to get instructions or firmware updates, it could be remotely disabled and so on.

It would just depend. You know, the degree to which you do those things would depend on, presumably on, you know, the incumbents you're trying to protect, and their characteristics.

CHAIR FONTES: Excuse me a second.

Jennifer?

MS. WARREN: Jennifer Warren. Just a quick question on this.

I mean, I think what Kevin said before was really a good idea. But with the NTIA putting in place regulatory requirements, was this, in thinking that they should have the regulatory requirements, were you thinking for commercial devices? Or for government communications devices, and the FCC should have in place for the commercial devices?

I'm just wondering where it says, The NTIA should have regulatory requirements.

MR. CALABRESE: Yes. I think both. You know, it's worked with FCC on parallel measures.

MS. WARREN: So each would have their own enforcement mechanism?

MR. CALABRESE: Right. So the parallel measures would be, presumably would be imposed by the FCC on the commercial users based on, you know, talking about sharing federal bands based on what NTIA says their needs are.

MS. WARREN: Okay. Jennifer again.

So the NTIA federal requirements will be for when the government systems are sharing with commercial?

MR. CALABRESE: Right.

MS. WARREN: Okay. Thank you.

MR. CALABRESE: And to basically identify --

CHAIR FONTES: Janice, there is a problem with our phone here where we can hardly hear anyone speaking.

MS. OBUCHOWSKI: Don't worry about it.

CHAIR FONTES: I think we heard you say, Don't worry about it.

MR. CALABRESE: You know, you would think that many of these, these requirements, whether you needed a realtime database or not a realtime database, you know, a disable feature or not, would actually be requests from NTIA based on federal

users. But they'd have to be operationalized through the FCC presumably who sets the rules for private sector sharing and device certification.

So Proposed Recommendation No. 2 is, to the extent possible, NTIA, again in coordination with the FCC, should require that a new unlicensed or shared bands devices be capable of connecting periodically to call home and obtain a firmware update, and to be disabled in a particular frequency or moved to another band when necessary.

So that's really probably just a particular instance, or the most likely instance of Recommendation 1, which is generally move from post hoc enforcement to technology based solutions that are baked into the device certification.

MR. NEBBIA: This is Karl Nebbia.

So I'm understanding then from that the most applicable place for those recommendations -- and there may be cases when the government is getting into a nonfederal band. I haven't seen those in my career.

But anyway, given that it's likely to happen the other way around, my understanding then is that when the commission comes with a new rulemaking to allow something along this line, that you're encouraging NTIA to take a more or less hard line position in working with the commission to say, For us to approve this, this is the thing that you have to incorporate in your rulemaking.

MR. CALABRESE: Yes. I'm not sure I'd use the word "hard line."

DR. KAHN: The NTIA owns that band, so in the sense it's going to be chaired, the NTIA is sort of structuring what the rules need to be on the other side.

MR. CALABRESE: Yes, exactly. And it's better to simply --

DR. KAHN: Right.

MR. CALABRESE -- have those ground rules than not have access to the band, or have, you know, very limited access.

MR. FONTES: Dale, did you have a comment?

MR. HATFIELD: I do. I would like to come back to a question I have.

MR. REASER: I have a short comment. I'd like to get back to your comment -- Rick Reaser -- about moving in.

Enforcement is how you do that. I tent my house every ten years now for termites. What that means is that we're going to have to replace wood that they've eaten.

It's a continual enforcement process. That's how you keep people from moving in. You've got to go enforce it. So this enforcement thing is really key to all the other things we do as well.

So you're right. Maybe eventually, like Masada, they'll eventually bridge the gap and want to commit suicide and it'll be over. But that's, you know, I don't go in that

direction. I know that's happened in the past, and eventually maybe we'll lose in the end.

And yet if you don't enforce at all you'll never get anywhere. That's why the enforcement thing is so important; otherwise this whole issue of enforcement gets down to the business of, you know, squatters, and all that kind of stuff. That's why you do it.

MR. CROSBY: I agree. But the world's changing so quickly, whatever rules you -- and I assume NTIA's willing to even create some enforcement things. I don't know if you've ever done that before, I'm not sure, for parties that aren't government users.

MR. NEBBIA: Commission.

MR. CROSBY: It's all big leaps of faith. But you're going to have to revisit this, Rick, all the time. All the time.

MR. REASER: I tent every ten years.

CHAIR FONTES: Dale?

MR. HATFIELD: I'm still a little bit concerned about I think what you call the smart -- I mean, the dumb cheap devices.

Is the vision here that unlicensed in the future will be limited to fairly sophisticated devices, rather than -- I mean, are we -- I mean, there's a whole lot of things out there that are unlicensed today that are really really useful things

that are dumb.

It's just not clear. Are we saying we're going to preclude those from operating in the future in these bands? Maybe that's the answer.

MR. CALABRESE: You're skipping ahead to Recommendation No. 5. And again this is very tentative.

THE FLOOR: This one we discussed the least.

MR. CALABRESE: But Kevin should weigh in. He was, you know, talking about this a lot.

But yes, I totally agree. In fact, with the so-called Internet things you're going to have potentially billions of unlicensed devices, you know, built into everything and networking, but not necessarily connecting directly.

So what we suggested was NTIA, in coordination with FCC, should further study the framework for cheap dumb devices.

So for example, should we limit, you know, given that you could use, you know, future unlicensed and shared bands much more efficiently with connected devices that have these precautions built in, should we for example constrain those sort of devices to the existing legacy bands?

Clearly we've got an installed base already, for example the 2.4 and the 900, that you're not going to want to -- not going to disrupt.

But it may be that in the future that's where all of those so-called dumb devices would need to operate. You'd have

a reservation for those, and not in a sense pollute every unlicensed band.

THE FLOOR: A junk band.

MR. GIBSON: So a garbage band.

MR. HATFIELD: So we turn it -- and I'm saying a bifurcated sort of unlicensed, there's unlicensed, a band that's more for connected devices and then a band for other things, and you would bifurcate essentially?

DR. KAHN: Yeah. This is Kevin again.

Two observations. One, the pressure for spectrum is coming from things that consume significant amounts of spectrum. Those are typically -- in fact, I challenge somebody to give me a good example in the commercial space.

Those are not devices that are not communicating; they're devices that are doing digital modulation and sending real information. They don't do that.

I mean, the amount of data from a garage door opener is tiny. So, you know, item 1, the dominant pressure for being able to put these new devices up are devices that inherently are smart; they're not dumb.

By the way, the other part of this is, What do you mean by dumb? We are pretty quickly headed for a world where the next generation of garage door openers could be a signal off your IPhone or your Android, right?

I mean, things that we in the past have considered

dumb in the sense they interpret and something happens, go look at what's happening with home controls, with remote controls in the home, IRs being replaced by, you know, things on your Smart Phone.

So things that we have traditionally said were dumb aren't dumb anymore. You know, these things all have a significant amount of compute power in them of some sort, and they are typically more and more using a form of honest to God digital communication in order to up their function level.

So the place where the problem is is in fact on devices that are capable of doing what we would think of as fairly smart things. So I'm suggesting that, given that that's where the pressure's coming from let's take advantage of that and not act like these devices are stupid. They're not. That's not where the pressure is coming from.

MR. HATFIELD: Dale Hatfield.

I didn't mean to imply that I was criticizing this. But it just seems like it's a fairly major increase in the way we create unlicensed. It really is substantial. That's what I was reacting to.

And I still have a little bit of unease that unlicensed bands have always been a place where you can experiment a little bit. And it sounds like some of the stuff of having to call home sort of forces you into, forces you into a particular model and would be a burden on a new entrant just

trying to do something.

It's been a band where there's been -- Michael, I'm using your material here -- it's been a band where people could experiment. It seems like this would constrain people a little bit from trying to experiment.

MR. CALABRESE: Yes.

MR. HATFIELD: It's not just a simple power; it's a lot more.

MR. CALABRESE: It could. I mean, that's something we do need to really think about.

At the same time, you know, I think we're anticipating what we see happening anyway for example with the TV white space. You know, you have to, you know, use it, you know, use the controller database if you have GPS, and check in periodically with the database.

So when you anticipate the sort of places that unlicensed will be able to operate, which will be primarily in shared bands, you know, this may not be, this may not be so onerous, but could certainly make the unlicensed use more possible and more efficient.

But yes, we never want to preclude. We want to be careful in talking about it not to preclude either the experimentation or the simple devices.

CHAIR FONTES: Any other comments? Final comments on your presentation enforcement part of it?

MR. CALABRESE: No. I'm fine.

CHAIR FONTES: Great. Any other comments for Michael? Perfect.

We're going to go to the next presentation. This is the spectrum management improvement subcommittee.

MR. GIBSON: Bryan and I will share. Looks like we're ready to go.

This is Mark Gibson. And Bryan Tramont and I are co-chairing this subcommittee. The subcommittee was titled spectrum management improvement. And we basically focused on data improvement, how to improve the databases.

Our question we picked was 6-C, which you can read. What we did is we took it apart, and this is what we did. We reframed the question as you see there.

So we were looking at it more from the standpoint of how can we, what techniques can be put in place to ensure the accuracy of data, and how can they be streamlined and simplified and improved to make sure you're validating and identifying and correcting erroneous data, maintaining accuracy and ensuring compliance? That's how we pulled it apart.

And then the other part was, you know, what lessons learned and techniques can be drawn from the commercial experiences? We used our experience as a database, white space database administration, and the fact of maintaining databases for spectrum management as well as some commercial nonspectrum

databases, like for example DNS registration. So we don't have any specific details from those databases; more just lessons learned and best practices.

The key, so our guiding principle on this for the most part was the GAO report. There was a key statement in the GAO report that essentially said that the NTIA system lacks transparency in data validation processes, which makes it uncertain that spectrum management decisions are based on accurate and complete data.

And I will not comment on that. Although we do work that data, and that's a fairly accurate statement. I will say, though --

MR. TRAMONT: Exercising some restraint there.

MR. GIBSON: My comment is that's an accurate statement, but I don't want to make any comment. I have nothing more to say.

There was another aspect of the report that said that NTIA lacked resources. Karl said at the last meeting, you know, we've all done this -- and you'll see in our recommendation, one of our recommendations is the NTIA should, I don't think it's disingenuous to say the NTIA should go out and get more resources because indeed we think if they could do that they would.

So it's not just a resource issue; I mean, it's more of an allocation issue. We'll talk about that.

Here's the approach we took. We looked at the FCC licensing systems as a stand by side by side comparison. We also looked at industry spectrum management systems, our own as well as others.

Other similar data management systems. I wouldn't necessarily call DNS registration similar, but it was something we had some insight on through some of the committee members. And that was the data in Who Is database, which is you type in Who Is, and they'll tell you who the domain name belongs to.

Then we also looked at some government IT directives, specifically the OSTP plan from IT management. And that came from the government's IT CEO. And so there was a couple of guidances in there as well.

And finally we talked to NTIA staff, who were very helpful and very forthcoming.

I know that stuff's hard to read. I didn't realize that until I just put it up. I'm not even going to try to read it.

Basically what this is is the FCC's database. This is how they do it. As you probably know, the commission's in the middle of a four-year process to improve their data management systems. They're calling it consolidated database.

The third bullet there describes what the databases are. We don't need to get into all that. There are many databases and they are disparate. For example, the antenna

structure registration system is totally different than maybe some of the previous assignment databases.

Another key aspect to this, and you'll see this also at NTIA but not to the same extent -- and it's important that we remember this -- that regulator's databases are for licensing, not necessarily for spectrum management. That may be a paradigm shift we need to think about.

We certainly run into that with the commission's databases. There's information -- we heard this in the workshop yesterday. There's information on license records, but very little information on receiver data or receivers at all.

So what those of us that are in the commercial world would have to do is sort of have to triangulate on that. If we know this transmitter's being used and figure it's going to be associated with this receiver, and then we maintain separate databases for the receiver characteristics.

We're not sure that that's going to change, nor do we really want that to change. It's just sort of a piece of information.

Key point though is the commission manages about two million licenses. That's a lot of data. So what they are doing is moving to a consolidated licensing system. And the key features of that are geared generally to improve data, data accuracy and data consistency.

So if you can probably see in the handouts, you'll see

this also represented in our best practices. As I said, the process will take, you know, about four years last I heard; maybe a little quicker than that.

Some of the techniques that the commission uses now to ensure accuracy are essentially things that, you know, some of these are administrative and are more or less regulatory based. For example, holding licensees responsible for their own data.

Now, the NTIA does the same thing. The agency is more or less the licensees, and they are responsible for the data. But you'll see in one of the recommendations -- and we heard this a little bit ago -- there's an enforcement issue there.

Nonetheless, what the commission does is there are financial constraints or requirements. There's costs associated with licensing. They're not prohibitive but they are substantial. Obviously if they were prohibitive no one would use them. But, you know, they are substantial.

For example, if somebody wants to change a license record they may incur costs. So there's an inherent need to put good data in to begin with. And so that's the financial.

The FCC does have fine enforcement. I get the enforcement reports on a regular basis for people they go after who have not done their thing. They put, the commission puts enforcement in place.

And it's not so much for enforcement for people that put bad data in the database. It's for people who operate

without having licenses or their licenses expire. So it's more or less keeping the data updated as opposed to inaccurate.

As we say here, the regulatory rules place the requirement on the licensees who own the data so the commission is sort of just a data house. I don't mean to belittle it, but the licensees again, they own the data.

They also require to renew on a regular basis. Sometimes it's five -- most of it's a 10-year. Sometimes it's a little shorter, five year. So the data's constantly being updated.

Finally, they do do occasional cleanup efforts. The example is BRS, the Broadcast Radio Service. The example there was at the beginning of the 2.1 AWS there were 2.1 gigahertz BRS systems in that spectrum, yet the license information on those was very suspect because the data were damaged in the flood the commission had many years ago.

THE FLOOR: In Gettysburg.

MR. GIBSON: In Gettysburg, right.

So the data was sort of languishing, and there was a concern because these systems are very expensive. And new licensees were responsible for paying to relocate them.

And so the commission said, Look. In order for licensees to get a sense what they're going to be paying for this and get a sense of what the auction cost will be, BRS gave licensees an amnesty period for updating their data. They

actually gave them two periods, two 90-day periods I believe it was, the outcome of which is the data were considered to be final.

Now, in practice there was still discovery issues that happened when BRS licensees were contacted, but nonetheless it was a fairly well defined process that came out of it.

There's also procedural checks within the commission's database. It's just rudimentary checks in the licensing system. So for example, when coordinates are entered, they check the county more or less. And they also verify the FAA compliance with the slope and proximity to the airports.

Another thing the commission allows primarily in the ULS -- I don't know if they do this in the other databases -- is bulk data upload.

Now, the good news about bulk data upload is it minimizes human interaction. The bad news is it can propagate data errors. So it's incumbent upon the licensees that are interfacing with the database to ensure the data are accurate as they update it.

So what industry does in IT best practices, this is what we came up with. And for most of those of us that interface with databases on a regular basis this is probably going to seem like, Duh. But it bears, you know, mentioning. We'll put this together in the report.

The first bullet is, you know, on a regular basis

those of us that manage databases do data accuracy procedures. What we do is we contact licensees on a regular basis and ask them if their data are accurate, and we compare that data with the hard databases, and sometimes compare that to the commission's data.

There's many times we're going to be comparing data on a system that's inconsistent with what the commission has.

Now, if they're customers of ours many times what we will do is we will offer to them to update the data on their behalf with the commission's databases so the data are consistent.

There's also best practices, things like limiting interaction. What that means is like, for example, the mass uploads.

The other things for example using pick lists to pre-populate where possible. An example of that is with the commissions's ULS you can actually pick the service codes from a pick list. You weren't able to do that before the ULS was available.

Check and verify. Essentially that is, the way we do it is, one person enters the data and another person checks the data to verify the data are correct with respect to the records.

We said allocate appropriate resources. We put that in there to say you can't do this, you know, on a shoestring. It does take some effort and some purpose to do this work.

And as I said, and I guess it bears repeating, perform regular system datawide accuracy checks, i.e. fix the bad data. So that's the best practice.

Accountability. Again, this is actually one of the things out of the GAO report was to require individual accountability; make people accountable for what they do. And there should be lots of issues associated with making people accountable.

And then establish milestones and rewards for data accuracy. That's another thing we do. We incentivize people by saying, you know, If your errors are below such and such you get a cookie or something. Cookies don't tend to work out well.

The other thing is crosscheck and verify. What we do for example is again, if we see an emission designator or let's say some sort of a code that's incorrectly associated with the data records, we will crosscheck that to essentially say, Well, the technology you're saying doesn't support, for example, that power.

We can put a lot of that in behind the scenes data checking that we do. So for example if you enter this radio with this power, it will indicate that that's not necessarily allowed because that radio can't operate at that power. So we do the checking. And we can also verify through emission equipment.

Another thing we do is calculate where appropriate.

That should make sense. But for example, since terrain databases are fairly easy to come by anymore, if someone enters coordinates we should be able to pull the terrain data from those coordinates.

And then collect only the data necessary for the specific task. We've seen situations in other databases where for one data record you have, for one data license record, you have lots of data that's superfluous. So the recommendation is that you don't get more than you need.

What we did in this case is we talked to NTIA to see what their approach was. We had a nice interview with Tom Woods, and got a lot of information.

This is the information that we got from NTIA as to what they're doing with respect to the GAO report. It's in the paper copy so I'm not going to dwell on it.

Suffice it to say that they take the NTIA (sic) report very seriously. And they've had meetings internally to talk about how to kind of address it.

So the point needs to be made that the NTIA is actually doing things with respect to the GAO report so they don't need to address that.

They are also expecting improvements from the FSMS. I talked to Byron Barker out in the hall to get a better sense of what that is. Those of us who know the FSMS it's kind of taken a little bit of a turn. It's now being developed under the JFC

with, evolving through the NTIA in that connection. It think it's changing a little bit.

Essentially what the FSMS is supposed to do is actually make it easier to do analysis. We understand that they're going to try to improve the data parts of that as well through various means. But we're still digging a little more into that. And the timeframe is still about four to five years out.

And so these are the recommendations, so this is sort of the takeaway. So the NTIA should -- we were asked to say what the NTIA should do. Here it is.

I think the first thing we said was as soon as practicable -- and whether or not this is practical we make no comment. It may not be practical. In fact, we had some discussion beforehand about the practicability of this but it would be sort of nice to have, and that is, take an effort to clean up the data.

You know, it's great to try to fix the data moving forward. But if the data behind is not accurate, you know, we're still asymmetric there.

So the idea would be to, you know, lock down, take an effort, however long that would take to go back and review all the assignments, and to clean them up.

I know that 30,000 foot what does "cleanup" mean? We have to get into the details of that. But that was one

recommendation.

Another recommendation was to establish goals and metrics for data accuracy and milestones for achieving those goals. If you're going to clean up the data you need to have some milestones for doing it.

There's a lot of data there. They're probably consistent with the commission's numbers. So that's a lot of work, to look at every assignment. So establishing goals and metrics will help break that down.

The other is to put the responsibilities on the agencies since the agencies own the data. Various agencies take different approaches to their responsibilities on making sure that data are accurate.

So this is the enforcement approach that we were talking about to allow the, or make the agencies more accountable for the data.

It's hard, you know, if you get data you can't really tell is accurate. That's why you need to have better and more accurate data management systems. It would kick it back to the agencies and make them fix it, put them as responsible for it.

We also thought investigating distributing databases was a good idea. Because what you're doing with the data is you're pulling data from separate sources as opposed to one chunk, that being the geometrics, that .1.

For example, one database might be sight information.

Another database might be radio information. The sub databases of that might be closer data. It's called normalization in the database world. That's one of the suggestions.

Finally, continue to develop the FSMS, you know, with considering requirements for supporting data accuracy. The FSMS has been out there for a while. But it meets the greenfield development where there are requirements being discussed right now.

To the extent we can put data accuracy requirements into these requirements, you can use that as a process. You can also go back to the GM systems community as well.

That completes that. Well, actually there's one more thing. Sorry.

We were asked to identify the data that is sufficient for spectrum planning. And this is it, really; I mean, at least it's what we use. You can blow this up into, you know, many more fields.

But data on transmitters' and receivers' location to where the systems are operating, information on equipment, information on tasks, and the operational characteristics.

So, you know, sometimes it may seem daunting trying to pull a database together for doing spectrum management, spectrum planning. But in the end, this is the template that we need.

MR. TRAMONT: The second question will be the topic at the next meeting.

This second is the next question. This is our first examination of the next question. Obviously the first question, 6-C, is where we spent our, where we're trying to move forward to.

MR. GIBSON: That's 6-A.

CHAIR FONTES: Gary had a comment or question. Then we'll go to Carl.

MR. EPSTEIN: Everything overlaps everything else, of course. We, you know, the working groups said it would've been great if we had all this information so we could figure out what to do with the spectrum.

What this one seems to come down to is, it all looks very neat and I can see the incentives with the FCC and I can see the incentives with industry.

This, in some sense, comes down to the enforcement mechanism. What is that all about? Is there legal or other power here? Is it in any way realistic? Are we smoking something funny? You know, or how does that happen?

MR. TRAMONT: I think the incentive problem -- and this probably runs together -- on the enforcement side there are, we understood at least from my interview with NTIA, there are not clear enforcement, there are not any obvious enforcements in place.

One in political escalation, so one of our recommendations was to expedite the path to political

escalation. And I think Jennifer pointed out, people's careers can depend on the effectiveness of performing these tasks. So there is obviously a career impact.

But that also could be made more, shall we say, transparent to the folks involved. So there's not, you know -- in the FCC context obviously we cannot -- we can support it but we do not have the normal tools you would use for enforcement in the FCC context, and we're trying to find ways to create some parallel processes with NTIA is one of the topics we spent some time on.

MR. FONTES: Jennifer, and then Karl.

MS. WARREN: Jennifer Warren.

Just to add maybe just one nuance to Bryan's point about the political escalation, we were talking about that in the context of raising it above like the IRAC level to the next level and the next level, not talking about going to the agencies, that sort of thing. Just wanted to be clear.

CHAIR FONTES: Karl?

MR. NEBBIA: I just wanted to point out, I think one of the things that's really important for us to understand is how much you would expect this kind of thing to cost because in terms of numbers of people that you think would be required to do it, and then ultimately that gets linked to what the cost would be.

Because I think if we're -- we've worked

traditionally, and I think the commission has also, on the basis of we regulate as little as possible. And now we're moving in where we're more, we've got all these spectrum issues to resolve, and sometimes we don't have the data for it so the pressure seems to be going the other direction.

But realistically right now we find errors, we get them corrected; that's one approach. Going through the whole database and trying to go out on each field operation is another thing.

I think I just as you look at that -- and I'd appreciate it if you could try to provide us whatever feedback you can as we close out this particular recommendation -- is considering there when you are cleaning up a database of fixed links, most of what you have is pretty homogenous, same types of systems. If somebody writes something down it really stands out if it's unusual or odd.

We're dealing with all kinds of different systems, some of which we've never seen. They tell me, I'm operating this kind of radio. Gee, whiz. I've never actually seen one of those face to face, and I wouldn't know if the characteristics are right or wrong. That's why we rely on the folks out in the field.

Anyway, if you can, any way you can quantify that to give us a sense of what that might cost, then when we talk with folks on the hill we can be specific about them.

MR. GIBSON: This is Mark.

And yes, we talked off line about that. So we'll take a stab at that.

I think, you know, none of us is thinking that we're going to make the database 100 percent accurate nor should that even be a goal. But as accurate as possible given some of that.

And I would also say, you know, Jennifer and I talked about this before the meeting. You know, there may be ways through the existing procedures that we can do this. The IRAC process.

You know, the idea is not necessarily to make it more difficult or more costly. But, you know, the report says, you know, the NTIA lacks resources, you know. That's a bit of an albatross. But we shouldn't go back to that as an excuse for not doing it.

You know, we need to be creative about trying to throw this into processes and procedures. We'll do that.

MR. REASER: This is Rick Reaser.

I think there's an important recommendation that we kind of glossed over. Okay. It's about the distributed database thing. I just went through this last night with the track and field example.

One of the things that goes on in some of these huge databases -- and I participated in the national track and field database for college and high school.

It's an open database. Everybody gets to see every number that goes in there, every mark, every measurement, every name, every grade, every unit. And what happens is a lot of policing and enforcement stuff happens from other people who pick up on stuff because there's a lot of people looking at the data.

So if you went to something like a distributive approach -- because right now, the approach you have now, there are errors on all sorts of stuff we build. To get them fixed you'd give up.

If there was a way you could do like I do in the track and field database where I put a note next to the record, Her name is really spelled this way. She's a sophomore, not a junior in college in eligibility. And there's one mark, Here it is. I have another record.

I can put that mark in and it goes in and sort of like a Wickipedia sort of thing. So, but the deal is, and you know something? It gets fixed. There's a person who's responsible for that meet, for that record, and that event, and they fix it based on comments they get from others.

I think this whole issue of the distributive thing might be something that you want to look at. And if you actually were smart enough to let contractors have access to this they'd be fixing stuff left and right making correction to our stuff about powers and modulations and model numbers and

things. We'd submit those kinds of things to them and they'd get them fixed.

We like to have the stuff -- we don't want our equipment misrepresented in government databases, especially when it involves minor changes like we got things on reverse part numbers we've been trying to fix for five years.

I mean, so I think this distributive idea really has power behind it. And there's a lot of things out there. I see some people nodding their head. It shouldn't be that difficult to get goodness into the data.

MR. GIBSON: That I think was why the reference to some of the Internet operational database, to keep the network, for example --

DR. KAHN: They're all maintained in a URL industry manner. And there isn't some huge infrastructure in one place that somebody's funding to, you know, keep it accurate.

Yeah, there's money being spent on it; there's no question. But, you know, I think sort of the underlying tone of this is that you need to put more of the responsibility -- not so much on you guys taking it on, you're right. Budgetarily that will kill you.

But essentially to force that responsibility back on the people who actually have the raw data at the beginning of the process because it's also the cheapest place to do it if you have the right structure in place.

CHAIR FONTES: Dale?

MR. HATFIELD: Very quick question. I'm hung up on receivers, and what receivers consume. The spectrum, we've taken all this time talking about transmitters, and sort of a -- receivers were sort of a footnote.

You can almost reverse the process. What we really need to know about is what receivers are out there so we can prevent the current sort of debacles that we're having right now.

It wasn't clear to me. And I realize in some situations like the weather band radio, you don't even control that. The people, a lot of people buy a lot cheap weather band receivers, and you're going to have an effect on the ability to use the spectrum on the receiver side.

So I've got sort of an uneasiness here that we're focusing on the wrong side of the problem; that maybe we should be focusing more on the receiver side.

MR. GIBSON: This is Mark again.

Good point. That's why, you know, in the set of data sufficient for spectrum planning, it isn't in capital letters, but we did have "receivers" up there, transmitter receiver information, make, manufacturer, model.

The intent is, you know, if you have that baseline information you can instruct the underlying data necessary to support spectrum planning.

So your point is very well taken. We should've said more about it. That was the intent.

CHAIR FONTES: Okay, great. We're through with the presentations.

We're just going to go through the rest of the agenda here. There's going to be some modifications simply because of the time constraints, and also the fact that some folks are scheduled to make flights.

So what I'd like to do now is open it up for comments from the public if you will, those on the phone first, to the presentations that were made today.

Now, I'll be perfectly honest with you. The phone connection is abysmal. If I were responsible for it I would apologize. But I'm still apologizing. Is that being polite?

But is there anybody calling with a question? I will take that as a no. I apologize.

Anybody in the audience here? I know there's one person here, Pierre de Vries, if I'm pronouncing your name correctly, who will want to make a short presentation here. We'll have that. I just want to make sure there weren't any other comments.

We will also be eliminating the 10-minute break for obvious reasons. And what I'd like to do is go ahead and turn it over to Pierre.

Pierre, introduce yourself.

MR. DE VRIES: Thank you very much. I am Pierre de Vries, senior adjunct fellow at Silicon Flatirons.

What I would like to do is to just give you a quick snapshot of some research that we've been doing at Silicon Flatirons in the last few years. This should only take five minutes, the mythical five minutes.

I'd like to start with the quote that I came across a couple of days ago in a wonderful book by Adam Gopnik about Charles Darwin and Abraham Lincoln. He was talking about Lincoln's practice as a lawyer.

Gopnik says, Law is the practice of rules in the context of deals. And that really struck me. And I started thinking about its application to what you do and what I'm thinking about.

And if you think about regulation, perhaps you need to twist it around a little bit and say, Regulation is the practice of deals in the context of rules.

And it struck me, in the short time that I've been working on this area -- compared to the people that are in this room, I'm an absolutely novice. I've only been doing this ten years.

There's no shortage of rules. But there's a woeful inadequacy in our ability to do deals of all sorts, not just commercial deals, but also the kinds of conversations that we've been talking about today.

So we need to do more deals because there's this increasingly intensive coexistence of diverse radio systems, parameters that need to be adjusted all the time because technology adjusts, business models change.

At the same time there seems to be an inefficiency in the institutions, inability to actually resolve conflicts in less than many many years.

So that led us to think about how one might change operating rights, how they're defined, how they're signed, and how they are enforced.

And so we've been working on this for a couple of years at Silicon Flatirons. It was inspired by Dale Hatfield's concern about the adjacent channel and out of bound interference problems, particularly when you have different services on different size frequency boundary.

So we started back in September of 2009 -- we have a small workshop here in Boulder -- to explore the reasons for the cross channel interference problems, mostly taking the engineering view on that.

At last year's ISOT, building on what I learned in that workshop, I made a presentation that had, broadly speaking, two recommendations. One was that one should aim regulation not at trying to minimize interference, but actually to maximize the value of the radio operation.

In a perfect world those two things are in fact just

the duals of each other. But I think there's a very different emphasis you have.

The way in which, one way in which you can actually maximize or think about maximizing value is to define operating rights more precisely. And we introduce this notion of the three Ps: Probabilistic, reception protections, and transmission permission, so probabilistic, permission, and protections.

In November of last year we had a DC conference sponsored by Flatirons and various other people where we added lawyers and economists to the conversation.

We had some very good contributions from Michael Calabrese and Greg Rosston and Tom Hazlett and John Williams. And we're planning another small workshop here in Boulder in a couple of months in October.

There we're going to focus on something that I've heard quite a lot about this afternoon, receiver issues and enforcement issues.

So to just briefly summarize where we are right now, it seems to me that to maximize value of radio operation you need to do three things, rule of threes.

The first is, define the asset, which is the permission to operate, more precisely and objectively. The second is to make rights enforcement more efficient. And the third is to facilitate transactions.

So in the time I have I'm just going to talk a little bit about the first of those three. If anybody's interested in learning more there are a couple of copies of a paper that my co-author and I have been working on.

If in the wonderful outcome you've run out of copies, contact me or ask Dale.

The three Ps is the synthesis of a lot of work of the last couple of decades, work that Bob Mathieson has done, an Electrospace work that was done in the UK on spectrum usage rights where you define transmission permissions in terms of resulting energy.

I'm going to focus on the reception protections, because that's slightly more novel and less talked about. What I mean by that is a statistically defined ceiling on the inbound and the out of bound energy that a licensee or operator can be expected to live with.

And once that's known, once you know how the protection levels are for an operator, you can in fact define the transmission permissions on the adjacent operations to them.

I just want to flag three things which I think are interesting about reception protections. The first one is, we heard some conversations about -- Tom, you mentioned the defined levels of interference, so this harmful interference metric, and what that is, and let's just live with it if it's ambiguous.

I think reception protection levels are a way to make

that much less ambiguous. It says, This is the level to which a receiver is protected. If the energy level is below that there is no harmful interference.

The second benefit is, I believe largely this obviates the need for receiver standards. Essentially you describe the operating environment rather than the receiver performance, and it's then up to the operator to figure out whether they want to build a really good receiver or whether they want to live with the interference and have degradation.

I think the third benefit is that it allows you to get past this very vague, harmful interference standard.

I'm going to stop there. Hopefully I've piqued people's interests here if people want to talk more. And grab a paper.

CHAIR FONTES: Thank you very much. Quite interesting actually.

So at this point we'd like to, rather than just go through, we'll go with Eric.

MR. NELSON: Yes.

CHAIR FONTES: Thank you.

Eric is the next-to-last item on the agenda just prior to adjourning the meeting. That's not quite what's going to happen. Thank you, Eric.

MR. NELSON: Thank you. On behalf of the spectrum propagation industry we appreciate the opportunity to give a

little bit of an update on the progress we've made on the spectrum sharing innovation test-bed.

A little bit of the title's missing there. Technically it's a pilot program. So going into this part of what we're trying to do is not only test devices but also evaluate the nature of testing itself along the lines of the WSRD meeting yesterday, ask the question as we go along, What is a test-bed?

So it's an opportunity to look at successes and failures as we go, and be honest with ourselves about having improved processes.

So starting, there was a public process we went through to -- it was a notice that went out and invited the parties to volunteer devices for participation.

That is list of companies that originally expressed interest in participating. One of these parties dropped out about six months into the program.

So we went through a test plan development process. So this is a whole series of meetings that we had. Public notice participant meetings occurred in autumn of 2008.

Those meetings gave us an opportunity at least to whiteboard what the various characteristics of the radios were so we could try to put together a one-size-fits-all test plans for the different radios.

Subsequent to that we drafted the test plan; went for

agency review to the IRAC technical subcommittee, and then back to the participants for their comment and eventually out for public review and comment which occurred in January 2009. First test article arrived in the spring of 2009.

So this is kind of an eye chart as well. It's a list of the different tests that we have. All this information is up on line. If you go to the OSM's website there's a whole page dedicated to the test-bed. There's also progress reports on it as well.

My goal today is to kind of give you some of the back door description of what's going on describing some of the frustrations and successes we've had in the laboratory.

But the first set of tests we had a huge new emission characterizations. That's, you know, essentially looking at the 500 test DSA devices. And measuring new emissions so that, for a variety of reasons.

One, for just your kind of your classic emission mask type measurement. But as well we would do a vector signal analyser capture of the emissions so that we could use it for some compatibility testing later on.

Then we have sensor characterization. So we would look at these devices, have a list of talk capabilities. We looked at the sensitivity to have the sensors in actual communications mode, so we would get them talking to each other.

Then we would evaluate not only how well did they

sense in terms of how, what -- both the power they would sense but how quickly they would sense, so it was a combination. We did that for both simulated static land mobile signals as well as standard ones.

Then a couple of other tests. And I'll speak a little bit more about some of these on the latest slide. We tried to look at what are the various RF effects that may occur. And tried to put together some test procedures for that.

One of the concerns we had, for instance, was sensor desensitization. If we have a real strong band signal from maybe a trunk land mobile radio system and the DSA device has a lot of power coming out of it, is it possible for that to desensitize the DSA device on that front end so that it might not be able to see some other channels that are, you know, in a a near or far type scenario?

The number of tests we did for geolocation, the spectrum access behavior is really just kind of looking at protocols. And the notion of those tests as the spectrum becomes more and more occupied does the DSA device gracefully exit channels.

You're also looking at cooperative sensing as well. Would a client be able to tell the base about something that only it could see. And then, you know, see if the base responded in kind to vacate the channel.

We did an LR emission characterization. So that's

something just to, just to provide DSA operatives a little bit of information about land mobile load. The waveforms are fairly well-known.

And then finally on the upper right there we have LMR receiver performance. So that's kind of classic interference protection criteria test. This is where we took the captured emissions from the DSA device and injected it into the land mobile radio.

We looked at both co-channel op frequency, and then one of the tests is looking at kind of the protocol behavior for project 25. It turns out if you, if you're in a situation where you've got a hidden land mobile radio, and the DSA device does properly detect when it's in the middle of a transmission, it's possible to knock out 5 milliseconds frame sync on a P-25 transmission.

The result of losing that frame sync is you lose the header of the transmission. If you lose the header you lose the whole first frame of the transmission. So that's something we tested as well and verified.

The last set of tests in Phase I, which is kind of Phase I encompasses our laboratory investigation, we took our equipment out to our field lab at Table Mountain, and did some radiative measurements there. The benefit of that is that it allowed us to get outside the, you know, ideal complex of a lab where we have sheltered enclosures.

And sure enough when we did take the equipment out to Table Mountain and tried to set up a control test to evaluate, you know, sensor behavior, we had, you know, uncontrolled devices popping up and kicking, kicking the DSA device into different channels and things like that. So it was a useful, useful experience out there.

We spent the last about nine to twelve months, depending on what you consider our first draft test plan, the maturity of that. But we've been putting together anticipated Phase II and III testing. So Phase II and III is essentially field testing.

The distinction of Phase II for the sake of agency feedback we got. They wanted to kind of see, you know, some demonstration in a truly dynamic environment that the DSA devices were properly detecting the void. So we cobbled together some combiners.

So we're able actually to get the two devices to talk to each other, DSA devices, through a conductive path and then couple the ambient LMR signals into them to see how they behave and with the test this one out, alter out the test range and expose the DSA devices to all different types of radio systems.

Beyond that Phase III test we've got a hidden note test which we had planned, which is essentially it's a near-far type scenario, trying to see with an actual land mobile radio in service as a DSA device comes in from a greater range, where

does it actually detect, and what is that actual mechanism.

And then we have a conventional LMR test. The trunk system test focuses on the control channel, because essentially with land mobile radio, once you get a voice channel grant, trunk systems look a lot like conventional systems in terms of susceptibility.

And then the test finally rounds out with some geolocation tests.

So I'll go through some of the challenges that we had. Each participant came in with a unique device. This is in the summary report that our Office of Spectrum Management put together. We have an annual report.

So it just lists the various characteristics of the device. We have some devices with contiguous channels today that are channel structures maybe, you know, more than a megahertz wide. We've got other devices that are OFDM. They essentially suppress that period.

That's been quite a bit of a challenge to us because some of the tests that we do we try to assess whether something has actually left the channel, and so to actually get input, you know, off of a spectrum analyzer, for instance, or an oscilloscope, requires a little more fine tuning than you would have if it was just on or off.

Now, if you have not just on or off but it's potentially 500 carriers, Which ones are on and off? So that

complicates things a bit.

So we've had to customize the test fixtures quite a bit to adapt to the various devices. Just to give you an idea, before I joined the Spectrum Propagation Agency I worked at our, in our public safety communications research lab, which did a lot of land mobile radio testing.

So I put here an example of kind of a typical land mobile radio receiver test. So this is a test setup that you would use to evaluate maybe co-channel or adjacent channel rejection for a land mobile radio.

So you've got receiver in the test that, you know, has some sort of EER detector and there's essentially a couple of RF signal generators combined, and you put that signal. For land mobile radio, the testing is separate; you test the transmitter separate from the receivers.

And this is a picture of kind of a typical test that we had for the test-bed. And what you have at the top, the top row there, is a chain of directional couplers and attenuators. That essentially allows us to get a conductive connection going within the two devices on your test.

But then we've got to tap into that and inject -- you know, in the lower left there we've got a vector signal generator that injects an incumbent signal that we're simulating. We have to run it through a number of different circulators to get the proper isolation.

Then over on the top there, the second directional coupler then provides signals that we can then dump into a digital storage oscilloscope so that we can evaluate, you know, when the device triggered, how long it took to vacate the channel. You can look at the difference between the base and the client in terms of vacating the channel.

So a considerably more complex system to iron out. Just to set it up takes a couple of hours to get all the connectors just right.

In fact, one of the things we struggled with is you might run a test, then you repeat it a month later, and if you don't connect every single connector just the way you did the last time -- and frankly even if you did -- you're going to find a one TDD difference in sensor sensitivity.

In a lot of cases, you know, our measurement error's on the order of the actual difference between the phenomena we're trying to measure.

Third point here, we mentioned lack of uniformity in test modes. So in some cases we had to actually modify the test fixtures, and we had to actually start reinterpreting the nature of the test.

If you're trying to, for some of the radios, if you're trying to force them out of service, the hypothesis being that you could get into a very dense environment where there is a lot of activity if there are co-channel assignment between the DSA

device and land mobile in that market, we anticipated that the DSA devices would actually completely shut down.

That may be true for some devices, but other devices, if they're running OFDM where they're just simply notching subcarriers, we struggle with, Well, is there a possibility that you would ever really have all of those subcarriers need to shut down?

So part of what we've had to do as we go along is really investigate what's the philosophy behind the testing. And make adaptations s to the test procedures to adjust for different type of equipment.

Some of the program challenges we had, first point, you know, not having prior experience, the meetings we had with each participant was very educational. We did walk through, you know, for several hours the characteristics of the device.

But we found that in the first week of having the actual device in front of us that, Boy, it would have been really nice if we could develop the test procedure after we had the chance to kick the tires on the radios for a while, see how they work.

That was just something that was a frustration and we put down as kind of a lesson learned maybe for some next iteration is maybe some sort of trial period where you can get in and actually gain familiarity with the equipment before you start developing test procedures.

Other issues we've had is some of the equipment came up in the WSRD meeting yesterday where some folks come to a test-bed with the notion that they're ready for rulemaking. Other folks had come in and kind of said, Well, we just really want to find out what sharing's all about. We want to learn from you, so there's been a disparity between the preparedness of the different participants.

You know, in one case we have a radio that got rebanded. And it works real well on a 50, 50 unload. But when you hook a mobile antenna, mag mount antenna to it, it gets a visual fault and the radio shuts down.

We're actually kind of struggling right now to find an antenna that will actually work with this thing for field testing.

And other issues we've had, there's been a broad level of protocol maturity. One of the devices we assessed didn't have any coordination between transmit and receive. And so when the base saw subscriber transmissions it detected them and it vacated the channel because it had no way of differentiating between an incumbent signal and a DUT or processor test DSA signal. So essentially what this device would do in practice would just be to constantly vacate the channel because it would detect itself.

And that's, you know, some of these devices will have to actually debug software just to get them to work, issues like

that that we've had to deal with to just keep the ball rolling and really extract as much knowledge as we can out of these devices.

One thing that came up in the WSRD meeting as well, going to point No. 3 there, the participants' ability to support tech support requests from ITS is bringing in different issues really was a function of their funded business activities and the availability for dedicated support or even on call support varied widely.

And I know one of the things that came up in one of the WSRD calls a couple of months ago was the notice of NSF funding for test-bed participants.

Office of Spectrum Management is just funding an ITS testing at our end. But funding for the test-bed participants so that they would have the ability to customize their equipment for, you know, various test control points that are required and also just for general tech support would be useful.

And then the other thing that happened too is early on we were led to believe there was, you know, quite a few of these devices in the queue. And we really wanted to be proactive and be ready to bring them in. So we prepared a second test station to speed up our testing.

We identified another room by a shield of enclosure, you know, acquired all the necessary test fixtures and test equipment. And for a little while there we did have two devices

running in parallel.

But for the most part that second test station has sat idle just because of the ability of participants to get their product ready for us to getting into the queue.

And what happened about a year ago, the reason why we started working on the Phase III test plan, original plan was to run two test stations in parallel, get all I guess at this point five devices, because one of them had dropped out, get all five devices through the lab testing and then we were going to proceed to field testing.

Because we saw these delays, you know, we would make phone connections, phone calls with the various participants, and could see that some of them were struggling to get their devices ready, we decided to start drafting the field testing plan.

So we're going to proceed with field testing even before, as soon as we can get the field test plan approved; not necessarily making it contingent upon finishing the lab testing for all the devices.

So in terms of accomplishment, I think that we're just about done with the lab testing on our second device that we took in. And really this conference is the only reason why we're not finishing this week; folks are attending the conference. But they've just got like two days' worth of work left on that.

As I said, we have a third device that we've evaluated. And it just reached the point where there were enough protocol idiosyncrasies that it just didn't make sense for us to continue testing. It's really back in the participant's court to see what they want to do to work on the protocols for that device.

We just received a fourth device last week and went through training. And it has the test control points that we need for some of our timing measurements. We're able to check them out actually on the fly last week and they look pretty good.

A fifth device is out there. Presently it's not funded to the extent that it would be connected to a transceiver. So it would just be a sensor technology that we could evaluate. We could look at sensor sensitivity. But there isn't a transceiver behind it so it would go through a limited set of tests.

We have been, as I say, working on the draft test plan. It's out for review now by the participants. In the process of writing up that test plan we've also started preparing test fixtures, and started getting the necessary equipment for the devices.

That was when we discovered during the radiated tests we weren't able to get one of the devices to actually radiate through a mag mount antenna.

We're working right now as well -- the plan is to conduct the test in the Denver and Boulder area, so we're working with local agencies and coordinating that.

I wanted to share just some perspectives on test-beds, kind of taking a philosophical look at things. We understand it's been a time-consuming process. I guess in hindsight if we had some of that more exploratory period we maybe would've been able to shrink some of the testing for Phase I.

But we do believe that it's been indispensable to do the lab testing. We can actually stop a vector signal analyzer capture and play it back and really study the protocol. That is invaluable for when you take that device out in the field and you have some knowledge of what it may do so you can characterize it.

In terms of trying to look forward at, you know, what test-beds are going to look like in the future, and just looking at some of the issues that have happened with DFS as well, we believe incumbent systems in many cases are too complex and varied to necessarily strand in a single test-bed.

I know there's talk about putting together kind of a national test-bed, a clearinghouse. And there is a role for that. But, you know, it's going to have some constraints on it in terms of not only the cost of the equipment whether you can strand it, but also just the expertise of the people that you need to operate it.

And so we see definitely a role for NC-2 testing, being able to integrate testing within an actual network. And that's what we're looking to do is field testing for the land mobile radio test. Actually right now we're talking to the federal protective service to test on their actual system here in Denver.

One of the things we see, seen a lot of talk about, you know, I think the time-limited leases, the ability to actually go out and control some of these DSA devices, some of these policy databases we believe would give us some hooks into behavior of the devices under test so that you could in a controlled way not only get them fielded, but some of our thinking is you could maybe work towards a core set of behaviors and properties of a DSA device, and that would be something that you would then get out, you know, get it type accepted, get it out into service.

And then you could work through expanding policies over time, kind of a complete twist on the way things have worked for DFS, but start with a real solid core set of behaviors, and then work to expand the behaviors through NC-2 testing is a idea that we've kicked around.

With less critical incumbent systems, you know, you could then go in and just do regular monitoring. And the critical ones, you know, you maybe go out and you do that kind of testing during maintenance windows so that you cannot cause

any harmful interference.

Other things we've looked at, we believe the interference protection criteria is absolutely essential. And it would have been ideal for this test-bed to actually get the IPC for land mobile radio out to DSA designers before they started designing systems to share with land mobile radio.

So that's something I think in the future, as we start exploring sharing other different types of devices that, you know, it'll really be important to get the IPC published in advance of developing new policies.

And just things to mention that are outside the scope, we see just the extreme importance of spectrum monitoring, you know, in the future.

Working with some of the test-bed participants, I really do believe you can, if you have enough iterations of this, if you take enough stabs at sensing and at policy databases, we can make these systems work but it's going to take multi iterations.

Evolution doesn't happen one mutation, like boom, there's a leg. There are thousands of mutations that have to happen to start producing function, functioning parts.

So that's not something that's going to happen in a test-bed where you throw it off to us for a year and we test it and kick it back to you. That's going to be pretty -- you know, we don't have geologic time to work with here.

So part of what you could do is to get the stuff out there with restrictive policies, and create an NC-2 test-bed where you really are testing the policies in a live test-bed.

But it's been mentioned here, the previous discussion about enforcement teams and toolsets are really something that we need to really start looking at so that future devices we're prepared to troubleshoot in the discovery.

Something that came up just in preparation for the conference, it's our understanding a large percentage of the problems with DFS devices is just people defeating the functionality.

We could spend, you know, as engineers a whole bunch of time putting together these very elegant systems and follow all the rules and processes and procedures, and some 17-year-old defeats, you know, all the processes and rules. It would be a shame if we spend all that hard engineering on it and don't make things tamperproof.

Then just, you know, another issues is conformity assessment processes. If we're going to start changing the way we envision certifying things we really have to, really have to think through that whole conformity assessment process in time cycles.

CHAIR FONTES: All right. Any questions or comments?

THE FLOOR: Very thorough.

MR. NELSON: I can leave the slides, yes.

CHAIR FONTES: Great. Any comments? Questions?

It's 5,000 feet over my head, but I'm glad you're doing this.

I'd like to turn it over to Bruce now to give us some information on the next meeting.

MR. WASHINGTON: Okay. Real briefly, I know you guys are tired; I know you're hungry and you're ready to go. But first I want to just thank the folks here at ITS Boulder for putting this on, supporting us.

I know we had some technical difficulties, but hey, we're in the technical business so we know we should be empathetic with that. But these guys did a bang-up job. I thank them for that.

The next meeting I understand where Karl will be looking at around about Octoberish. We've got some things that are going to kick out, so mark your calendars for October.

I will be putting out information. I will be expecting -- huh? I heard, Set a date. I heard, Pick a month. I think we'll take that back to co-chairs to put that out.

When we do that please RSVP on time so we can plan accordingly.

THE FLOOR: Give us a date, we'll RSVP on time.

MR. WASHINGTON: So that's all really I have.

We do have one bit. I'd like for the Chairman to promptly adjourn the meeting so the reporter can stop recording.

Then we just have one photo op and then we can be on our way.

CHAIR FONTES: I just want to thank everybody for coming out here. Thank you for the presentations today.

Meeting's adjourned.

(Whereupon the within proceedings adjourned at 4:37 PM.)

C E R T I F I C A T I O N

I, Martha Loomis, Certified Shorthand Reporter, appointed to take the within proceedings hereby certify that the proceedings was taken by me, then reduced to typewritten form by means of computer-aided transcription; that the foregoing is a true transcript of the proceedings had subject to my ability to hear and understand, and that I have no interest in the proceedings.

IN WITNESS WHEREOF, I have hereunto set my hand.

_____

Martha Loomis

Certified Shorthand Reporter

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