

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND
INFORMATION ADMINISTRATION

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COMMERCE SPECTRUM MANAGEMENT
ADVISORY COMMITTEE (CSMAC)

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MEETING

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TUESDAY

AUGUST 15, 2017

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The Advisory Committee met at the
Renaissance Boulder Flatiron Hotel located at 500
Flatiron Boulevard, Broomfield, Colorado, at 8:00
a.m., Larry Alder and H. Mark Gibson, Co-Chairs,
presiding.

PRESENT

LARRY ALDER, OneWeb, Co-Chair
H. MARK GIBSON, Comsearch, Co-Chair
AUDREY ALLISON, The Boeing Company
PAUL ANUSZKIEWICZ, CTIA
MARY BROWN, Cisco Systems, Inc.
MICHAEL CALABRESE, The New America Foundation
DALE N. HATFIELD, University of Colorado at
Boulder
CAROLYN KAHN, The MITRE Corporation
PAUL KOLODZY, Kolodzy Consulting, LLC
MARK LEWELLEN, John Deere Intelligent Solutions
Group*
ALLEN MacKENZIE, Virginia Polytechnic
Institute and State University
DONNA BETHEA MURPHY, Inmarsat
JANICE OBUCHOWSKI, Freedom Technologies, Inc.
CARL POVELITES, AT&T Services, Inc.
MARK RACEK, Ericsson, Inc.
CHARLA RATH, Verizon Communications*
RICHARD L. REASER, JR., Raytheon Company
DENNIS A. ROBERSON, Illinois Institute of
Technology
ANDREW ROY, Aviation Spectrum Resources, Inc.*
STEVE SHARKEY, T-Mobile US, Inc.
MARIAM SOROND, Dish Network, LLC*
BRYAN TRAMONT, Wilkinson Barker Knauer, LLP
JENNIFER WARREN, Lockheed Martin Corporation*
ROBERT WELLER, National Association of
Broadcasters

ALSO PRESENT

PAIGE R. ATKINS, NTIA
MICHAEL COTTON, NTIA
JULIE KNAPP, FCC
GLENN REYNOLDS, NTIA

*participating via telephone

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1 P-R-O-C-E-E-D-I-N-G-S

2 (8:00 a.m.)

3 MR. GIBSON: Okay, welcome. We're
4 only up here because that's where they put us.
5 We have done nothing to deserve this, I'm
6 speaking for myself. The rest of this, all this
7 bunch may belong here, but I'm just here because
8 this is where they put me.

9 MR. ROBERSON: So, when we approach
10 the bench, we have to say, Your Honor?

11 MR. GIBSON: You do. Everybody else

12 --

13 PARTICIPANT: Objection overruled.

14 MR. GIBSON: Okay. And I see Julie is
15 in here, great. So we'll start off, welcome to
16 Boulder, actually almost Boulder.

17 Thanks to everybody for coming. It's
18 good to look out and see non-CSMAC people here as
19 well, as well as CSMAC people.

20 That's basically all the opening
21 remarks I have. Anything else for anybody else
22 on the stage here? I take that as a no.

1 So let me start just with my comments.
2 First of all, thanks to everybody for showing up.
3 We're tagging this at the beginning of our ISART
4 conference, which I always look forward to. This
5 one is about millimeter wave, so there's a lot of
6 good panel discussions and presentations about
7 that, so I hope everybody can stick around for
8 that.

9 And thank ITS for keeping this going
10 for us, here in Boulder. Thanks also to the Co-
11 Chairs for getting your materials in on the
12 deadline, that always makes it helpful.

13 I'm sure Dave and the folks within
14 NTIA really appreciates that, as does the public
15 that reads this. There's a fair amount of work
16 that's been done so far and so thank you all for
17 doing that.

18 And today's meeting is really to kind
19 of check in where we are. Some people have
20 submitted recommendations, others are in the
21 midst of discernment, let's say, doing surveys
22 and what not.

1 So we'll hopefully check in, provide
2 any guidance. You guys are facing each so you
3 can help each other out. And we on the dais will
4 listen and enjoy.

5 So having said that, the other thing
6 I will just remind you of, because I like to do
7 this every now and then, tomorrow is the
8 anniversary of Elvis Presley's death. Forty
9 years, so Don't be Blue.

10 (Laughter)

11 MR. GIBSON: So having said that,
12 let's go ahead and, any other comments? You have
13 any comments? Okay. How can you follow that up,
14 right?

15 (Laughter)

16 MR. GIBSON: Yes, and Glenn will be
17 doing remarks for ITS. And Glenn is, where is
18 Glenn, I mean NTIA. Should I give Glenn now?
19 Glenn.

20 MR. REYNOLDS: Thank you. And I'm
21 really going to keep this short, and not sort of
22 get into the usual high-level opening comments.

1 I do appreciate NTIA. Greatly
2 appreciate you all being, willing to come out
3 here and willing to get out of D.C. in August.
4 But it is important.

5 It's helpful for us, we hope that there
6 are synergies between the work that CSMAC is
7 doing and the efforts and the focus of ISART this
8 year. As I'm sure you all are aware, ISART is
9 going to be very much focused this week on
10 millimeter wave bands.

11 The discussion, the talk, all of the
12 policy engagement in D.C., on 5G, has moved
13 forward, I think, faster than certainly any of
14 us, in the Government side, have expected. And I
15 think we are all trying to figure out how we, if
16 not stay ahead of the curve, try to keep up with
17 what you all are doing in the industry so that
18 the policy and spectrum needs, for all you, are
19 not being dragged down by slow processes going on
20 in the policy on the Government side.

21 Relatedly I guess I would sort of
22 address the elephant in the room briefly. Just

1 to emphasize that despite the fact that we, at
2 NTIA, continue to be without a political
3 appointee, I can assure you that the work that
4 you all are engaged in remains critically
5 important.

6 And it will be used and emphasized and
7 studied by both the folks, by the career staff
8 and by the political leadership that we fully
9 expect will get onboard in the near future.
10 Things are continuing to move, as you can
11 imagine.

12 There are decisions that need to be
13 made, there are policies that need to be thought
14 about. And we are continuing to engage, both
15 within the department and with the folks over at
16 the White House.

17 As you all know, Grace Koh is over
18 there. And Kelsey Guyselman is now over at OSTP.
19 And we're working with them to keep the trains
20 moving until we have our new political leadership
21 onboard.

22 So with that, I just want to say thank

1 you again for coming out here and we look forward
2 to hearing your thoughts today.

3 MR. GIBSON: Thanks, Glenn. One bit
4 of housekeeping, actually two bits of
5 housekeeping, one, for all the CSMAC people,
6 please remember to say who you are when you
7 speak. And if you don't, one of us will
8 remember. That's for the transcript.

9 And for those on the phone, please be
10 sure to mute, unless you're speaking. That
11 always causes some weird feedback. It's kind of
12 cool to listen to, but it really screws up the
13 meeting. So if you would just please adhere to
14 the protocols when you're not in the room that
15 would be great.

16 Now we're on the point where we'll do
17 the roll call, so let's start with Brian and go
18 clockwise.

19 MR. TRAMONT: Bryan Tramont, Wilkinson
20 and Barker.

21 MR. RACEK: Mark Racek, Ericsson.

22 MR. SHARKEY: Steve Sharkey, T-Mobile.

1 MR. POVELITES: Carl Povelites, AT&T.

2 MR. KOLODZY: Paul Kolodzy, Kolodzy

3 Consulting.

4 MR. HATFIELD: Dale Hatfield,

5 University of Colorado.

6 MR. MACKENZIE: Allen MacKenzie,

7 Virginia Tech.

8 MR. ROBERSON: Dennis Roberson,

9 Illinois Institute of Technology and Roberson and
10 Associates.

11 MR. WELLER: Robert Weller, National
12 Association of Broadcasters.

13 (Laughter)

14 MR. KNAPP: Julie Knapp, FCC.

15 MS. BETHEA MURPHY: Donna Bethea
16 Murphy, Inmarsat.

17 MR. CALABRESE: Michael Calabrese,
18 Technology Institute.

19 MS. KAHN: Carolyn Kahn, MITRE.

20 MR. REASER: Rick Reaser, Raytheon.

21 MS. BROWN: Mary Brown, Cisco.

22 MS. ALLISON: Audrey Allison, Boeing.

1 I also have a billboard.

2 MR. ANUSZKIEWICZ: Paul Anuszkiewicz,
3 CTIA.

4 MS. OBUCHOWSKI: Janice Obuchowski,
5 Freedom Technologies.

6 MR. GIBSON: Okay. And then for those
7 CSMAC members on the phone.

8 MS. RATH: Charla Rath, Verizon.

9 MS. SOROND: Mariam Sorond, Dish
10 Network.

11 MR. ROY: Andrew Roy, ASRI.

12 MS. WARREN: Jennifer Warren, Lockheed
13 Martin.

14 MR. GIBSON: That was Jennifer. Okay.
15 Anybody else --

16 MR. LEWELLEN: Mark Lewellen, John
17 Deere.

18 MR. GIBSON: Okay. Any other CSMAC
19 people on the phone? Okay. Good, so that's the
20 roll call.

21 We'd like to acknowledge our very
22 special guest, Julie Knapp, the head of the OET.

1 Julie, welcome, thanks for being here.

2 Any other special guests? That's it?

3 MS. ATKINS: That's it.

4 MR. GIBSON: I think so, okay. If
5 you're special and you're here and you want to be
6 a guest, just let us know.

7 (Laughter)

8 MS. ATKINS: If you are here you're
9 special.

10 MR. GIBSON: If you're here you're
11 special, yes. Special people. Okay, now we're
12 ready for the spectrum update. Paige.

13 MS. ATKINS: Good morning. I'd like
14 to echo Glenn and Mark's welcome today. This is
15 the third CSMAC meeting of the year as well as
16 the current term, and we're lucky to have this
17 alongside with the ISART conference. So I hope
18 that everybody can participate.

19 And I asked this last year, does
20 anybody actually know what ISART stands for? And
21 ITS can't answer. Okay. International Symposium
22 on Advanced Radio Technologies.

1 Last year it was the students that I
2 think answered. It was Dale's students.

3 So the ISART topic is very relevant.
4 We've mentioned millimeter wave, but it really is
5 a conference about information exchange,
6 brainstorming, collaboration.

7 And that's really appurtenant to what
8 we are discussing today. It's not just a topic,
9 but then that deliberation, collaboration that
10 gains us the biggest bang.

11 So I appreciate everybody being here
12 and I hope many of you can stay for the actual
13 conference, it will be an excited one. Lots of
14 good panels and keynote speakers. Including one
15 that's in the audience.

16 So I recognize that the current CSMAC
17 schedule has been aggressive for the meaty topics
18 that we've teed up for your deliberation. And I
19 expect today we'll have a pretty robust
20 discussion around some of the preliminary results
21 and findings to date.

22 And it's really important that we have

1 that robust discussion as we move toward,
2 hopefully final recommendations toward the end of
3 the year. So I encourage you to vet and discuss
4 during that, this morning.

5 And before we dive into the primary
6 focus for today, which is the Subcommittee
7 updates and discussion, we're going to have a
8 slightly expanded spectrum update. Not only my
9 normal spectrum update, but we will ask Julie to
10 provide an update on the FCCs Technological
11 Advisory Council, if I got that right, the TAC
12 activities, as well as ITS.

13 Mr. Mike Cotton will give us an update
14 on some of the ITS relevant activities to the
15 topics that we're deliberating here.

16 So on to our update. So we
17 collectively continue to make steady progress
18 across all fronts, from AWS-3 transitions to
19 making 3.5 gigahertz in frontiers bands a
20 reality, as well as looking at new options. And
21 I'll mention the mid-band in a while, a little
22 bit later.

1 And by the way, when I give you my
2 update, I want to emphasize, this is a collective
3 update. It's not just an NTIA update. And all
4 of the hard questions go to Julie.

5 (Off microphone comment)

6 MS. ATKINS: I just want to keep the
7 momentum going.

8 So NTIA recently published their 10th
9 Annual Report to Congress, as required by the
10 Commercial Spectrum Enhancement Act or CSEA,
11 describing the progress of the federal agencies
12 and transitioning out of, not just AWS-3 band,
13 but also the AWS-1 band, which we're still
14 reporting.

15 We also recently published, or posted
16 on our website, an AWS-3 transition status report
17 providing the completion status for the federal
18 AWS-3 assignments transitioning relative to their
19 original schedule in the transition plans.

20 And the intent here is to create
21 better transparency into our progress, to
22 relocate systems or to share bands. So I would

1 encourage you, if you haven't see those reports,
2 take a look at them. But it's a good source of
3 information on the progress, for our
4 transitioning activities.

5 A lot of work on 3.5 continues. The
6 3.5 gigahertz band. And it's really been a great
7 collaborative effort with government and industry
8 stakeholders making steady progress on
9 implementing this innovative sharing and
10 licensing approach embodied in the citizens
11 broadband radio service.

12 And equipment providers are pioneering
13 hardware for the band. And we continue to hear
14 plans from service providers and carriers, big
15 and small, for a host of applications. So it's
16 really an exciting area.

17 And NTIA working in collaboration with
18 the Commission, the DoD and the wireless
19 industry, particularly the Wireless Innovation
20 Forum, or WinnForum, are finalizing a
21 certification system and process to test
22 compliance of both the spectrum access systems,

1 the SAS, as well as the environmental sensing
2 capability, the ECS.

3 And we are working with the ESC
4 applicants to define Dynamic Coastal Protection
5 Areas, DPAs. And that's to replace the static
6 exclusion zones as we have traditionally defined.

7 And these DPAs will only be activated
8 when the sensing capability senses that there is
9 a Military radar in the area, and it's detected.
10 So it's a different way of approaching the
11 problem and hopefully moving us closer to dynamic
12 sharing in the future.

13 So the majority of the effort over the
14 last few months has been focused on completing
15 the WinnForum standards that will be used as the
16 bases for the SAS and ESC, FCC certification.

17 And the initial SAS certification is
18 expected by the end of this calendar year, and
19 the initial ESC certifications are expected the
20 first quarter of 2018, on the current schedule.

21 Meanwhile it's been a little over a
22 year since the FCC released a Spectrum Frontiers

1 Report and Order and Further Notice. The use of
2 these millimeter wave bands for 5G sparked a
3 great deal of interests, as all of you are aware.

4 And this ISART conference is very well
5 timed to continue that dialogue in this, I'll
6 call it "new spectrum." Which just a few years
7 ago was thought infeasible relief for some of
8 these emerging mobile applications.

9 And as you know, the interests in
10 millimeter wave bands, for 5G, doesn't stop at
11 the border. Delegates to the International
12 Telecommunications Union, or ITU technical
13 meetings, also are examining the compatibility of
14 terrestrial broadband services with incumbent
15 services. Both in the frontiers bands as well as
16 other bands above 24 gigahertz.

17 We just had a successful CTEL meeting.
18 And for those of you unfamiliar with CTEL, it is
19 Region 2 in ITU speak. And think of it as the
20 Americans.

21 And Region 2 is pushing forward with
22 the sharing and compatibility studies needed to

1 accommodate wireless broadband technology, in the
2 millimeter wave bands. And again, ITU speak for
3 the conference, it's Agenda Item 1.13, if
4 somebody mentions that.

5 And as you know, NTIA is intimately
6 involved in developing the federal and U.S.
7 positions for these meetings in close
8 collaboration, again, with the Commission,
9 Department of State, the Agencies and Industry.

10 And we look forward to working with many of you,
11 to prepare for the next role of radio
12 communications conference. Which is now just
13 over two years away.

14 And now our national proprieties for
15 the conference continue to evolve. Agenda Item
16 1.13, this item in particular, which covers
17 broadband and bands above 24 gigahertz, remains a
18 top priority for the U.S. And that's not going
19 to change.

20 So both domestically and
21 internationally there remains much work to do in
22 pioneering sharing in millimeter wave bands. For

1 example, NTIA is working with the Commission, and
2 soon with the agencies, to explore workable
3 sharing approaches in the 37 to 37.6 band.

4 And we will also be working with the
5 Commission and others to evaluate the additional
6 bands and the further notice. And they actually
7 raise some interesting challenges from a
8 coexistence or a sharing perspective.

9 And I think that really highlights the
10 need for a strong technical foundation to feed
11 the policy decisions that we make, in this band,
12 as well as others.

13 And we will continue to work with the
14 Commission to make sure rules are in place for
15 the spectrum to be available. Especially for
16 those bands that will be shared with federal
17 users.

18 And though there has been a great deal
19 of focus on millimeter wave, the Federal
20 Communications Commission recently launched a new
21 inquiry seeking comments on ways to expand
22 opportunities for next generation services, in

1 mid-band spectrum between 3.7 and 24 gigahertz.

2 And this new notice of inquiry seeks
3 comment on three specific non-federal bands and
4 asked commenters to identify other mid-band
5 frequencies that may be suitable for expanded
6 flexible use.

7 In parallel, NTIA continues to
8 leverage our own interagency processes. The
9 Policy and Plan Steering Group, the PPSG, as well
10 as the Interdepartment Radio Advisory Committee,
11 the IRAC, to assess other opportunities for
12 increased commercial access in bands used by the
13 federal agencies. And that's especially if we're
14 looking at sharing scenarios.

15 As we collectively continue to build
16 the pipeline of spectrum to meet increasing
17 commercial, as well Government requirements,
18 spectrum efficiency and sharing will continue to
19 be key elements to our success. Reinforcing the
20 continued important and urgency of the work that
21 this Committee is doing for NTIA. So we are very
22 appreciative.

1 We also continue to work with the
2 federal agencies to explore the strengths and
3 weaknesses of various incentive mechanisms
4 intended to result in efficient and effective
5 federal government use.

6 We have engaged ITS to conduct initial
7 research on how to technically define spectrum
8 efficiency in the federal agency contacts. And
9 for those of you that have been involved in this
10 discussion over the last 15 or 20 years, will
11 know that's not an easy problem to tackle.

12 We are also assessing how the agencies
13 make decisions regarding spectrum use from the
14 very earliest stages of defining mission and
15 system requirements through operational
16 deployment.

17 And these results will help us
18 identify the gaps in our knowledge, processes and
19 tools, so we can start closing that gap, or those
20 gaps, and provide the necessary tools that help
21 the agencies make better spectrum efficient
22 decisions.

1 And we also are very much looking
2 forward to the CSMAC recommendations coming out
3 of your effort. Looking at perhaps other policy
4 recommendations that we should consider, to
5 promote efficiency over time, and move the ball
6 forward.

7 As I've mentioned before, we strongly
8 believe one of the most effective incentives are
9 ones that give the agencies the necessary
10 research to look at alternatives. In terms of
11 other ways, other spectrum or other technics, as
12 well as upgrading to more efficient spectrum
13 technologies.

14 The Spectrum Pipeline Act of 2015,
15 which we've talked about in prior meetings,
16 broaden the scope of eligible expenses covered
17 under the Spectrum Relocation Fund, or the SRF.
18 And we continue to see agencies seeking pipeline
19 funds to create opportunities for increase
20 spectrum access for commercial users.

21 And for example, and we talked about
22 this at the last meeting, FAA, DoD, DHS and NOAA,

1 are jointly assessing the opportunity, or
2 possibility, of consolidating and relocating long
3 range, short range and weather radar systems, to
4 potentially free up a portion of 1,300 to 1,350
5 megahertz, for commercial access. And it's
6 called the Spectrum Efficient National
7 Surveillance Radar, or SENSUR.

8 That program is the first pipeline
9 plan approved by the technical panel notified to
10 Congress. And that occurred in the January time
11 frame. And the program is well underway.

12 The SENSUR joint program office is
13 currently reviewing responses to requests for
14 information. And they plan to wrap-up their
15 assessment on the RFI responses by the end of
16 this month. And at that time, they will be able
17 to better understand the technical risk of the
18 program and whether any adjustments to their
19 program are necessary.

20 But again, that's well underway. So
21 that's the first program that was born out of the
22 Pipeline Act.

1 Also since our last meeting, a second
2 pipeline plan has been approved and notified to
3 Congress. And that will study the potential for
4 sharing in the 1,675 to 1,680 megahertz band
5 currently used by the National Oceanic and
6 Atmospheric Administration, NOAA, for
7 meteorological satellite and radiosonde
8 operations. Radiosondes being the weather
9 balloons.

10 And they anticipate the transmittal of
11 additional agency pipeline plans, transmittal
12 through the technical panel, and OMB to Congress
13 over the next few months.

14 As we continue to make progress,
15 Congress has also been working on several related
16 bills. As you're aware, such as MOBILE NOW and
17 the recently introduced Airways Act.

18 That if an Act it could influence our
19 efforts fairly significantly. However, we're
20 confident that our activities will yield good
21 results, our current activities, and build a
22 solid pipeline of spectrum over time.

1 So before I wrap-up I want to mention
2 a couple of other items. Following up on a
3 recommendation from the previous CSMAC cycle we
4 are continuing to plan a workshop, ideally by the
5 end of this calendar year, that will look at
6 bidirectional sharing.

7 And that means different things to
8 different people, but particularly we're
9 interested in the potential for federal users to
10 access non-federal spectrum. And this, again,
11 was a topic for discussion during the last CSMAC
12 cycle.

13 And our goal is to have a substantive
14 discussion with industry around specific use
15 cases of interests to federal users. That's been
16 the challenge.

17 How would the federal users anticipate
18 using non-federal spectrum, what are these cases,
19 to help us figure out the viability and the
20 methods by which you would do that. So standby
21 for more information, and again, hopefully we'll
22 have that by the end of this calendar year.

1 In collaboration with the Commission,
2 we are planning a series of workshops that will
3 focus on spectrum enforcement. And by that, I
4 mean not necessarily the traditional definition
5 of enforcement, but the whole scope of
6 prevention, detection and resolution.

7 And as we move to more intensive use
8 of spectrum and more spectrum sharing between
9 federal and non-federal users, all parties really
10 need to have confidence in the enforcement regime
11 that reduces the risk of interference to
12 acceptable levels.

13 Our initial workshop is going to be
14 for the federal agencies, only, to share best
15 practices, exchange information, understand
16 current concerns. But we look forward to
17 extending this outreach to industry, in
18 particular, in the near future.

19 And again, our initial workshop will
20 be sometime within the, hopefully within the last
21 quarter of this calendar year. Again, for the
22 federal agencies. So, two areas that we're

1 following up with, largely based on the CSMAC
2 recommendations.

3 So before I turn the microphone over
4 to Julie, let me congratulate the Subcommittees.
5 There's been a great deal of engagement within
6 the Subcommittees.

7 And again, these are meaty issues and
8 I know we've been on a compressed schedule, so I
9 really appreciate everyone's contributions and
10 work, I know it's not easy. And can't emphasize
11 enough, we appreciate that you all are
12 volunteering your time to do this, to help us.

13 And it is important for us to get your
14 feedback and your recommendations so we can make
15 better policy decisions over time. And it really
16 does result in a world leading spectrum policy,
17 in promoting the U.S. economic and technological
18 leadership while ensuring the U.S. Government can
19 also fulfill its missions for our citizens.

20 So I encourage all of us to take
21 advantage of this meeting and the clean mountain
22 air, to engage deliberate and collaborate and

1 hash out as much as we can. Again, as we look at
2 moving toward the end of the year for final
3 recommendations.

4 I know in some cases that may be
5 challenging, so think about final recommendations
6 as well as potentially topics to tee up for the
7 next year following. And with that I'm happy to
8 take questions or we can turn it over to Julie
9 and do questions toward the end, after both the
10 TAC update and the ITS update.

11 MR. GIBSON: No questions for, Paige?
12 Really?

13 MS. ATKINS: They're saving them.

14 MR. GIBSON: I have a comment. I'd
15 just like to comment on the work that's being
16 done for 3.5 gig CBRS, SAS and ESC certification.
17 Just to say that, I won't speak for industry but
18 I reckon industry shares the sentiment that the
19 collaboration has been amazing.

20 There are a lot of surprises, and I
21 think we expected them. But I think just the
22 level of commitment, across the government, DoD,

1 Navy, NTIA, ITS, has just been really awesome.
2 So thank you. And let's hope it sets up the
3 framework for moving in shared band situations.
4 Janice.

5 MS. OBUCHOWSKI: This was a, kind of
6 a shout out to NTIA. We finally caught up with
7 the research that NTIA was doing back in 1989,
8 '90, when I was assistant secretary and I came
9 out to ITS, and they were doing millimeter wave
10 research. Basic first and only in the world at
11 that point.

12 I thought I might have to investigate
13 because I kept keeping these travel vouchers for
14 trips to Hawaii. I said, what's this dude from
15 ITS doing in Hawaii. And it said, ideal
16 circumstance for studying rain attenuation.

17 So, glad, you have to be grateful that
18 I bought off on those vouchers. But no --

19 (Laughter)

20 MS. OBUCHOWSKI: -- he did do the
21 breakthrough research. And when I hear about the
22 breakthroughs that are currently, finally coming

1 to market, I do want to extent that complement.

2 MR. GIBSON: Cool.

3 MS. OBUCHOWSKI: I don't know that
4 it's really appreciated sufficiently. Thank you.

5 MR. GIBSON: No other questions?
6 Okay, Julie needs to be at a mic. Take Dennis'
7 mic, that's always good.

8 MR. WELLER: Mark was going to order
9 that anyway.

10 MR. GIBSON: Nobody heard that.

11 MR. KNAPP: So I'm not going to be on
12 camera? That's a good thing.

13 (Laughter)

14 (Off record comments)

15 MR. GIBSON: Is that on? Is his mic
16 on?

17 MR. KNAPP: I think so.

18 MR. GIBSON: Okay.

19 MR. KNAPP: Yes. So thanks. And we
20 may be sitting at opposite ends here but
21 actually, on all these issues that Paige
22 discussed, we sit side-by-side in working through

1 some very tough problems to come up with good
2 solutions, I think, for the country.

3 So, there were a couple of things I
4 did want to add. So dido to everything that
5 Paige said.

6 It perhaps has been a no busier time
7 on spectrum. I started to think about all the
8 different things that we're doing. If I went
9 into all of them, we'd be here a long time.

10 I'm just going to touch on a few
11 others. So Paige mentioned the NOI on the mid-
12 band spectrum. And also, the next day the
13 commission issued an NOI on 900 megahertz, and
14 how we can make more efficient use of that band
15 as well.

16 So, the work is continuing on the
17 spectrums frontiers proceeding. And both the
18 bands where we had petitions for reconsideration
19 and the bands that we had in the further notice.

20 And there's been interest above 95
21 megahertz, and we're trying to do some work to
22 flesh out exactly what kinds of rules we might

1 propose there.

2 The incentive auction team, is led by
3 Jean Kiddo, they're hard at work implementing the
4 TV incentive auction yielded at 84 megahertz of
5 spectrum for wireless broadband services. And at
6 the same time, we've got a proceeding, as Bob
7 well knows, to consider providing for ATSC 3.0 on
8 a voluntary basis. So there's a lot of work
9 going on there.

10 We've completed the Phase 1 testing on
11 license sharing on 5.9 gigahertz with the DSRC.
12 We're busy analyzing the results and preparing a
13 report.

14 We also have a proceeding that was
15 considering additional allocations and licensing
16 provisions for NGSO satellites, so we're doing
17 work on that as well.

18 There is quite a few others, I'm sure
19 I'll leave out your favorite one. TV white space
20 reconsiderations and the reserve channel
21 proceeding, the Ligado proceeding of course, the
22 4.9 proceeding, the higher ground

1 reconsideration, et cetera. So, lots of things
2 going on, on the spectrum front.

3 So let me just say a few words about
4 the TAC. So, to start with, I want to recognize
5 Dennis Roberson's leadership with the TAC. We
6 wouldn't be where we are without all of his fine
7 work.

8 Dale also participates on the TAC.
9 We've had liaisons between the TAC and the CSMAC,
10 so that the work is complementary.

11 The TAC, it's a little bit larger than
12 this group I think. We've got 45 active TAC
13 members and there's about 120 additional work
14 group members that span roughly 70 entities.
15 Many of your organizations have other
16 representatives who have either been members of
17 the TAC or have been working with the TAC.

18 And the thing that we always charge
19 the TAC with is coming up with actionable
20 recommendations. We may not be able to do
21 everything that the TAC recommends, but it really
22 has played a key role in so many of the things

1 that we're doing.

2 Everything from the work on spectrum
3 frontiers really had its root on our side in the
4 TAC. The work on 3.5 was sparked there and so
5 forth. So, a lot of terrific ideas have come out
6 of there and we actually implemented them.

7 So I'm not going to go into all of the
8 work that the TAC has done, I'm just going to
9 highlight a few things that I think may be
10 relevant here.

11 One group that we called, this is from
12 last year, future game changing technology, had
13 recommended that the FCC should institutionalize
14 a process for anticipating keeping up with major
15 shifts in technology, usage in patterns. I am
16 not going to tell you the response because we
17 have a meeting coming up on September 19th, and
18 so this is just a teaser for the things that
19 you'll probably be hearing about.

20 It also called for balance spectrum
21 allocations that we should work closely with the
22 administration, NTIA and Congress, to ensure a

1 flow of spectrum that's balanced across high,
2 middle and low spectrum bands for commercial use
3 and promote flexible use policies that support
4 experimentation.

5 Many of you may know that just earlier
6 in the year we made available program licenses
7 with much greater flexible now in conducting
8 experiments.

9 Out of the spectrum and receiver
10 performance group, one of their recommendations
11 was that the FCC direct our lab to measure
12 advance lighting and switching power supplies on
13 the market to ascertain if they met regulatory
14 noise limits and initiate enforcement if not, and
15 to also issue a notice of inquiry/notice of
16 proposed rulemaking to gain more information
17 about the advisability of rule changes to deal
18 with advance lighting and switching power
19 supplies and to reduce noise in the spectrum.

20 The emitters are both government and
21 non-government and so we're all in this together.
22 So the question is, by most accounts the nice

1 floor is rising and when I've talked to the group
2 I've said, well, don't just tell me the noise
3 floor is rising, what do you think are the
4 leading contributors and what should be done
5 about it.

6 There's a lot of work that went on in
7 that group as well in developing a policy
8 statement on spectrum. And it recommended that
9 the FCC consider it, and I'm just going to go
10 through, quickly, some of the points in there.

11 Formalizing and implementing the TACs
12 receiver recommendations and spectrum allocation
13 principle and policies to adopt risked informed
14 interference assessment and statistical service
15 rules. So many of our standards right now are
16 based on worst case as opposed to truly
17 evaluating, well, how big is the risk and what
18 would happen if there were an adverse
19 consequence.

20 To implement the steps outlined by the
21 TAC for improving enforcement. I know that
22 there's been work going on here as well, and as

1 Paige mentioned, trying to work jointly on that.
2 Particularly as we do things, like at 3.5, where
3 we've got sharing across systems.

4 And that's to include a next
5 generation enforcement architecture to create a
6 public database of past enforcement activities
7 and incorporate interference hunters. They
8 haven't made the TV show about them yet, but --

9 (Laughter)

10 MR. KNAPP: -- we all think it's
11 pretty exciting.

12 In some of the topics that we're
13 working on right now we've continued to do a lot
14 of work on mobile device theft prevention. And
15 we've got a group that's working on identifying
16 technical rules that perhaps should be eliminated
17 or no longer necessary and outdated. So they've
18 got some ideas of what to do there.

19 We've also got a group working on
20 broadband deployment technology challenges, more
21 from the technical side than the policy and
22 infrastructure deployment side.

1 Another group working on the
2 implications of next generation TV broadcasting
3 satellite, not satellite, TV broadcasting
4 technology, and we've also got a, that's
5 continued to work on satellite systems and so
6 forth.

7 So, I will stop there and any hard
8 questions I'm going to turn back over to Paige.

9 (Laughter)

10 MR. GIBSON: Okay. Any questions for
11 Julie? Bob.

12 MR. WELLER: Julie, can you elaborate
13 a little bit on the status of the laboratory
14 testing of advance lighting systems and a list of
15 whys that you actually got devices, are they
16 being tested?

17 MR. KNAPP: So, it's like wine. No
18 wine before it's time.

19 (Laughter)

20 MR. KNAPP: There's work going on.
21 Stay tuned, we'll have more to say as the sun
22 falls.

1 MR. WELLER: Okay.

2 MR. GIBSON: Any other questions for
3 Julie? Boy, this thin mountain air has really
4 made you all mellow. Cool. Okay, cool.

5 I think Paige said, let's be
6 liberated, was that the word?

7 (Laughter)

8 MR. GIBSON: So here comes Mike Cotton
9 speaking for Keith Gremban.

10 (Laughter)

11 MR. COTTON: Hi everybody. I just
12 wanted to say thanks for the opportunity to speak
13 with CSMAC.

14 I wanted to note that I was the last,
15 I made the last trip to Hawaii in the rain
16 attenuation measurements, so it was really fun to
17 hear about that research into that.

18 So the need for additional spectrum to
19 support consumer applications is growing. And
20 last year ITS presented at CSMAC and the research
21 projects that we work on towards spectrum
22 sharing.

1 The research topics were in three
2 major areas. One is in spectrum monitoring, one
3 is in radio wave propagation modeling and
4 measurement and one is in electromagnetic
5 compatibility studies.

6 So, I'm here to basically provide a
7 delta on that and talk a little bit about what
8 we've accomplished in the last year.

9 So, for spectrum monitoring. Our
10 spectrum monitoring project continues to develop
11 tools and best practices and technologies to
12 enable wide area continuous monitoring of
13 spectrum use.

14 Our goal is to demonstrate cost
15 effective sensing and sensors, software to
16 integrate across multiple sensors, and also user
17 interface technologies for exploring the data
18 that's acquired.

19 Last year at ISART we spoke about
20 spectrum forensics and I stood up and said, in
21 collaboration with Ms. Gaithersburg, we are
22 releasing a capability, a monitoring capability

1 called MSOD. Which stood for Measured Spectrum
2 Occupancy Database.

3 Only two months after that public
4 release we determined that really the approach
5 taken there and the assumptions in the
6 development of that was, it made it too big to
7 scale. Basically, the application was too big,
8 too integrated, crossed over too many
9 disciplines.

10 For any organization to really host
11 it, they would require an ITT team, an RF
12 engineering team, a software architect team and
13 so forth.

14 So, we went back to the design board
15 this year and we've broken it up. We've re-
16 architected it. And the focus of this year's
17 work, in spectrum monitoring, has been at the
18 sensor manager/sensor network level.

19 And what we're trying to do there is
20 basically, you know, not provide a full solution,
21 but provide sensing as a service. So that RF
22 engineers can develop and install this type of

1 network, and basically make a profit off of the
2 data.

3 And then, on the data client side, the
4 data clients would come to this sensor manager
5 and basically say, okay, go to the website, what
6 is your sensor network capabilities, get those
7 capabilities, how are the sensors that out there
8 deployed scheduled for measurements, what kind of
9 data, and hey, I'd like to have some of that.

10 And basically that enables a data
11 distribution model where data clients can work on
12 the data visualization and the data mining part
13 of that.

14 So, on the sensor development side of
15 that, we have deployed a number of sensors along
16 the coast to measure the 3.5 gigahertz space.
17 We're going to start reporting to OSM on a
18 monthly basis on those to kind of get our
19 connection with OSM going with monitoring.

20 I should also say we've prototyped a
21 cheap sensor that costs about \$5,000. We're
22 building about 20 of those guys. And we're going

1 to be deploying that in and around Boulder this
2 year.

3 So the goal for the Boulder deployment
4 is to prototype an automated spectrum enforcement
5 system in Boulder. And so I'm very excited to
6 hear about the initiative here at CSMAC. I
7 really hope to participate in the workshop and
8 basically share in the discussion.

9 But our approach is to start with a
10 baseline understanding of the RF environment in
11 Boulder and then understand where there are
12 changes from that baseline. Manmade noise
13 certainly is something that's changing.

14 So we can identify the trends and
15 changes like that, and also changes from the
16 baseline and have that trigger work flows. And
17 that's kind of what we're doing towards automated
18 enforcement.

19 We're hoping that this is really the
20 foundation, or a foundation, for testing
21 experimental licenses and testing out new
22 technologies in a real-world environment. So

1 we're hoping to have that baseline understanding
2 environment for that.

3 Okay, so propagation measurement and
4 modeling. We've been working in the space for a
5 long time, and we continue to advance state of
6 the art through a number of internally and
7 externally funded projects.

8 DSO and OSM has us focusing on
9 characterizing propagation and cluttered
10 environments. Environments where radio wave
11 propagations are moving through manmade
12 structures and foliage and so forth.

13 So we've been going into a number of
14 different environments, Arizona, L.A., Los
15 Angeles, Denver and we're moving to North
16 Carolina next month I think. Some of those
17 measurements have been published in IEEE Military
18 communications conference, last week, at the IEEE
19 EMC conference.

20 In addition, the measurements. We're
21 really attacking these things from first
22 principles too.

1 ITM was released in 1965, IF-77 was in
2 the '70's. Those code bases are old. And the
3 authors are not on staff. So we --

4 (Laughter)

5 MR. GIBSON: That's a good way to put
6 it.

7 MR. COTTON: -- we have maintained the
8 expertise. But we're doing on an approach for
9 modernizing these tools, is we have formed an ITS
10 propagation focus group. And our focus there is
11 to develop these models from first principles.

12 This year our focus is on air to
13 ground propagation, where we're focusing on the
14 IF-77 model, which needs to be re-architected.
15 DSO is interested in that as well as OSM.

16 So literally, 40 lectures to get from
17 Maxwell's equations to all of the work, all of
18 the models that go into the algorithm that is IF-
19 77.

20 I suspect there is a lot of work to
21 publish this, still to be done. The material has
22 grown. And next year I suspect we will produce

1 an algorithm paper on IF-77, similar to the
2 algorithm paper that is associated with ITM.

3 We are also not just driving our
4 measurement bands into these most complicative
5 environments, we're also doing simple propagation
6 measurements out at Table Mountain where we're
7 measuring canonical geometries, knife, single
8 knife edge diffractions, measurements through
9 single walls, a wall with a window.

10 We're trying to kind of validate those
11 core pieces of our propagation models. See if we
12 can do things numerically to generalize those
13 things and make our models more general.

14 And then finally, on propagation, I
15 wanted to say that we are working to improve the
16 usability of those tools via software best
17 practices. So this year we published an official
18 version of the (indiscernible) model, which
19 WinnForum has been using for 3.5 gigahertz SAS
20 developments.

21 We are establishing a modern software
22 infrastructure and framework for the development

1 and testing of our propagation models. And we're
2 involving OSM with that.

3 So it's not just our experts throwing
4 together engineering code and getting that done,
5 we now are establishing a muscular storage behind
6 this so that we're data driving in our
7 predictions. We have an API on top of the data
8 to gear the interface with it, so we can query
9 that data in a uniformed way.

10 And we have a QA environment which
11 we're going to have both ITS testers, OSM testers
12 on, before it gets to public release. We're
13 hoping that that will actually grow to the ITU
14 community, and even broader.

15 Because, similar to the way GNU Radio
16 is to software defined radio and all that, where
17 we really feel like ITS is in a position to
18 establish a community around propagation modeling
19 and measurements. And so we're trying to do that
20 with software best practices.

21 Electromagnetic compatibility, this is
22 a difficult problem that we continue to work on.

1 You know, there's a, it's a matrix problem with
2 all kinds of parameter, input parameters to these
3 problems.

4 Also, there is the Black Box problem
5 where we don't really know what's going on
6 inside, the device is under test.

7 Over the last few years we've
8 developed, we focused more on simulation
9 capabilities rather than testing the boxes and
10 that's beginning to bear fruit. We have been
11 focusing on characterizing the IPC of radar
12 systems, specifically for SPN-43 (phonetic),
13 which is for 3.5 gigahertz incumbent.

14 And then also we're looking into solid
15 state radars and interference in and out of LTE
16 systems. Which are kind of the most important
17 systems these, I shouldn't say that, which are
18 important systems these days to consider.

19 The other thing that I just wanted to
20 mention on the EMC side is the aggregate problem.
21 We've started working the aggregate problem in
22 2016 in the AWS-3 scenario where we were modeling

1 the Monte Carlo simulations, emissions, aggregate
2 emissions from smart phones. And an uplink
3 scenario with where the incumbent is the NOAA
4 MET-SET Station.

5 So we've moved that this year, and
6 advanced that in a number of ways. We have
7 advanced the layout of transmitters such that
8 assumptions like uniform spacial distribution is
9 not the assumption put down there. We found out,
10 via measurement, that that's not a good
11 assumption to make.

12 We are looking at TDD systems, which
13 is relevant to 3.5, where up and down link both
14 operate in the same band. We are also executing
15 on evaluating heterogeneous transmitters which,
16 again, is we're moving our aggregate modeling
17 towards 3.5 and we're trying to advance that to
18 make sure that we can be smart about
19 certification and so forth in that space.

20 And most importantly, in the aggregate
21 thing, we're working to validate. I mean, we've
22 been modeling and running these simulations to

1 try to make it go faster.

2 We haven't gotten to making some
3 measurements to make sure that it's right. And
4 so we are getting to work on that. And making
5 progress there.

6 And we're also working to do a
7 sensitivity analyses so that we're investigating,
8 what are the strongest contributors in the
9 aggregate emission modeling model and do we need
10 to do this extensive Monte Carlo simulation or
11 can we just cut to the chase and work towards
12 modeling those strongest contributors.

13 So just one more minute, I'm not sure
14 how much time I have.

15 MR. GIBSON: You're good.

16 MR. COTTON: So, in addition to the
17 work supporting spectrum sharing, we have a
18 number of other projects that are working to
19 advance radio science in developing tools that
20 will be needed in the future. We continue work
21 on quality of experience.

22 In the past, we have set the bar for

1 doing subjective evaluation of audio and video
2 when subjected to background noise and
3 interference.

4 We continue, I mentioned about the
5 software, I was talking to Dennis earlier about
6 this. Software is becoming an important part of
7 our output.

8 It's not just publications, we are
9 working to, we are using GitHub software
10 repositories as another publication mechanism for
11 us. So we have developed an ITS policy that
12 we're hoping to be an NTIA policy, in terms of
13 software release, so that spectrum monitoring can
14 make available sensor software that people can
15 pull from. These propagation models can be
16 available to the public.

17 IoT, we're working on getting a test
18 bed going in there to evaluate what it means when
19 these huge numbers of devices are on and we're
20 looking to model that and measure what type of
21 noise floor increase would happen there.

22 We are working for DoD, DOT, DHS,

1 Coast Guard, NOAA and even DARPA these days.

2 Kind of on a sharp end of things.

3 So, I just wanted to, again, I'll take
4 any questions, but, you know, one thing too I
5 wanted to say with Julie, is I've been in contact
6 with Bob Pavlak in talking about a lot of your
7 work on TAC. I think Bob and I are trying to
8 work out a deep dive you guys in late September,
9 because I think that a lot of the spectrum
10 monitoring infrastructure that we're building, I
11 think you guys, we should compare notes on a
12 little bit.

13 MR. KNAPP: He's coming.

14 MR. COTTON: Yes, I hope so.

15 MR. GIBSON: Glenn wanted to make a
16 comment.

17 MR. REYNOLDS: Sort of an advertising
18 message for a second. First of all, for those of
19 you who don't know Mike, Mike is the head of our
20 theory division in ITS. He's been in that role
21 for about two years and has been doing a great
22 job.

1 I think last year ITS, we had to go
2 back to Congress, for the first time ever, and
3 ask Congress to raise the ceiling on the amount
4 of reimbursable work that we can do, in which we
5 did, which is just showing the kind of aggressive
6 work that Mike and Keith and Rebecca and all the
7 ITS folks have been doing.

8 In particularly, in frankly what I
9 guess would understatedly say an extremely
10 challenging budget environment. I think if any
11 of you all have any interest in the capabilities
12 of ITS, what we can, what type of work we can do,
13 a lot of our work on the creative basis, Mike is
14 a great guy to talk to. Keith will be around
15 this afternoon, Rebecca is here, other folks are
16 here.

17 But I also sort of, I think we would
18 like to hear from you all, just informally, just
19 as part of conversations, what type of work is
20 the most important for the industry going
21 forward, what should we be focusing, what I can
22 say are very limited resources right now,

1 particularly in our budgetary, our budget funding
2 as opposed to our reimbursable funding.

3 Because as we are evaluating our
4 options right now, we're actually going to have
5 to make some difficult decisions on where to
6 focus our efforts. And so understanding from you
7 all, what is the most important types of work
8 that we can be focusing our resources in over the
9 next couple years would be extremely helpful.

10 MR. GIBSON: All right, thanks Glenn.
11 A couple questions. Rick.

12 MR. REASER: Rick Reaser from
13 Raytheon. I want to think, you talked a lot
14 about sort of looking at interference for IPCs
15 and stuff like that, have you guys kind of come
16 up with some ideas about what is interference and
17 what categorizes it?

18 Like, what is the definition of
19 interference to these things and when do you, how
20 do you determine whether that's interference or
21 it's a nuisance or whatever?

22 I think that, all these things are

1 really, really important that you're doing, but
2 the fundamental issues, and it goes back, we
3 probably don't want to define what harmful
4 interference, so I'm not going to go down that
5 path, but at some point you have kind of a
6 metric, okay, this is kind of a reasonable man
7 about, okay, if this is happening, yes, you're
8 being interfered with, now we need to decide what
9 we want to do about it. Or if anything.

10 So that's the other thing. And by the
11 way, each radio service kind of has its own kind
12 of sets of things that you worry about that are
13 different between a radar and a broadcasting
14 versus other kind of things.

15 You know, I have speckles on my TV and
16 I realize it's not wireless, it's probably
17 wireless up to some point it is, but out of all
18 the ones that go off my modem and through my
19 other parts of my house too. But, you know, I'm
20 not necessarily bothered if I miss a few pixels
21 or use a few words. Have you thought about that?
22 What's the definition there?

1 MR. COTTON: Yes, I think that, you
2 know, the one thing about IPC simulation is that
3 you're in kind of the error rate space, right?
4 And there's really, and that's good to quantify
5 that, you can do things because it's a big matrix
6 problem that you can get to that way.

7 But yes, if you don't get the human
8 element into the measure, then it's really
9 difficult to get to that final assessment.

10 And what happens in there, for us, is
11 when it becomes a priority to test that, this
12 service or that service or the other, then we
13 will bring it to the lab. We'll put a, whatever
14 the human interface is for that system and we'll
15 look at it.

16 We have, there's the QoE, Quality of
17 Experience Group that we have that will help us
18 assess what type of quality that is in a
19 subjective way. And we can even do it
20 objectively by bringing in testers as well.

21 So, it's a big question, but you're
22 right, I think that that's the bottom line. If

1 you don't get to that bottom line answer, then
2 you can always just argue about those error rates
3 and things like that forever.

4 MR. REASER: And a follow-up to that.
5 Rick Reaser.

6 MR. GIBSON: Rick, make it brief if
7 you would because we got three people on the
8 line, so thanks.

9 MR. REASER: Okay. The other thing is
10 --

11 MR. GIBSON: Four.

12 MR. REASER: -- have you started
13 looking at statistical ways of looking at that as
14 well?

15 I've been involved in some of these
16 things where it happens once in a billion years
17 and if it happens once in a billion years it's
18 harmful interference, which is kind of
19 ridiculous. And sometimes the scenarios of these
20 core cases just rarely happen.

21 I'm talking about the L band or GPS
22 thing I was involved with for like literally 20

1 years. But some of these have, so statistical,
2 are you looking at statistical things in terms
3 of, terms with this interference?

4 MR. COTTON: Yes. I mean, we don't
5 usually go -- there is an economics sort of
6 element to this whole thing. There's also,
7 systems these days are more adaptable.

8 LTE networks, if they have
9 interference in a space they can adapt and go at
10 it in a different way and things like that.

11 So yes, I mean, we recognize that
12 there are these statistical means. There is risk
13 assessments that should be done in a
14 probabilistic way.

15 I think that that's something that
16 kind of needs to be addressed as a community in
17 engaging with us to some degree.

18 MS. ATKINS: Just to add, so as we
19 have progressed with 3.5 and other scenarios, we
20 have moved toward a statistical approach in terms
21 of looking at potential for interference, the
22 protection zones, et cetera. So we are moving in

1 that direction, there is still a lot of work to
2 go.

3 MR. GIBSON: Okay, so we got Dennis,
4 Dale, Bob, Michael, you in or you're out Paul?
5 And then Paul. So, and we've got like ten
6 minutes, so I'd ask you just to implore to keep
7 it brief and succinct, I'd appreciate that, thank
8 you. Dennis.

9 MR. ROBERSON: I'm going to tie
10 several things together here. But this
11 interference one, just following up on Rick's
12 point, and really, it's Glenn's point of, what
13 can ITS do for you.

14 I think this really is an
15 extraordinarily important issue. We keep dancing
16 around it as a community, and we have danced
17 around it for years.

18 We've got Pierre de Vries with his
19 harmed claimed threshold and so on, but we never
20 quite nail this one down. And it is a logical
21 extension off the propagation work. Okay, so you
22 propagate, then what.

1 MR. COTTON: And propagation is
2 probabilistic too. I mean, it's --

3 MR. ROBERSON: Yes, indeed. Indeed.
4 But getting much further along that path would be
5 enormously helpful, because we get into all of
6 these issues, and with our sharing, these things
7 amplified tremendously.

8 The boundary issues, in the TAC we've
9 been at this for a decade, maybe more, two
10 decades. So, we really could use some
11 significant leadership, I think out of ITS, to
12 help us in that space.

13 It's just an enormous issue that
14 spends all kinds of time, spends all kinds of
15 time with the commission trying to sort these
16 things out and, well, enough, you said to keep it
17 short but it's a huge one for your consideration.

18 The other one that also ties into the
19 funding, there is this funding for ITS itself but
20 there is Naston (phonetic). And you are part of
21 Naston, but you're not, and could you, or maybe
22 Glenn, speak to how you are seeing Naston these

1 days with its testing because it's certainly come
2 along and has become a major thrust and done some
3 significant studies at this point, but how is
4 that going and how do you see the relationship
5 and how do we think about that in terms of your
6 funding, because Naston seems to have a model for
7 funding that's independent of the ITS model and
8 where do we go for this and where do we go for
9 that, is there some definition you can provide?

10 MR. REYNOLDS: I'll give a quick
11 answer and I will defer to Keith. Yes, the
12 Naston is something that we've been working as
13 part of.

14 There are, actually, there are costs
15 associated with actually participating in Naston.
16 And the types of work that Naston is going after
17 are not always the same types of work that we're
18 in a position to engage in, so we're trying to
19 figure out the, frankly, how Naston fits within
20 the ITS model. And we can have a further
21 discussion about that offline, but it's a
22 challenging situation.

1 Again, partly because of the budget
2 situation and the fact that we --

3 MR. ROBERSON: Yes, that's why I
4 addressed here because it fits right in what
5 you're talking about.

6 MR. REYNOLDS: Yes. So, with the
7 amount, you know, it takes resources, it takes
8 money to make money. It takes resources to
9 invest in order to be in a position to do a
10 certain amount of work.

11 And we're trying to figure out, again
12 Dennis, kind of going to the ultimate question
13 that we're literally working on, as we speak, is
14 where do we put those limited investment dollars,
15 both as far as budget money and in personnel, and
16 do we direct them in that direction or in other
17 directions. And that's something we're literally
18 in the process of trying to figure out how best
19 to utilize those resources.

20 MR. ROBERSON: Thanks.

21 MR. GIBSON: All right, thanks,
22 Dennis. Dale.

1 MR. HATFIELD: Oh, I was just going to
2 say that I really support --

3 MR. GIBSON: Can you pull the mic down
4 there? Thank you.

5 MR. HATFIELD: Yes, I'm Dale Hatfield.
6 I just want to say I support what Rick said and
7 add just a little bit.

8 And I'll read from something I wrote
9 here very recently. Like many localities in
10 Boulder, we have an automated speed limit
11 enforcement system, but how can you automatically
12 decide to issue someone a speeding ticket if you
13 don't establish the applicable speed limit
14 itself. So it's really, really is fundamental to
15 what we're doing.

16 And then associated with that, it
17 seems to me there's two sides to this. One is,
18 when you're looking at interference to a
19 government radar and we need to do something kind
20 of immediately and get it fixed.

21 And then there is the issue, I want to
22 go back and issue a notice of apparent liability,

1 where I want to see somebody's equipment, because
2 that gets you in to an enforcement area that's
3 sort of different than what you do right when
4 you're first sensing it. And I don't think those
5 distinctions maybe have been explored as much as
6 they could.

7 I could go on, but I, you know, this
8 is an area that I feel very, very strongly about
9 but I'll let it stand in to those two points.

10 MR. GIBSON: Thanks, Dale. Bob.

11 MR. WELLER: I probably don't need a
12 microphone. Michael, thank you for the excellent
13 presentation. I would echo the comments of
14 others concerning the importance of your work
15 relating to interference.

16 I'm kind of a propagation geek. And
17 the ESSA databanks that data were collected in
18 the 1960's and '70's, formed a databank that I
19 and many others have used for validation of
20 propagation models.

21 Is your current work something of
22 similar scale? You know, month long projects all

1 around the country.

2 The previous work was, as I understand
3 it, CW fixed frequency operation over a fairly
4 wide range, but are you now looking at wideband
5 propagation models with extended, the related
6 extended parameters?

7 We're talking about the spectrum
8 frontier, so measurements above 10 gigahertz, say
9 clutter. Can you expand just a little bit more
10 on what it is that you're doing?

11 MR. COTTON: Sure, I appreciate that.
12 So, let's see. So, right now we have been
13 marching up these propagation measurements. They
14 are primarily CW type measurements.

15 This year with OSM we've brought back
16 our pseudo-noise random code impulse response
17 measurement, which is a more wideband type of
18 measurement. And we're doing comparisons
19 alongside. So there's some subtleties in
20 comparing those two data sets and we're doing
21 that.

22 Yes, I mean, one thing where that's

1 been great, let's see, in terms of scope, I mean,
2 we don't, I talked about opening up the software
3 into a test environment. You know, we really
4 haven't made any of the data accessible, so we
5 are basically driving to, internally, to advance
6 the ITS models. So we haven't gone there yet.

7 Did I touch everything there?

8 MR. WELLER: That's helpful. I don't
9 want to take any more time, but I want to
10 emphasize there's interest and it's important and
11 thank you for doing it.

12 MR. COTTON: Okay.

13 MR. GIBSON: Okay, thanks. We have
14 four minutes and two people, so it's two
15 questions per. And I really want to make sure we
16 have plenty of time, the allotted amount of time
17 for the Subcommittee reports. So Michael and
18 then Paul.

19 MR. CALABRESE: Okay. Yes, it should
20 be two quick questions here.

21 MR. GIBSON: That's my job, keep us on
22 time.

1 MR. CALABRESE: Pardon?

2 MR. GIBSON: Nothing, keep going.

3 MR. CALABRESE: Your propagation
4 measurement in modeling, is it, it sounds like
5 that can be incredible valuable, but I'm
6 wondering, are you focusing in any particular
7 place? In other words, is this focused on
8 millimeter wave or are there particular bands
9 that you're focused on?

10 MR. COTTON: Yes.

11 MR. CALABRESE: Did you focus on, and
12 the other, as you mentioned, the aggregate
13 emissions problem. You're focusing on the 3.5
14 band, is that in relation more to fixed
15 satellites or the Navy?

16 MR. COTTON: Yes. So, yes, I missed
17 that. So we are focusing our clutter
18 measurements on shared bands, so 1.7 and 3.5 is
19 where we're measuring those.

20 Really, we have collaboration with the
21 University of Colorado where we have a link to
22 measure. It's way up at like 280 gigahertz.

1 Measure propagation up at those higher
2 frequencies, it's more driven for Military
3 applications at this point.

4 But there is this link that we're
5 looking to put more channels in that are more
6 related to the 5G type of scenarios. That has
7 not been installed yet but we're hoping to get
8 that off the ground this year.

9 Really, it's funny, because I was a
10 part of the millimeter wave lab. I started at
11 ITS as a student working underneath Hans Lebee
12 (phonetic). You know, it's amazing that this
13 space is coming back. I'm amazed at that.

14 But ITS retired that program, probably
15 in 1996. And so we have expertise in that space.
16 I was basically a physicist when I joined ITS and
17 we still have that here, but we're really excited
18 to bring back the measurement side of it. It's
19 going to take some investment and work.

20 MR. GIBSON: All right, Paul, you got
21 two minutes. And put your tents down if you're
22 not speaking.

1 MR. KOLODZY: Okay. Mike, as you're
2 looking at some of these interference analyses
3 and things, I think it's great. A couple
4 questions for you to think about.

5 One is, have you broken this up into
6 actually, what I look at as a three components of
7 interference in a sense of application impact of
8 interference versus the transport layer impact of
9 interference versus the PHY layer impact of
10 interference where we finally can tease apart
11 these things to basically look at technology,
12 neutral ways of reviewing this and trying to get
13 ahead of it so you're not continually revisiting
14 this like, oh, (indiscernible) is here now I got
15 to do this, oh, now a distributor of
16 (indiscernible) is here now I got to do that.

17 Have you started to break that down to
18 those pieces or are you still looking at it as a
19 grouping as to interference impact at some level?

20 MR. COTTON: We are starting to. We
21 really do, you know, we're the PHY layer lab. We
22 kind of look at energy detection. That's our

1 first thing, right, is to get into that.

2 We've also, just this last year, we've
3 expanded it, our staff, to a couple of PhDs and
4 comp theory and that focus on the different
5 layers of this, are helping us move towards
6 assessing these other layers.

7 MR. KOLODZY: Yes, I really recommend
8 you think about the, that's the space that's
9 moving so rapidly in what's going on in the
10 application space. And we tend to forget that.

11 We're all geeky scientists, we always
12 love to work on the stuff that we can do in
13 physics versus doing something that's a little
14 bit squishier, which is the application side.
15 But there's actually where the rubber hits the
16 road. You may really want to --

17 MR. COTTON: Yes, we got to our QoE
18 guys in with our comp theory guys.

19 MR. GIBSON: Okay, speaking of rubber
20 hitting the road, thanks, Mike.

21 (Laughter)

22 MR. COTTON: Thank you very much

1 everybody, I really appreciate it.

2 MR. GIBSON: And I would just note,
3 that's his addition as a game show host with his
4 microphone that way, so he looks like Gene
5 Rayburn.

6 So with that, we move into the
7 committee out briefs. We'll start with the 5G
8 Subcommittee, Mariam is on the horn. Are you
9 going to be doing the brief, Mark?

10 MR. RACEK: Well, I'm going to start
11 off with the status --

12 MR. GIBSON: Okay.

13 MR. RACEK: -- Mariam is going to go
14 ahead.

15 MR. GIBSON: Okay.

16 MR. RACEK: She's the co-chair, Mariam
17 Sorond. She's the Co-Chair of 5G Subcommittee
18 and she's going to be giving the presentation.
19 But just to go ahead and the give the Membership
20 a little idea of what the status is.

21 As somebody said before, I guess with
22 respect to the TAC, we're very focused on sort of

1 actionable recommendations. So we're very
2 focused on that.

3 We, so far we've had five meetings.
4 And thank you to all of the Membership of the
5 Subcommittee, it's been very productive. Mariam
6 is going to go into sort of the details, but we
7 fairly have been able to go ahead and provide a
8 lot of detail with respect to our responses when
9 it comes to the recommendations, or the
10 questions.

11 And we've been able to have a draft
12 final report. That draft final report has been
13 made available to the Membership.

14 And okay, I guess that's it. I'll
15 turn it over to Mariam.

16 MS. SOROND: Okay. Hi everyone. So,
17 this is Mariam Sorond from Dish.

18 As Mark said, I think we were, so the
19 draft report right now is, it actually, it does
20 need quite a bit of work we just wanted to share
21 an interim version with everyone. There are
22 comments back and forth from different

1 Subcommittee Members that we still are talking
2 about it, and we'll actually go through them at
3 our next meeting. So please consider this as a
4 draft, it will probably change.

5 But we thought to help the discussion
6 over here, we put a few slides together that
7 we've shared with everyone. So I was going to go
8 through the slides and not so much focus on the
9 report, at this point.

10 So, basically in the slide, the first
11 one is just a repasting of the NTIA question. On
12 Slide Number 3 we're trying to say that we're
13 looking at interference management and sharing in
14 multiple standards bodies. And at this stage the
15 standards bodies are not necessary focused on
16 sharing.

17 So there's an exercise that says,
18 okay, what's there so we can leverage it that
19 would help sharing. But I think ultimately, you
20 know, also the past Subcommittees we've been
21 pointing out that we need to make this a little
22 bit more focused on sharing and try to see if the

1 standards bodies would entertain specific work
2 that allows for sharing between federal and non-
3 federal users.

4 Because the technics that are there
5 are really just enabling the sharing that is,
6 that is within technology, intra-cell and intra-
7 user and things like that. And they're
8 leveraging, they're helpful really for the
9 network efficiency and network interference
10 matters, rather than being sort of parameters
11 that you would use to enable sharing between
12 different networks per say.

13 MS. ATKINS: Mariam?

14 MS. SOROND: Yes.

15 MS. ATKINS: This is Paige. One thing
16 I wanted to note in this, I'm keying off the
17 words on your slide as well, that I don't want to
18 focus on sharing between federal and non-federal
19 explicitly, as it relates to standards, it is
20 more of a generalized sharing technics or
21 technologies. Understand that your comment, I
22 believe, was focused on looking at optimization,

1 I'll say, and interference within someone's
2 network versus with external or inter-network or
3 inter-systems.

4 But I just wanted to make sure that we
5 aren't focused on federal versus non-federal as
6 much as general sharing across the board.

7 MS. SOROND: Okay. Okay, that's
8 helpful. I appreciate that clarification.

9 But yes, you're right, it is really
10 about, within a network and basically other
11 users. Let's say associated with a different
12 type of network.

13 So basically like, you know, there is
14 mechanisms for resource scheduling, and things
15 like that, within the 3GPP and IEEE standards.
16 But these are not necessarily geared towards
17 different users as much as the same users.

18 Now, they go through like adjacent
19 channel users, but it's still within the same
20 technology level. So basically, when you have
21 and LT carrier, they do look at what happens with
22 the adjacent LT carrier, but not necessarily a

1 different technology. That's what I was trying
2 to point out.

3 So, basically that's what we wanted to
4 bring out and see if we can get any feedback or
5 thoughts on that, at this point. But that's the
6 situation we're dealing with.

7 So we can pull out, or we're trying to
8 attempt to pull out, things that are there
9 already to help, but really the solid approach
10 would be to actually incorporate things that are
11 meant for different technologies and different
12 networks to share.

13 So that pretty much covers the
14 thoughts on Slide 3 and 4, at a high level. And
15 there is, Slide 5 is really about deployment. So
16 this is another layer of things.

17 So basically, one layer of things is,
18 what's there in the technology, what are the
19 specifications and mechanisms within the
20 interface or the network that enabled sharing.

21 But, the last one is also the
22 deployment, which is distinct. It's, how do you

1 deploy these networks in more of an
2 implementation of those technologies aspect that
3 also could potentially be looked at for trying to
4 see how we can efficiently look at the multiple
5 deployment scenarios that, for example, small
6 cells versus macro cells or basically satellite
7 versus terrestrial or things like that that could
8 also be looked at.

9 So this is a lot of sort of different
10 layers that we're investigating in a
11 Subcommittee.

12 So, we're going to land at, probably
13 right now, ultimately towards a recommendation to
14 try to account for these scenarios. But as far
15 as actionable recommendations, I think we're
16 going to probably land where we did last time
17 where there will be a lot of information there
18 and now we need to probably figure out, how did
19 this information CSMAC and the TAC and the FDC
20 and the NTIA efforts, the standards bodies, how
21 is this brought together.

22 It's probably going to be the same

1 challenge that we're going to face. Because
2 right now there is not necessarily a path that
3 says, okay, I'll take this, I'll go to this place
4 and this is where you can get these implemented.
5 It gets a little bit more complicated than that.

6 So, going over to the very last slide,
7 this is an example of --

8 MR. RACEK: Okay. So we did have some
9 discussion about this as a proposed NTIA action.
10 The thought was, is that to actually study
11 sharing, one of the things that could be done is
12 to actually introduce a study item within 3GPP.

13 And sort of the discussion that we had
14 within our subcommittee is actually who should
15 actually do that, whether it should be NTIA
16 itself, or should it be sort of sponsored by NTIA
17 but performed by maybe one of the companies
18 within CSMAC.

19 The feeling was is maybe that this may
20 be something that NTIA would actually want to
21 perform. Apparently, NTIA is allowed to submit -
22 --

1 MS. SOROND: I'm really sorry. The
2 bridge kicked me out.

3 MR. RACEK: Okay. I was just covering
4 this.

5 MS. SOROND: Okay, great, go ahead.

6 MR. RACEK: You can add anything. I'm
7 at the point now that NTIA, it looks as if they
8 do have the authority to be able to submit to
9 3GPP.

10 And it may make sense that NTIA
11 actually would take ownership over the study item
12 itself and that here, what we have is sort of --
13 there are some sort of conditioning.

14 And that is you do have to get four
15 co-sponsors from member companies, which I don't
16 think would be a problem, and that, you know, it
17 probably could be useful to actually find, within
18 the CSMAC group, maybe co-sponsors or something
19 that also are interested in a particular type of
20 sharing as well.

21 And we have here sort of what the next
22 meeting is. If NTIA wants to take this action,

1 then in September there is a 3GPP meeting. So it
2 gives a little bit of time, maybe not a
3 sufficient amount of time, to identify what an
4 appropriate study item might actually look like.
5 But, you know, that would be sort of the first
6 opportunity to be able to do that.

7 So, you know, as we have indicated
8 throughout the slides, these are just sort of
9 thoughts that we have. We haven't actually come
10 to a recommendation standpoint, but we did want
11 to conclude on something that sort of, you know,
12 kind of summarizes the efforts that we've had
13 within the subcommittee.

14 CO-CHAIR ALDER: Mariam, did you have
15 anything to add?

16 MS. SOROND: Yes. I would just say,
17 on this last slide we did get feedback from Amy,
18 you know, from our NTIA member of the
19 subcommittee, about potentially, you know, issues
20 or challenges with NTIA proposing work at 3GPP.

21 So I just wanted to mention that
22 that's been brought up. So we really need to

1 kind of go to the next meeting and figure this
2 out. That's why we pegged it as an example.
3 But, you know, it's been done in the past for the
4 first net contributions in 3GPP.

5 The NTIA will need supporting members,
6 so we need to also figure out what the industry
7 members that support this work item is. But we
8 think it's a really good way to move forward
9 capturing what we've been trying to highlight in
10 this presentation.

11 CO-CHAIR ALDER: All right, great. I
12 think we have time for questions and discussion
13 on this topic. So I see two questions. Janice?

14 MS. OBUCHOWSKI: Well, it's part
15 question, part observation. Compliments to the
16 Co-chair and the active people, phenomenal sort
17 of description of the 5G process and the kinds of
18 sharing that it fundamentally addresses. And
19 it's pretty straightforward in saying this is
20 kind of an intra-system, intra-technology form of
21 sharing. Got that.

22 It, however, does lead me to the

1 observation, when you look across study items you
2 also, in another item, have, you know, very
3 encouraging statements about how 5G is most
4 efficient across broad swaths of spectrum. Fair
5 enough.

6 I also heard the observation, "the
7 most important technology." Having said that, as
8 someone who thinks there are very substantial
9 requirements going forward for federal
10 technologies and other commercial technologies,
11 it is striking that, well, it's interesting that
12 the study, because it was very straightforward
13 and very honest, said there's a radical
14 difference when you look at LTE or any other
15 robust standard between designing in sharing for
16 non-completely related technologies or bolting
17 them on. And that does concern me.

18 And I think, to my mind, it needs to
19 amount to some kind of recommendation that it is
20 crucial to decide how sharing will happen with
21 5G, particularly because 5G is so ambitious in
22 terms of not just its standards ability but its

1 desire to acquire a vast array of spectrum which
2 hitherto has been shared.

3 And if you decide not to design it in,
4 you know, you're in this bolt-on scenario, or
5 you're in a scenario of what we currently do,
6 which is geographic sharing.

7 And since many of these other
8 technologies also have ambitions not to be
9 stagnant but to develop, and that's in the
10 national interest, I'm not sure where we, as a
11 committee, will address that concern which has to
12 be a fundamental concern of NTIA's along with
13 promoting commercial spectrum.

14 It's more of an observation. And this
15 is a very -- you know, as somebody who wants to
16 learn and contribute, I sit in on all these
17 committees. And when you listen to the
18 discussion, what is presented is a phenomenally
19 ambitious growth path for 5G commercial across
20 myriad bands.

21 But there are a lot of other
22 technologies that, if they are not somehow

1 designed into that picture, will either have to
2 be bolted on or will be in a national debate,
3 band across band, for geography.

4 And I don't know where we're heading
5 with our recommendations, but that's an
6 observation that concerns me. Because we're here
7 talking about commercial technologies.

8 But we're doing that in the context of
9 an agency that also has very substantial
10 responsibilities to ensure that in a, you know, a
11 world where, number one, there are a lot of other
12 sophisticated technologies that want access to
13 those same bands and, two, we live in a very
14 dangerous world with very sophisticated players.
15 And on the federal side, people need to
16 understand how we are going to use radio waves
17 going forward.

18 CO-CHAIR ALDER: Thanks, Janice. And
19 after the direct response, we'll move to Mark.

20 MALE PARTICIPANT: All right. Well,
21 I have two questions. One, I'll just talk to you
22 offline about. It has to do with the

1 accompanying paper. And I just want to ask a
2 question about that.

3 But I wanted just a more foundational
4 question. With respect to recommendations, do
5 you have recommendations kind of that you're
6 working on that you think you'll be able to bring
7 into the meeting in November? How do you feel
8 about that?

9 MALE PARTICIPANT: Well, the paper
10 does have some draft ---

11 CO-CHAIR ALDER: Yes.

12 MALE PARTICIPANT: -- recommendations.
13 I mean, we had a couple before this point that
14 sort of talked about sort of database and how
15 databases could be utilized as well. So we will
16 have sort of some recommendations, I guess, in
17 November. Is that the timeframe?

18 CO-CHAIR ALDER: Yes, yes.

19 MALE PARTICIPANT: Yes. Then we will
20 have some recommendations. But in some of these
21 cases, going back to what Janice has said, is
22 that, you know, the questions were fairly

1 generic.

2 I think Paige has sort of re-
3 emphasized that we're looking at general sharing,
4 versus federal, versus non-federal type of
5 sharing. So the answers are going to be, you
6 know, fairly general.

7 And as we said in the slide
8 presentation that, you know, these type of
9 technologies are going to operate across
10 different frequency bands, and they support
11 different use cases. And therefore, we'll have
12 different requirements like latency, reliability,
13 those sort of things.

14 So all we can bring forward, I think,
15 is sort of, you know, to sort of formulate the
16 question that sort of needs to be answered in the
17 hopes that we can come to some sort of
18 definition, maybe through activities within 3GPP
19 where you can bring a study item and actually
20 start to get some clarity, and bring some of the
21 requirements into 3GPP, and let them work in that
22 vein.

1 Of course, that doesn't address all of
2 the other standards organizations. But as we
3 heard, you know LTE is very important. So that
4 could be a start.

5 CO-CHAIR ALDER: Okay, thanks.

6 MALE PARTICIPANT: Mark, a couple of
7 things. In getting back to what Paige said in
8 the beginning, one of the degrees of freedom you
9 have here, there's a lot of questions. You don't
10 have to answer everything this, you know, this
11 year. So pick the things that you guys feel you
12 have the most information. And you can push some
13 of the other stuff out and say, hey, we just
14 didn't get to that this time. So you can choose
15 to focus on what you think.

16 I do agree with Janice. This is a
17 great report. It lists a lot of the
18 technologies. And I think you had the really
19 important statement that, hey, it's really not
20 designed for sharing between technologies, just
21 kind of designed within.

22 And so it kind of begs the question,

1 you know, which is actually what should be added.
2 That, to me, begs the question. We have a couple
3 of more questions though. I think, Dale, you had
4 your tile up, or is that leftover?

5 MR. HATFIELD: I'm sorry. Just very,
6 very quickly, I'm still a little bit concerned
7 that it's really focused on the 3GPP ITU thing.
8 And there's a lot of other activities, I think,
9 that are relevant, of course, the internet
10 IETF/W3C and so forth.

11 But also, I see so much going now on
12 the open source area. And I think some of the
13 open source things, here again, if you're trying
14 to build capabilities in for sharing, some of
15 those open source projects may have features and
16 functions that could aid it.

17 So I think just focusing on 3GPP and
18 the ITU, as admirable as that is, I think we risk
19 perhaps missing something. And I'm not plugging
20 anything here at all. But Facebook has what they
21 call OpenCellular now.

22 MALE PARTICIPANT: Yes.

1 MR. HATFIELD: Yes. I mean, and
2 they're trying to go to a more open architecture.
3 Will that succeed? Actually, I'm not advocating
4 or anything. But it seems we need to think about
5 some of those open source things which are
6 increasingly important, I think, in this area.

7 CO-CHAIR ALDER: Paul?

8 MALE PARTICIPANT: Mark, and Mariam,
9 and your group, what I saw looking at this,
10 wondering if you're trying to tease apart --
11 there seems to be some confusion between the
12 mobile, and non-mobile, or fixed aspects with
13 respect to 5G.

14 Do you plan, I have not read your
15 report, so I apologize if this is actually teased
16 out in there, but have you started looking at the
17 aspects of --- are you focusing more on the
18 mobile aspects of sharing, and what might be the
19 issues, or the fixed?

20 Because I think those tend to get
21 confused, and everybody kind of lumps it all
22 together. And I think sharing opportunities in

1 one might be more readily available than on the
2 other. Have you guys thought about that?

3 MS. SOROND: Yes. I can take that.
4 So this is Mariam. And that's a really good
5 point by Paul and also a good point previous to
6 that by Dale.

7 But it boils down to a couple of
8 things for us. These are all really interesting
9 to look at. And there's no disagreement there.
10 One is we could leave them as the next steps if
11 we don't get around to it this time. But our
12 challenge right now is actionable
13 recommendations.

14 So there's a lot of information there,
15 there's a lot of different angles of things that
16 we could look at. How do we turn that into an
17 actionable recommendation, and not just
18 necessarily another white paper, is what I would
19 really like to get feedback on at this meeting.

20 Because we're going to end up with
21 this last slide, actionable recommendation, like
22 last time. It is to take one these standards

1 bodies, and it doesn't have to be 3GPP, that is
2 absolutely correct, but assuming that 5G right
3 now is sort of -- there's a lot of activity in
4 3GPP, it might be a good one.

5 But it's what we do with all of this
6 information that is a challenge. Mobile and
7 fixed is a really good point, but how do we
8 address that? How do we turn it into an
9 actionable recommendation is the challenge.

10 CO-CHAIR ALDER: Anyone want to help
11 Mariam?

12 MS. SOROND: Do I want to what?

13 CO-CHAIR ALDER: No, I said anyone
14 want to provide some help for Mariam there. She
15 asked a request.

16 MS. SOROND: Yes, please. Please, I
17 would really appreciate feedback. Because we
18 went through this the last time. And I feel sort
19 of a deja vu again. And I really want the
20 subcommittee, with a lot of the good work, and
21 focus, and emphasis --- and by the way, we do
22 have

1 a fifth member from Facebook on there. So that's
2 really being looked at as well. But, you know,
3 what we could do to move forward and what we
4 could set in action I would appreciate feedback
5 on.

6 MALE PARTICIPANT: Well, I was just
7 going to reiterate what Larry said, what Paige
8 said which is, you know, if no recommendation is
9 to be had, don't make the recommendation. Maybe
10 you can just define further study that might lead
11 to the recommendation.

12 And I know we're not trying to make
13 more work for ourselves, but this is probably one
14 of the more complicated topics that we deal with
15 which is 5G, because it means different things to
16 different people, at least in the context of
17 spectrum sharing. So if all you do is parse it
18 and come up with a better way to address it,
19 that's success. I think it is.

20 MS. ATKINS: This is Paige. So just
21 to add, I think that we need to be reasonable.
22 And I think there may be some actionable

1 recommendations that would come out of this
2 discussion. And I think the members perhaps can
3 provide additional feedback in that regard.

4 I do agree that if we need to tee up
5 a potential topic for this next year, that is
6 okay. Though I would like to emphasize that 5G
7 is aggressively moving forward to include the
8 standards activities. And I'd hate to lose a
9 window of opportunity if there are things that we
10 should be addressing now.

11 So do what's reasonable, and what
12 makes sense, and that is useful to us in this
13 cycle, and understand that we want to take
14 advantage of the window of opportunity if
15 possible.

16 I would also say, just a quick comment
17 in general, though the reports are helpful, I
18 wouldn't focus too much time just on writing a
19 report. It's really are there recommendations
20 that we can wrap context around versus
21 generating, I'll say, a large report, though the
22 information in the reports are always helpful. I

1 just want to ensure we aren't diverting too much
2 resource and time just in writing and editing a
3 report.

4 CO-CHAIR ALDER: I think we're going
5 to move on to the next subcommittee. Was there
6 someone on the phone that had a comment there?

7 MS. WARREN: Yes, this is Jennifer.
8 Can you hear me?

9 CO-CHAIR ALDER: Yes, go ahead,
10 Jennifer.

11 MS. WARREN: Hi. I just wanted to
12 add, because I was listening this discussion, and
13 it sounded like there were time constraints ---

14 (Telephonic interference)

15 MS. WARREN: -- with different
16 possible recommendations. Would that be relevant
17 to note, where any recommendations that come out
18 of the group have any time constraints on them
19 being meaningful to do?

20 MALE PARTICIPANT: Yes. To move on.

21 MS. WARREN: So that would be my
22 request then.

1 (Laughter)

2 CO-CHAIR ALDER: Thanks, Jennifer.
3 You know, before we move on, just something that
4 comes to mind personally. I don't know if this
5 is helpful to the subcommittee. It just feels
6 like 5G is going to try and use all these
7 different bands. And these different bands have
8 different things in them, radar, fixed,
9 satellite.

10 I don't know if there's expertise on
11 the subcommittee to address any particular of
12 those use cases, if you say, well, how should 5G
13 share with, you know, fixed terrestrial, or
14 satellite, or radar. That just comes to mind for
15 me when I read this stuff.

16 MALE PARTICIPANT: And just a reminder
17 for those on the phone, you guys, if you're not
18 speaking, please mute. I think that's why
19 Jennifer sounded somewhat duckish.

20 CO-CHAIR ALDER: Okay, with that,
21 we're going to move on.

22 MS. WARREN: I didn't need to know

1 that. Thank you.

2 (Laughter)

3 MALE PARTICIPANT: We just wanted to
4 defend you from sounding duckish.

5 CO-CHAIR ALDER: We're going to move
6 on to the next agenda item which is the key
7 characteristics. But we have neither Charla nor
8 Tom is --

9 MALE PARTICIPANT: I think Charla's
10 going to do this one.

11 MS. RATH: I'm on the phone --

12 CO-CHAIR ALDER: Charla's on the
13 phone?

14 MS. RATH: -- Larry.

15 CO-CHAIR ALDER: Okay, great. Charla,
16 take it away.

17 MS. RATH: Yes, thanks. And sorry
18 that I can't be there in person. I had some
19 family commitments that I couldn't get out of.
20 So I had to stay here in DC. And my co-chair,
21 Tom Dombrowsky, couldn't be here at all. So it's
22 just me here as the co-chair. But there

1 obviously are several, I think almost all of our
2 subcommittee members are on the phone or there in
3 person.

4 So what I'm going to do is run through
5 where we stand, and what our thinking is, and
6 then, you know, to please ask fellow subcommittee
7 members to speak up and add anything that they'd
8 like to do -- that they would like to.

9 As you may have noticed, our report is
10 very short. I realize now that we probably could
11 have made it a little bit longer by actually
12 including the questions which we didn't. I'll
13 review them very briefly for folks, in case you
14 don't have them with you.

15 But what we decided last week, in
16 fact, we were actually writing a report and, you
17 know, to Paige's point, we were writing a report,
18 but we were writing it in large part so that we
19 could use it to generate discussion on how we
20 might answer the questions and what kinds of
21 recommendations we might make.

22 And what we decided is while it, you

1 know, we do, as most of these reports are, it's
2 in draft shape. As we were going through, sort
3 of back and forth on it, it became clear that,
4 you know, several of us felt as though the
5 answers to the questions didn't really address
6 all the different possible industry players.

7 And by that, I mean, we can't be
8 comprehensive, obviously. But there was, you
9 know, there was clearly some would have advanced
10 more toward terrestrial services, particularly
11 mobile. And the idea is that we want to get more
12 in each of these areas and be thinking about them
13 before we actually share it with the full
14 committee.

15 And it's not to say, you know, some of
16 the questions actually did deal with it probably
17 better than others, but as I said, we just felt
18 that the timing wasn't good in terms of sharing,
19 if it's where we actually had a chance to go
20 through and really deal with those issues a
21 little bit more closely.

22 We intend to do that very quickly and

1 are not waiting until the next meeting. And
2 we're hoping to be able to get something out to
3 the committee before, you know, well before
4 November.

5 When Tom is back from vacation, what
6 he and I will do is call a meeting and then also
7 try and do this. We've actually accomplished a
8 fair amount through email as well.

9 So the -- welcome to my notes here.
10 So basically what we did do is we actually put
11 before the committee three recommendations. And
12 we would really like to talk them through.

13 I think even among some of us, there
14 might not have been full, you know, agreement on
15 the nature of the recommendations. They more or
16 less follow the first three questions. So we
17 have recommendations on the first three questions
18 but not the last two.

19 So what I'll do is let me --- I'll
20 read the question, and then we can talk through
21 the first draft recommendation. And I'll do the
22 same for the second two.

1 So the first question was, from an
2 industry perspective, what are the key
3 characteristics to consider in evaluating the
4 desirability of a particular frequency band as a
5 candidate for license inclusive for shared and
6 unlicensed spectrum?

7 And then we also got feedback through
8 Amy from Paige that she was interested in having
9 us look at the relative priorities of
10 characteristics, not just the characteristics
11 themselves.

12 So our --- you know, you can read
13 this, but basically what we, as a group, looked
14 at as being, you know, critical to commercial
15 industry for propagation, coverage, capacity,
16 contiguity, international harmonization, and
17 encompass the issues.

18 And we did actually take up Paige's
19 question, but there was just a lot of back and
20 forth on that. And, you know, I think we'll take
21 it up again just to see whether we can hone in.

22 But what we came out with was that, in

1 fact, the relative priority for the
2 characteristics is likely to vary based on
3 industry, and actually even within industry, on
4 each case.

5 So that, you know, again, Paige, to
6 address your issue, you know, I'm not sure that
7 we're going to have a better take than this.
8 Although quite frankly, this is actually --- I
9 believe that it, you know, if we kick the tires
10 on this, both here in this meeting as well as
11 when we go back to our subcommittee, I think this
12 could actually be a useful part of the
13 recommendation.

14 I don't know how you want to handle
15 this. I can stop now and let my subcommittee
16 members chime in. Or I could go through all
17 three.

18 CO-CHAIR ALDER: Charla, why in the
19 interest of time, why don't you cover the brief,
20 and then we'll do discussion and comments.

21 MS. RATH: Okay, great. So second
22 recommendation, you know, is fairly

1 straightforward. We recommend that, for either
2 re-purposing or sharing, that the government
3 actually look at contiguous spectrum.

4 And, you know, this is harder to show
5 without the, you know, without the background.

6 But what a few of us did from satellites,
7 unlicensed as well as licensed point of view, is
8 we went and looked at various technologies and
9 looked at, you know, the key components of both,
10 you know, what you gain from having contiguous
11 spectrum.

12 And again, there was a question that
13 Paige raised, and it may have lost something,
14 Paige, in translation, and I would like to
15 actually, you know, have you walk through it. It
16 had to do with, you know, putting this in
17 context.

18 And we looked at that and were, you
19 know, somewhat -- we were a little bit --- we
20 were having to make an interpretation of what
21 that actually meant. So what we were
22 interpreting it is whether, for example, the need

1 for contiguity changes depending on band width or
2 frequency.

3 So, you know, when I'm finished here,
4 that would be helpful, Paige, to have you sort of
5 talk about that and again, you know, my
6 colleagues.

7 The third recommendation is --- and
8 this is one I just wanted to be clear that, you
9 know, the language is pretty, you know, NTIA
10 should not attempt to rigidly define, blah, blah,
11 blah, blah, low, mid, high band spectrum. And
12 sorry, I forgot I was going to read each of
13 these.

14 Question 2 was what are the technical
15 and operational impacts of contiguous versus non-
16 contiguous spectrum to satisfy commercial
17 requirement.

18 Question 3, the one that I'm on now,
19 is when industry describes its need for low,
20 medium, and high band spectrum, what should we
21 understand to be the definitions of those broad
22 frequency ranges and the rationale for selecting

1 the boundaries between each.

2 I think, you know, one of the comments
3 that clearly, you know, we'll think of a better
4 way to say this in the final recommendation, but
5 certainly if we were looking at this, and
6 everybody around the table knows this, is that,
7 you know, several years ago if you had talked
8 about low, mid, and high frequencies, it would
9 not be the ranges that we're talking about now
10 and certainly not, you know, mid-band spectrum
11 would not be what the Commission just adopted in
12 NOI 37 out of it, you know, frequent seven
13 gigahertz to 24 gigahertz.

14 So, you know, and one of the issues we
15 were looking at is saying when you talk about a
16 band like that as a bit-band, you know, clearly
17 the propagation characteristics, and just the way
18 that it can reduce even availability that can be
19 encompassed can change dramatically when you have
20 a large range.

21 So one of the things that we're
22 looking at, you know, is again, that we're not

1 100 percent sure how helpful it is. You know, in
2 some ways those definitions are, you know,
3 they're being used by us, they're being used by
4 government, they're being used across the board.

5 But, you know, we're struggling with
6 just how useful they are definitionally, whether
7 we should actually be, for purposes of answering
8 the questions, you know, which is the rationale
9 for selecting boundaries, we might even --- we
10 were even looking at potentially, you know,
11 making them more than --- having more than just
12 grade, you know, low, mid, and high, maybe even
13 looking at ranges where there's a little more
14 commonality in propagation characteristics.

15 So we don't have recommendations on
16 the final two questions. Question 4, to what
17 extent does the channel bandwidth need for any
18 given deployment barrier, depending on whether
19 deployment is low, medium, or high band spectrum.
20 Obviously, that is somewhat contingent on what we
21 recommend for spreading (phonetic)**1:42:34.

22 And Question 5, what commonalities and

1 compatibilities between federal and commercial
2 application could be exploited to maximize the
3 potential for sharing between federal and non-
4 federal users. These might include, for example,
5 applications that coexist technically and/or
6 operationally for common technology.

7 And the lack of recommendations there
8 is not, you know, it is not an evidence that, you
9 know, there hasn't been work done in those areas.
10 I think we just haven't really been (inaudible)
11 yet.

12 And again, as I said, our plan is to,
13 you know, take the feedback we get here and then
14 move forward fairly quickly in trying, you know,
15 to finish up the report and potentially come up
16 with recommendations for, you know, to hone these
17 recommendations and come up with new
18 recommendations or, to the extent that Larry had
19 said earlier, you know, perhaps recommend that
20 some of those things could be used for the
21 (inaudible).

22 I'm not saying we think any of them do

1 at this point. But, you know, I heard that.
2 And, you know, if we think that makes sense,
3 we'll probably recommend that.

4 So that's my description. And turning
5 it over to some of my cohorts if anybody has any
6 comments, if I left anything out, if I
7 misrepresented what we're thinking, please
8 comment.

9 CO-CHAIR ALDER: All right, Charla. I
10 think Paige wants to make a comment first.

11 MS. ATKINS: Yes, Charla, I want to
12 address, I think, a couple of items. The
13 question on context, and this was particularly
14 relevant to the key characteristics for
15 commercial deployment, you know, obviously, the
16 key characteristics as defined have tradeoffs,
17 particularly propagation and coverage versus
18 capacity, as an example.

19 So the context was related to how we
20 consider these key characteristics associated
21 with perhaps, I'll say, use cases, or unlicensed
22 versus licensed, or other applications, different

1 kinds of technologies, just to help us as we try
2 to apply these key characteristics in our own
3 processes of looking at bands for consideration.

4 Also the part of the intent of the
5 question of low, mid, and high is to help us
6 prioritize where we focus our resources in this
7 resource constrained environment.

8 So as we look at the needs across all
9 of those bands, what does that look like in terms
10 of projected requirements? And how do we define
11 those bands so, as we look at options that we may
12 want to focus resources, how we prioritize those
13 smartly. So that just gives you some additional
14 background, I think, in terms of the intent of --
15 -

16 MS. RATH: Actually that, yes, that's
17 helpful, and particularly the latter which I
18 think fits in with some of the description I gave
19 as well. Because if we narrow, you know, that
20 probably is helpful to you as well, is if we
21 narrow, say, you know, big bandwidth, one, two
22 and three kind of thing, as opposed to, you know,

1 3.72 as well, you know, 24 gigahertz.

2 CO-CHAIR ALDER: All right, are there
3 other questions and comments? I see one from
4 Dennis.

5 MR. ROBERSON: Dennis Roberson. On
6 this third point, the recommendations and the
7 comments you just made about low, medium, or mid,
8 and high bands, I'm just going to really hit this
9 point an additional time.

10 These have been so fluid over the
11 years that, even though we've just put out an NOI
12 in the mid-band and redefined it once again, it's
13 really becoming less and less helpful, in my
14 mind, to make these distinctions.

15 I think we're better served just to
16 put out numbers and characteristics of bands, in
17 the way you described it, for applications rather
18 than try to artificially create low, mid, and
19 high.

20 Because the terms don't have any
21 meaning anymore from, at least from my
22 perspective, just because they're so fluid and

1 they're so different in different timeframes, and
2 different based on the way the technology has
3 evolved.

4 So things that we only thought we
5 could do with low band, where low band was
6 kilohertz, if you go back far enough, and Dale is
7 laughing, because, yes, you know, it has really,
8 really, really changed. And I think it's very,
9 very artificial to use that terminology.

10 MALE PARTICIPANT: Yes. I think what
11 we're hearing is, you know, focus on what bands
12 should they focus on instead of naming ---

13 (Simultaneous speaking)

14 MALE PARTICIPANT: And there are
15 numbers that are ---

16 MS. RATH: But not specific individual
17 bands. But ---

18 MALE PARTICIPANT: -- frequency
19 ranges.

20 MS. RATH: -- I'm looking at kind of
21 ranges. And because we understand that there are
22 evolving requirements across everything.

1 MALE PARTICIPANT: Right.

2 MS. RATH: But we can't focus on
3 everything, so helping us prioritize our
4 resources. And I fully agree that the
5 assumptions we made, you know, five years ago on
6 bands, and applications, et cetera, have changed
7 in some cases very dramatically. So we don't
8 want to get locked in. It's just a matter of how
9 do we help prioritize ---

10 MALE PARTICIPANT: Yes. And that's
11 the point, just to recognize that. I mean, if
12 you go to the physics, since I do have a physics
13 degree along the way, there are things like water
14 absorption, where water absorption hits, and
15 oxygen absorption bands, and things like that,
16 that are fixed. But beyond those kinds of
17 things, much of the rest of it is really, really
18 very fluid.

19 CO-CHAIR ALDER: All right.

20 MALE PARTICIPANT: Well, in terms of
21 what will ---

22 MS. WARREN: And this is Jennifer.

1 MALE PARTICIPANT: -- help you versus
2 what will help Charla, I mean, that's where we
3 need to make the connection.

4 MALE PARTICIPANT: Right.

5 MALE PARTICIPANT: Charla and the
6 committee. So, I mean, we can talk all that we
7 want to about what this means. I mean, 100 years
8 ago, high band was kilohertz. So, you know, it
9 changes with the times.

10 MS. RATH: But I do think it's helpful
11 just, you know, Paige's comment in particular
12 about the resource constraints and sort of focus,
13 and then Dennis' on top of that suggesting, you
14 know, that it really is about --- again, I kind
15 of had to, when we started talking about mid-
16 band, again, I was like, well, what do we mean by
17 mid-band? Okay, great, we'll call that mid-band
18 now.

19 But it was not even -- like I just
20 said, a year or two ago it wouldn't have been
21 that high.

22 MS. WARREN: This is Jennifer. Could

1 I get in here?

2 CO-CHAIR ALDER: Go ahead, Jennifer,
3 you're up.

4 MS. WARREN: Great. I also think that
5 focusing on band ranges is important because of
6 the fact that this approach varies significantly
7 by sub-sector of the industry. So high range and
8 mid range haven't varied as much for the
9 satellite industry as, you know, the shift within
10 the wireless industry.

11 But more importantly, internationally,
12 none of this translates, whereas band ranges do.
13 And if we're going to be talking about
14 harmonization and scale, I think that's a better
15 opportunity for alignment. So I would support
16 this change. Thank you.

17 CO-CHAIR ALDER: Thanks, Jennifer.
18 Donna?

19 MS. BETHEA MURPHY: Yes. Donna Bethea
20 Murphy from Inmarsat. I agree with the previous
21 speakers, that is that each band has a different
22 propagation characteristic. So maybe we talk in

1 specificity associated with propagation
2 characteristics or bands, and assuming everyone
3 knows what the propagation characteristics are
4 that are associated with those.

5 But I think that when we're looking at
6 sort of, you know, writing a bigger document, we
7 have to consider the --- and I know we're trying
8 to bring this to a higher level, but I think when
9 you look at the service, the applications, the
10 coverage, and even if you're talking about, let's
11 take for example satellite service, well, you
12 could have a mobile satellite service. You could
13 have someone providing broadcast within the
14 mobile satellite service, or broadcasting within
15 the fixed satellite service.

16 And I think each time you look at the
17 characteristics, the dynamics with sharing or,
18 you know, how you can fit other services in,
19 changes.

20 And I do think it's interesting as we
21 look to sort of make everything the same, even if
22 we're looking at --- not looking at worst cases

1 like Julie was talking about before. If you have
2 a frequency band where you have lots of different
3 applications in there, what you may be doing is
4 rewarding the one system that was built, instead
5 of being built to sort of maximize the use, the
6 one system that is built sort of, you know, at
7 the mid-level.

8 So I think that this group has an
9 interesting task. And I think that there are a
10 lot of things that we need to look at to put out
11 something that is usable, that someone can make a
12 decision about. And I think that we will have to
13 get a little bit into specificity as opposed to
14 sort of generic things.

15 CO-CHAIR ALDER: All right. Any other
16 comments on the phone?

17 (No audible response)

18 CO-CHAIR ALDER: All right. Thank
19 you, Charla. That was great. And, I guess,
20 Charla, anything else, or we'll move on?

21 MS. RATH: No, that's it. Thanks.

22 CO-CHAIR ALDER: All right. With

1 that, we will move onto the Enforcement
2 Subcommittee. And I think Paul's going to
3 present. Am I correct?

4 MR. KOLODZY: Well, again, my cohort,
5 I think, is also on the phone right now, Mark
6 Crosby.

7 MR. CROSBY: Yes, I am. But you have
8 the conn, Paul. Go ahead.

9 MR. KOLODZY: Okay. Which means I can
10 blame him, good.

11 (Laughter)

12 MR. KOLODZY: Okay. This group has
13 been struggling a little bit and trying to get
14 some momentum going. We've been --- there's been
15 some meetings going on. We're trying to be
16 different than the previous --- actually some of
17 the questions we were asked were different than
18 the previous Enforcement Committee questions.

19 And so we were trying to address, you
20 know, how to, you know, some of the technologies,
21 some of the possibilities that are out there for
22 doing enforcement. What are some of the

1 technology pieces, and what are some of the
2 things that are going on in the 5G world that are
3 unique for enforcement that should be brought on?

4 Those are essentially the questions
5 that you asked and sort of asking what do we
6 recommend to try to do to move forward in the
7 automated enforcement area. And you can see here
8 all the members. We've had -- everybody has been
9 involved one time or another in some of the
10 meetings.

11 If we go to the next slide, how we
12 kind of broke it up as a group, and I'm just
13 going to go quickly through this, was simply to
14 bring up , in a sense, four different groups, one
15 of them to look at the background area and ask
16 the question, you know, hey, what has been going
17 on in enforcement? How is enforcement being
18 done? How is automated enforcement being done at
19 the present time and, in trying to link back into
20 other studies that are going on, so it's not
21 simply we're trying to recreate and repeat other
22 work.

1 The other aspect was then, okay, what
2 is currently out there today that we can take
3 advantage of with respect to enforcement and
4 automate the system. So what's, like, right now
5 available, what's on the mark, what's out there,
6 and what are the ramifications legally and
7 policy-wise? Because that would be sort of like
8 the near-term or the low hanging fruit in the
9 sense of trying to look at for enforcement.

10 Group 3 was trying to look at, hey,
11 what's really technically possible, and what is
12 out there that, if we actually started bringing
13 into the system, that would sort of try to build
14 up new automated enforcement mechanisms which, at
15 the end, I think what you're looking for is
16 trying to understand how you can use automate
17 enforcements to push sharing to a new level.

18 And that's really what your goal is,
19 it's not really just to enforce the mechanisms.
20 But right now, we tend to build enforcements or
21 rules for sharing based upon that there is no
22 enforcement mechanism.

1 So you have to actually be very
2 conservative and try to back off, versus if you
3 have some automated ways, so all those corner
4 cases that we tend to look at, if you can
5 automate those out, now you can actually be much
6 more aggressive, I believe, in the enforcement
7 process. And so that's what this Group 3 is
8 trying to ask, you know, "What can you do there?"

9 And then Group 4 was trying to look
10 at, hey, what is the 5G specific? And you're
11 going to hear a little bit about some of those
12 aspects.

13 We've met a few times, as I said.
14 Look at everything you have here as a work in
15 progress. This is an interim report. This is
16 when we talk about recommendations or findings,
17 they have not been thoroughly vetted by the
18 group. We are just getting to that point. So
19 take these with, as I said, a grain of salt as we
20 move forward here. So (inaudible) what, you're
21 thinking of this?

22 But feedback as to areas where you may

1 not have been looking at that we should be
2 looking at, I think, it would be very valuable
3 right now.

4 And I think the rest of the committee,
5 you know, as we get done with this, feel free to
6 jump in and kind of expound on a little bit of
7 some of the ideas we were putting out here. The
8 status, as I said, we're doing these preliminary
9 findings, and these are raw materials.

10 The next slide, the next slide. So
11 the activities, we've had multiple meetings,
12 we've actually developed a bibliography of prior
13 work thanks to the Group 1 activities. We have a
14 list of references and contacts where they've
15 been looking, and you'll see a little bit later
16 on, trying to talk to interference hunters and
17 the like, and trying to understand a little bit
18 about how they're doing it to see how you can
19 automate some of those processes. And we're
20 talking to equipment manufacturers about what is
21 possible.

22 If you go to the next slide, so the

1 preliminary findings on this, again, preliminary
2 should be double, triple underlined, okay. First
3 of all, which is kind of interesting to note, is
4 that most companies hire consultants, at least
5 the smaller companies, to find their
6 interference. When they have a problem, they
7 actually hire out.

8 Some larger companies, like I would
9 presume the big wireless carriers, will have
10 internal teams. But in general, all the other
11 players are all looking at some individuals, like
12 your interference hunter people, or whatever, to
13 go out and find that.

14 And they break up the interference
15 into really the three types. One of them which
16 is, believe it or not, one of the biggest cases
17 is intra-system or self-interference. We find
18 that a lot.

19 The other one is that somebody, one
20 group, one item, one person, one emitter, causing
21 problems. So you're just trying to find that
22 emitter.

1 And the other one, as we talked about
2 before, and Julie was looking at it, is the rise
3 in the noise floor, is that all of a sudden,
4 we're having a problem in general here, it's no
5 longer very specific, find that.

6 So when you talk about automated
7 enforcement, and you look at somewhat in the AWS-
8 3 band that I've been involved with, it's almost,
9 like, widespread when you're seeing the whole
10 noise floor rising up because of many, many users
11 integrating together. You have to look at that
12 differently than you can look at, hey, there's
13 just a hot spot there, and I need to be
14 addressing it. So we find that.

15 We also find out that, really, there
16 are limits. And I invite some of the committee
17 members to comment on this later, there's a limit
18 to what consultants can actually do. You know,
19 there's only so far they can go in the sense of
20 locating people and tracking them in, like, due
21 to legal or policy issues, and especially in the
22 privacy area, and the ability to access

1 particular locations so they can determine what's
2 really going on.

3 So in overall, just even using these
4 kind of mechanisms, if you don't find some way of
5 automating it, you still are going to have to
6 bring in outside teams from the regulatory
7 agencies to actually have the ability to break
8 through these privacy and access issues. Or
9 you're going to need policy changes to allow that
10 to occur. And that's a sticky wicket.

11 Automated systems tend to be also
12 applying just to current waveforms. So
13 basically, people build systems that do WiFi
14 hunters, that do, you know, looking for cellular
15 bands and all this stuff. They don't build
16 systems that actually cross the board and
17 actually can use waveforms that aren't
18 standardized.

19 And so therefore, if you're actually
20 trying to locate somebody who's using a waveform
21 that is not using one of the standard waveforms,
22 you have a tough time at this. And so therefore,

1 there's a whole technology built up there.

2 Instead of using energy detectors or
3 using something actually much more sophisticated,
4 you're going to need much more sophisticated
5 technology to be able to hide, I mean, to find
6 some of these people who are using waveforms that
7 are not standardized waveforms.

8 The next slide, some of the evolving
9 challenges that happen, giving that as a
10 backdrop, essentially you're getting to smaller
11 and smaller cells. So now it's no longer just a
12 big stick looking for who's interfering
13 associated with them. It can be in so many
14 different characteristics. You have to somehow
15 understand how to break those up.

16 As I was saying, even though there is
17 more cells, they're getting closer together, and
18 that the capacity and latency constraints now,
19 interference now could be on latency not just on
20 pure dropping something out and the like. And
21 this actually goes to some of the questions I was
22 asking the ITS folks, which is how are you

1 looking at interference.

2 And some of the new challenges that
3 are going on in the 5G world, the whole area of
4 device to device communications is now coming up.
5 And so now interference, which is associated with
6 the device to device, is something that probably
7 many of us are not thinking about.

8 We also have to deal with what is
9 interference when you have adaptable rise
10 (phonetic)**1:59:40. And considering that is
11 now being employed not only in the high frequency
12 bands, but it's actually in distributed and non-
13 distributed MIMO systems. It's actually becoming
14 more prevalent.

15 And you also have --- the systems are
16 already doing dynamic framing which means that,
17 when you're trying to actually understand what
18 interference is, you have to put it in the
19 context of how it's changing its frame sizes
20 which actually indicates what kind of
21 interference you actually are getting. And so
22 those are kind of the new challenges when you're

1 trying to go into automated systems.

2 But the good news is there's new
3 capabilities in the sense that, as we go to 5G
4 and these higher band spectrums, there's a lot of
5 bandwidth to be had that maybe you might be able
6 to glean off a percent here, a percent there,
7 which gives you a better capability of actually
8 distributing the information around to be able to
9 do enforcement.

10 Next slide. So again, now that was
11 three underlying of preliminary. This is the
12 four underlying part of the preliminary.

13 (Laughter)

14 MR. KOLODZY: And that is one of them
15 --- and pretty much the group has been talking
16 about this, which is how you get best practices
17 or databases of what people have found out before
18 to be used by future users, future interference
19 hunters, and the like.

20 People have built up techniques. In
21 fact, a lot of them are willing to share those
22 techniques, okay. But the question is, is how do

1 you get a database together so that people can
2 say, hey, this is how I found, you know, how you
3 can locate this kind of interference source and
4 the like.

5 And that's actually a pretty
6 straightforward type of process. The question
7 is, how do you actually host something like that?

8 The next one is how do you actually
9 look at transient interference cases and the
10 impact of transient interference, okay. And the
11 idea is to somehow find a way to study that.
12 Because everybody tends to look at, if it's in
13 one microsecond, one nanosecond, is that
14 interference? Is it one second interference, is
15 it one second every second for half a second, for
16 ten mintes, is that interference? What are all
17 these duty cycle issues?

18 And this goes back to the application
19 and in the transport phase, not actually in the
20 five layer anymore. And that actually gets a lot
21 more complicated. So recommending maybe a study
22 in that area.

1 Trying to also require a machine-
2 readable report for interference detection
3 systems. So basically, how do you standardize
4 the methodology to actually provide the
5 information about interference?

6 One possibility is that when you start
7 to do sharing, do you actually put in the policy
8 or in the technical rules to enable kill switches
9 or pause transmission switches. Or, we've talked
10 about in previous times, beacon IDing and ID
11 capability.

12 So the idea is that you do that in the
13 5G to aid in this machine and machine
14 interference diagnostics, also to look at
15 analyzing the different enforcement stages of
16 automation, all the way from --- it's not that
17 you have to go all the way to the step of,
18 "Listen, this is the person who's interfering
19 with you, and this is how they're interfering
20 me," but actually looking at, first of all, I
21 want to find if I have interference.

22 How do I report that process? How do

1 I report what the impact of that is, how to
2 report, you know, the characteristics of it, how
3 to report maybe the spacial characteristics of
4 it? So how do you go up the levels instead of
5 just saying enforcement is everything, you know,
6 from beginning detection stages all the way up
7 into the shutting down of the interferer?

8 And finally, and these kind of all tie
9 together, how do you build an automated
10 enforcement architecture? Because that actually
11 is how you're going to be able to fit all these
12 pieces in.

13 And with that, Mark, would you like to
14 add any additional comments?

15 MR. CROSBY: You did a great job, sir.
16 I think my only comment, I think, we covered in
17 the last two bullets. I think one of the issues
18 that we have or challenges that we have is I
19 think it's easier to, you know, work with
20 interference mitigation.

21 You know, you can identify it, and you
22 can figure out where it is, you know, but it's

1 not malicious, right. So interference mitigation
2 is, in my opinion, not enforcement. It's maybe a
3 lower piece to it, but it's not an enforcement
4 activity.

5 And sometimes we also get discussions
6 into, well, we're doing enforcement when we have
7 automated means to maintain the integrity of
8 systems. Yes, that's important. But again, I
9 don't think that's enforcement.

10 Enforcement is when somebody, or a
11 group of people, or one person, or even vendors
12 get -- you know, equipment can come in that's not
13 type-accepted, or there's malicious, or maybe not
14 malicious, but rules are broken. And then you've
15 got to fix it. That's enforcement to me.

16 And so I really want the subcommittee
17 to, maybe with Paige's comment, I know
18 interference mitigation is important, but I don't
19 view that personally as an enforcement.

20 Enforcement is when somebody breaks a
21 rule, you know, on purpose or by mistake. But
22 you go after them, and you fix it. That's

1 enforcement. And, you know, I sort of also have
2 been spending a lot of time reading Dale's emails
3 and I ---

4 (Laughter)

5 MR. CROSBY: -- and, you know, Dale's
6 right, you know, in a lot of respects. You know,
7 what are we enforcing? I mean, is this --- do we
8 leave it alone and the parties will take care of
9 it? Because, you know, the speed limit's 55, and
10 they were doing 50? Or enforcement's when
11 somebody's doing 90, and the speed limit's 55.

12 I mean, I think the committee, the
13 subcommittee's doing great work. I think we have
14 a lot more to go and further clarification and
15 guidance from Paige, I think, at this time, and
16 the other members of CSMAC, would be helpful.

17 MS. ATKINS: Okay, Mark, I'll chime
18 in. This is Paige. And I've said this in past
19 sessions. I'm going to repeat it here. When I
20 use the term enforcement, I use it fairly loosely
21 and broadly.

22 It's not just the traditional

1 enforcement definition or mechanisms, as you
2 describe, but looking more wholistically at how
3 you even prevent interference. You know
4 something's about to occur, and you can prevent
5 it, or you identify and then resolve it.

6 So I've always talked to that term of
7 enforcement, and in context of this subcommittee
8 as a broader context, particularly as you look at
9 automated capabilities that you might want to
10 inject into the, I'll call it the infrastructure,
11 more broadly.

12 I also wanted to just ask a question
13 in terms of --- and this is probably a step too
14 far. But as you look at this problem set, as you
15 look toward the future and things like dynamic
16 spectrum access, software defined radius,
17 software defined networks, then how does that
18 change the dynamic for, no pun intended, or, you
19 know, the framework of what you might be looking
20 at as well?

21 MALE PARTICIPANT: Correct.

22 MR. CROSBY: That's a great question.

1 One would think that, and listen, I'm no
2 technologist in this, but one would think you'd
3 be able to embed those type of devices or the
4 very sophisticated hopping and, you know,
5 interference mitigation type of software inside
6 those systems and those devices, one would think.
7 But again, maybe I'm a dreamer.

8 My only other comment is, with Paige,
9 I love talking about things like kill switches
10 and the things which is, you know, really hard
11 core enforcement.

12 (Laughter)

13 MALE PARTICIPANT: I appreciate it.

14 MALE PARTICIPANT: It's hard core
15 anytime you say kill anything.

16 MR. CROSBY: No, I mean, again, I like
17 that, Mark, though, you know. And sometimes I
18 understand.

19 MALE PARTICIPANT: Sometimes they call
20 that stop buzzer. But if you want to go full,
21 you know, metal jacket, call it ---

22 CO-CHAIR ALDER: All right, Mark, if

1 you don't have any more, we have a lot tents --

2 MR. CROSBY: I'm done.

3 CO-CHAIR ALDER: -- up here in the
4 room.

5 MR. CROSBY: I'm done.

6 CO-CHAIR ALDER: Let's move that. I
7 think, Mark, you were actually the first tent.

8 MR. MCHENRY: Yes. So I wanted to
9 make a comment. I said this before. I think
10 you've got some SAS people. I know I'm on this
11 committee, although I have missed the call, so
12 mea culpa. I think Paul's on the committee, and
13 I think Curt's on this committee.

14 You're going to have an excellent
15 example of how this is going to work in the
16 context of SAS, CBRS, and ESC. Because right
17 now, in fact, probably in the next couple of
18 weeks, we're going to be meeting with the
19 Commission to talk about enforcement in the
20 context of SAS. And we're talking about
21 interference reporting and enforcement in the
22 context of ESC. So stay tuned.

1 I'm not sure if we'll be able to feed
2 anything back in terms of recommendations by
3 November. But that's playing out exactly in CBRS
4 along the lines of what, you know, what you're
5 asking about.

6 You know, and Mark mentioned it's not
7 enforcement until you break the rules. So that's
8 an interesting concept. We're trying to put the
9 anti-enforcement on some of what we're doing so
10 that breaking the rules means we don't interfere
11 with ships coming onto air craft --- or air craft
12 coming onto to aircraft carriers. I'll leave
13 that as it is. So we'll try to feed that back to
14 you in the context of calls. But there will be a
15 lot coming out of that.

16 MALE PARTICIPANT: Well, that said, I
17 presume then you're going to be very actively
18 participating in Group 2. Because that's
19 actually the group that you said. This is the
20 technology today.

21 MR. MCHENRY: Yes.

22 MALE PARTICIPANT: This is how we're

1 employing it, and this is its challenges
2 associated with that.

3 MR. MCHENRY: Yes.

4 MALE PARTICIPANT: So I'll count for
5 your input.

6 MR. MCHENRY: I'll be there.

7 CO-CHAIR ALDER: Bryan.

8 MR. TRAMONT: So this is Bryan
9 Tramont. I have two quick things. One is when
10 we did one of the prior Enforcement Committee
11 activities, we drew a distinction between
12 ensuring compliance versus taking enforcement
13 action. And it might be a useful distinction to
14 continue to draw from a taxonomy perspective,
15 about the compliance versus enforcement. So
16 that's one.

17 Two is whenever there's a bullet that
18 starts with mandate about technologies, I break
19 out into hives. And one thing I would just, as a
20 comment ---

21 MR. KOLODZY: Number 4 underlined.

22 MR. TRAMONT: Understood. There's a

1 lot of salt here. I know, very small grains, but
2 for everybody to think about where the incentives
3 align here.

4 And Dale talks a lot about incentives,
5 and are we really talking about a mandate? Or
6 are we talking about a situation where compliant
7 companies will do these things because their
8 incentives align to do so?

9 And then relatedly, companies who want
10 to break the rules won't comply anyway. So it
11 won't matter. So there's a bit of a cross-
12 connect about how you think about mandates and
13 incentives aligning.

14 You don't need one if you have the
15 incentives aligning. And indeed, the people who
16 will break the rules will break the rules. So
17 just try and think about that. And I always am
18 nervous about any mandates that have any specific
19 technological capabilities associated with them.
20 So I just wanted to add that cautionary note.

21 CO-CHAIR ALDER: Thanks, Bryan. Dale?

22 MR. HATFIELD: A real minor thing, but

1 it seems to me, talking about waveforms and
2 shifting waveforms, we've had emission
3 designators in the past which have been useful in
4 enforcement. If you see an FM, this is a silly
5 example, you receive an FM signal on an AM band,
6 it kind of tells you, hey, there's something
7 going on.

8 So we've used emission designators.
9 I'm not sure what they mean anymore. I think
10 there might be an interesting recommendation
11 coming out of this that would be look at the role
12 of emission designators. In a situation now with
13 software defined radios, you can be changing
14 those waveforms on the fly.

15 Finally, and I apologize for being a
16 broken record here, but I still am extremely
17 concerned about the spoofing and jamming issue.

18 We've had this recent, the issue, GPS
19 that --- and again, these systems went -- radio
20 systems are inherently open. You put them in a
21 Farady cage, they don't work for their intended
22 purpose.

1 And we've got, I think, in talking
2 about the enforcement thing, is to look at people
3 who are using the evolving technology can both
4 spooof and jam. And I don't think the reactions,
5 it seems to me, the architecture of the design of
6 the enforcement system, I think, has to change a
7 little bit when you think about that threat
8 vector.

9 CO-CHAIR ALDER: Thank's Dale.
10 Michael?

11 MR. CALABRESE: Yes, Michael
12 Calabrese. On recommendation, preliminary
13 Recommendation Number 3 ---

14 MR. KOLODZY: Four lines preliminary
15 ---

16 MR. CALABRESE: Right, exactly, four
17 lines. It talks about develop a machine readable
18 report standard for interference detection
19 results.

20 And I'm wondering if -- does this
21 suggest development of standardized metrics or
22 collecting interference detection results? And

1 if so -- I mean, which I think would be probably
2 very useful -- but if so, does that then go
3 beyond, for example, the mechanism of a database
4 to work in bands where monitoring is the
5 mechanism, and perhaps even monitoring by
6 incumbent. But if it's a standardized way, then
7 it can be shipped over to the FCC, and they
8 actually know what they're looking at?

9 MR. KOLODZY: Right. This specific
10 recommendation was not on how do you standardize
11 the measurements but more how do you standardize
12 the presentation of that information, okay.

13 So the two are intertwined. But I
14 just want to make sure we're not telling people
15 this is how you make measurements. It's more if
16 you can tell us what the noise floor is, if you
17 can tell us what you're measuring and how you
18 measuring it, then at least it can be brought in
19 together versus telling people, you know,
20 mandating, not mandate, sorry, bad term,
21 suggesting standards with respect to how you make
22 the measurements or how you do it.

1 So this is the idea of --- it's almost
2 like building a messaging format that we do for a
3 lot of things, you know, to make sure that the
4 messages can be read by everybody and can be
5 understood by everybody.

6 MR. CALABRESE: So the goal would be
7 a degree of standardization?

8 MR. KOLODZY: Yes, on the reporting,
9 not on how you, you know, how you report it, not
10 what you report.

11 MR. CALABRESE: And then in terms of
12 mechanisms, are you focusing on monitoring,
13 spectrum monitoring as a mechanism as well as
14 databases?

15 MALE PARTICIPANT: Well, yes,
16 definitely spectrum monitoring, but we haven't
17 gotten to that point. We have to figure out what
18 any kind of recommendations are for spectrum
19 monitoring. So good idea, good point, we just
20 haven't gotten to that point yet in the
21 discussions.

22 MR. CALABRESE: Yes, I was thinking

1 that maybe the combination of those standardized
2 metrics and monitoring could ---

3 MALE PARTICIPANT: Oh, yes, that's ---

4 MR. CALABRESE: -- you know, perhaps
5 work in more places than the database mechanism
6 where you can get the kilohertz.

7 CO-CHAIR ALDER: Hi, Rick. You had
8 one?

9 MR. REASER: I just wanted to amplify.
10 Some of these things are related, and so we have
11 some things about cleanup. And not to hammer on
12 the mandate thing, but one of the ideas is to
13 actually, you know, as a part of the
14 authorization and licensing system, to have
15 requirements for --- there are certain features
16 that would be implemented in devices that we get
17 authorized in the future.

18 So one of the things could be you have
19 to provide a report. One of the things you do if
20 you're going to have a certain class of service,
21 or certain rights, in order to have those, you
22 would be, you know, told you'd have to provide

1 that as a part of your device and be able to
2 report in.

3 And we've talked about this in terms
4 of, like, tethered and non-tethered systems. And
5 there are systems like that today. If you take a
6 look at the way the TV White Space works, and
7 this whole business we're doing with the three
8 and half gigahertz, those are very similar kind
9 of things.

10 Now I guess you kind of lock down this
11 method or this thing about whether to mandate or
12 not, but if you pile those things together it's
13 very, very powerful.

14 CO-CHAIR ALDER: All right, thank you.
15 I had a few things to just --- what strikes me is
16 it seems like the general problem is super hard
17 in enforcement.

18 (Laughter)

19 CO-CHAIR ALDER: So it just seems like
20 is there kind of an easy --- is there some low
21 hanging fruits, some easy wins? Or is there,
22 like, an if/then statement? If we did this, then

1 we'd unlock a whole nother level of sharing
2 between systems or something.

3 I just fear that the general problem
4 is super hard. So I'd look for the low handing
5 fruit or what can enable -- maybe 3.5 gigahertz
6 is a good if/then, if we do this, then we can do
7 that. So that was some of mine.

8 Anything else from the phone? I want
9 to make sure we give the phone people an
10 opportunity to comment before we move on.

11 (No audible response)

12 CO-CHAIR ALDER: Okay, not hearing
13 anything, either the phone's disconnected or
14 there's no comments.

15 (Off the record comments)

16 CO-CHAIR ALDER: We'll move on to the
17 last of the subcommittees to give a briefing
18 today, which is the spectral efficiency group.
19 And I assume, Bryan, you're going to be
20 presenting?

21 MR. TRAMONT: That's right, and
22 Jennifer will correct me as appropriate as we go

1 through this.

2 So we are the Spectrum Efficiency
3 Subcommittee. Our list of members is on the
4 second slide. We were given two questions. And
5 Carolyn has the lead on the first one. And I
6 have the lead on the second.

7 So what additional regulatory
8 procedural, legislative, or policy actions could
9 be implemented to improve spectrum efficiency
10 without harming effectiveness, including enhanced
11 funding options for federal agencies, one, and
12 then two, what practices, technical and
13 otherwise, has industry adopted to optimize its
14 efficiency across disparate networks that might
15 have useful lessons for NTIA and federal
16 agencies?

17 So Carolyn's going to talk us through
18 the work done so far in Question 1, and then I
19 will take it over on Question 2.

20 MS. KAHN: Okay, so for Question 1, we
21 had an overall subcommittee kickoff. Then we
22 focused on outreach. And we had some

1 discussions, planning on how we're going to do
2 the outreach. Our subcommittee developed some
3 survey questions both for OMB as well as for the
4 federal agencies.

5 So we first conducted targeted
6 outreach focused on the management regulatory
7 side to date. And so the point was to use these
8 responses to inform our questions. And the
9 dialogue then was a federal agency.

10 So to date, we've received some input
11 from NTIA, specifically ITS on their metrics
12 effort, and also conducted an interview with OMB.
13 We then had some -- the subcommittee provided
14 some input. We had some brainstorming
15 discussions about preliminary recommendations and
16 then decided that we did need to have some more
17 interviews to better understand the
18 implementation side. This rounder discussion
19 would help inform all elements of this topic.

20 So we then reached out to federal
21 agencies with focusing on implementation of
22 regulatory, procedural, legislative, and policy

1 actions. We reached out to DoD, FAA, NASA, NOAA,
2 and DHS, as well as to conduct some follow-on
3 discussions with ITS and OMB, specifically their
4 Office of Federal Procurement Policy. So that is
5 ongoing. Then that will be followed up with our
6 report and recommendations.

7 So we're keeping an open mind,
8 considering many options. This slide lists some
9 of the considerations that we're discussing and
10 thinking about. This includes further expansion
11 of the spectrum relocation fund.

12 This would be applicable in limited
13 situations when there's a case for auctions,
14 because that's how the SRF is replenished. In
15 other cases, we're considering devising
16 mechanisms for federal government to share
17 spectrum without giving up their assignments.

18 Some preliminary considerations that
19 we've talked about is considering recommending a
20 focus of another CSMAC working group on federal
21 mechanisms to monetize assets on a non-permanent
22 basis. This could be a follow-on effort.

1 So we're also talking about spectrum
2 efficiency metrics leveraging the work that ITS
3 is doing. We're talking about agency
4 accountability to current and additional
5 guidance, and policy, and regulatory
6 requirements, but recognize that there are some
7 resources that need to go along with it.

8 So considering making a recommendation
9 about any policy, or recommendation, or change
10 should be accompanied with sufficient resources
11 and staffing to properly address it by the
12 agency.

13 So if there's a requirement, the
14 agencies have the resources and staffing
15 available to address that properly, also
16 considering the various federal incentives and
17 proposals that are out there, considering a macro
18 level kind of systemic look at both federal and
19 non-federal options, such as sharing and property
20 rights, as well as combinations of all of these
21 different proposals.

22 **MALE PARTICIPANT:** Can I ask a

1 question before you go on? Are those
2 considerations based on the survey and the
3 interviews, more or less?

4 MS. KAHN: Based on that as well as
5 our subcommittee discussions.

6 MALE PARTICIPANT: Okay, good.
7 Thanks.

8 MS. KAHN: And I'll turn it back over
9 to Bryan.

10 MR. TRAMONT: Great. So as you can
11 see by the framing of the questions, the first
12 question was really focused on federal users.
13 The second is focused on industry practices. And
14 so we've been working since, I guess that's
15 April, on a variety of responses here.

16 We began by developing a series of 14
17 questions that we developed as a group and shared
18 with all the CSMAC, so you all got that. Those
19 questions were finalized. We solicited inputs on
20 any changes to the questions. Then we sent out
21 the questions to every member of the CSMAC as
22 well as any non-members of CSMAC that people

1 thought would be useful to get feedback from.

2 And we now are presenting --- the sort
3 of state of play right now is we have, and we're
4 going to go through briefly, the responses from
5 those questions so far. We would like to plead
6 with other members of the CSMAC to respond if you
7 haven't already.

8 We've heard from six so far. And we
9 appreciate that very much, our responsive
10 friends. But others have been less responsive.
11 So we would love to hear from more of you.
12 Because the report will be stronger the more
13 people are in it.

14 The results are anonymous. We
15 concluded that that was the best way to ensure
16 the best feedback. And so we'll now proceed
17 through the 14 questions. I am not going to
18 detail the answers. Instead, we just sort of
19 gave taglines.

20 The real reason we decided it would be
21 useful to have these listed with you all this
22 morning is so that it might --- because it might

1 trigger some of you to respond and say, oh, no,
2 that dynamic load balancing is ridiculous. We
3 should never have government do that, or what
4 have you. So it's supposed to prompt some
5 thought on various members of CSMAC to respond.

6 So what practices, technical and
7 otherwise, has industry adopted to optimize its
8 efficiency across disparate networks that might
9 provide useful lessons for NTIA and federal
10 agencies? And so here you see, and once again,
11 anonymized across the six responses.

12 And then we did have, and I didn't
13 touch on this, but it was on the slide, we had
14 manufacturers, service providers, broadcasters,
15 all participate. So we do have a good diversity
16 so far.

17 Did somebody have something on the
18 phone?

19 (No audible response)

20 MR. TRAMONT: Okay. Two is what
21 future practices has industry planned or
22 considered to enhance efficiency. And here's

1 another, once again, robust set of responses from
2 our members.

3 Then we went to --- and now we walked
4 into the mess of what is low, mid, and high band.
5 But nonetheless, industry has emphasized the need
6 for access to all that stuff. In order to be
7 able to meet customer expectations, how does
8 spectrum efficiency play into the needs for this
9 access to spectrum across the range of
10 frequencies, and what bands are users provided
11 with services? So sort of tailoring it down more
12 narrowly from the prior question. And what
13 should these types of frequency requirements
14 apply to government --- how should these types of
15 frequency requirements apply to government users?

16 So how has spectrum efficiency
17 improved as we move across different generations
18 of service as sort of an analogy to what federal
19 government users could do? What other methods
20 have you used to increase network efficiency?
21 That's basically a catchall. What difficulties
22 have you encountered when such transitions

1 occurred?

2 Commercial users have gone through a
3 series of transitions to more efficient
4 technologies which have included substantial
5 investments. And they've been doing it while
6 continuing to meet the needs of their customers.

7 That would be the same type of
8 transition that the federal government would need
9 to use in order to maintain its mission critical
10 function. And so the hope was that there would
11 be some lessons learned from the commercial side
12 that maybe the federal government users, because
13 of the lack of resources, have not had the
14 opportunity to learn those lessons yet.

15 How do you go about phasing out less
16 efficient technologies? This is particularly
17 interesting, I think, from the commercial side
18 where command and control of your customers is
19 not always available. Steve can't go to all the
20 customers at T-Mobile and make them give back
21 their phones that are inefficient. And so the
22 challenges on the federal government side are

1 different here.

2 MR. SHARKEY: Eventually we can.

3 MR. TRAMONT: Well, perhaps. Yes, we
4 have had that --- well, anyway, that's a whole
5 different story.

6 (Off the record comments)

7 MR. TRAMONT: Exactly, encouraged,
8 strongly encouraged. But they can use
9 marketplace incentives to do that, yes. Only
10 that one time.

11 But anyway, at any rate, so the
12 challenges are different here, and we recognize
13 that. But I thought that --- we thought that it
14 would be useful to get some of this from the
15 commercial guys.

16 Number 8, as a manufacturer or a
17 commercial service provider, what incentives did
18 you typically need to offer customers to incent
19 them to switch? As we just talked about, here's
20 a free phone. And do you think such incentives
21 can translate from commercial to government?

22 Are there differences in efficiency

1 advantages that can be gained based on the size
2 and frequency of the blocks of the spectrum? So
3 one of the things that we didn't, well, we wanted
4 to be cognizant of is that some of the
5 experiences, for example, of LMR, et cetera, in
6 lower band and narrower frequencies is much
7 different than you might have in a fixed
8 microwave band or in a CMRS band.

9 So we didn't want to overgeneralize on
10 the differences in this frequency advantage or
11 efficiency advantage across those systems. And
12 we're trying to capture those distinctions with
13 this question.

14 Some recent allocations in the
15 spectrum decisions are based on the use of
16 database, which we've talked about. How is
17 industry anticipating those type of controls to
18 spectrum access to impact overall spectrum
19 efficiencies in all these technologies?
20 Something the government should be developing.

21 So I think there's, in exclusive bands
22 as well, I think we recognize this question is

1 capturing some shared learning between commercial
2 and federal. But to the extent that commercial
3 entities have knowledge or experience, it may not
4 be completely transparent to the federal side.
5 We wanted to try and capture that here.

6 How important will unlicensed
7 offloading continue to be for meeting future
8 spectrum use requirements? Here to, recognize it
9 doesn't map exactly to federal users, although it
10 does have a certain QOS analogy, if you will, in
11 the sense that when commercial systems
12 traditionally turned unlicensed, they recognized
13 that they may be getting lower QOS in some cases,
14 and they may be getting less security.

15 And so are there ways in which that
16 same set of considerations may translate into
17 federal users and therefore maybe have some
18 lessons that might be useful to them?

19 What's been the biggest obstacles?
20 This is an open-ended question. And how is
21 industry overcoming them? And you see a few of
22 them, the tradeoffs between cost and power,

1 regulatory restrictions, and reforming. The loss
2 of efficiency during spectrum reforming sprang
3 up. But this is one where we would like to get
4 some more feedback if we can before we get to the
5 final report.

6 Are there other lessons learned, once
7 again, a catchall, that have application for
8 federal government users? And finally, is there
9 anything that you, you commercial user, as you
10 sit here, efficiency gains that government's
11 readily achieved that you're aware of? Sort of
12 the low hanging fruit question.

13 So those are our 14. More is better.
14 We would love to get more inputs or feedback on
15 these inputs. Our goal is to take the next four
16 to six weeks to get more responses in, including
17 non CSMAC members, if you have suggestions on
18 other people we should go to.

19 And then we will push all this into a
20 report that looks more like, I think, like a
21 catalogue of things that people have given us as
22 opposed to some of our other reports which tend

1 to be more narrative, with more editorial
2 control, is our plan.

3 So I don't know. Carolyn, if you want
4 to --- is there anything else on your work plan?
5 I think we've kind of detailed that already.

6 MS. KAHN: Right.

7 MR. TRAMONT: Jennifer, anything I
8 messed up?

9 MS. WARREN: No, not at all.

10 MR. TRAMONT: Whoa.

11 (Laughter)

12 MR. TRAMONT: Mark your calendars.

13 All right.

14 MS. WARREN: Exactly, only today.

15 MR. TRAMONT: Well, I know how you
16 feel about the schedule.

17 (Off the record comments)

18 CO-CHAIR ALDER: Other questions,
19 comments for this group?

20 MALE PARTICIPANT: I have a quick
21 question. And maybe you said this at the end.
22 Do you see recommendations coming out of this or

1 more and more work coming out of this? I mean --
2 -

3 MR. TRAMONT: I see a catalogue of
4 answers to those questions coming out of this.
5 And I feel like the challenge -- and Paige, maybe
6 you can shed light on this now -- is we're,
7 especially on my question, it may be less true
8 for Carolyn's, we are trying to come up with a
9 list, sort of a catalogue of things.

10 You can only access how useful they
11 are in terms of lessons for the federal
12 government side. And so I feel like the way the
13 work flow would probably be most logical is for
14 us to finish, NTIA to come back with places where
15 they think the suggestions actually have some
16 merit, and then maybe there's more interchange of
17 information across that, if that makes sense.

18 MS. ATKINS: Yes, I think that makes
19 sense. I would also add that if there is some
20 sort of a, I'll call it prioritization, but
21 things that have made the biggest difference on
22 the industry side, that we may want to focus on

1 initially as part of that discussion.

2 MR. TRAMONT: And the trick for us,
3 that we just --- because they're coming in as
4 inputs from across multiple CSMAC members,
5 getting that comparative is going to be tricky.
6 But I hear you. And we'll see if we can
7 prioritize.

8 CO-CHAIR ALDER: Dennis?

9 MR. ROBERSON: Dennis Roberson here.
10 How are you trying to address the challenge that
11 spectrum efficiency is in the eye of the
12 beholder?

13 I mean, there's the classical, being
14 an academic, there is the classical bits, per
15 hertz, per square meter or cubic meter, depending
16 on your perspective. There's that kind of metric
17 for spectrum efficiency. But that doesn't apply
18 when you're in a specific case. Spectrum
19 efficiency for public safety is very different
20 from spectrum efficiency for cellular, commercial
21 cellular. And it's very different for satellites
22 than it is. So how are you trying to deal with

1 that?

2 Since I've fought with this now for a
3 long time and still don't really have an answer
4 that I'm very comfortable with other than going
5 back to the academic side. And I can hide behind
6 that one.

7 MR. TRAMONT: Well, and your
8 channeling our initial call. So we began our
9 initial call by saying that we are not going to
10 re-litigate what the definition is of spectrum
11 efficiency, that we were going to take the
12 definition that had previously been adopted by
13 CSMAC in one of our earlier working groups and
14 just use it. Because we worried that it was
15 infinite regression for all the reasons you just
16 outlined.

17 MR. ROBERSON: Yes, okay.

18 MS. KAHN: And if I could, I think
19 what we're also going to do, as we're talking to
20 the federal agencies that are the operators, is
21 let them define for us how they want, you know,
22 and we'll incorporate that so that it's more

1 mission specific or agency specific. We've run
2 into this discussion already with one of the
3 agencies.

4 MALE PARTICIPANT: Yes. Let me make
5 one comment about that. Because I'm setting up
6 some of these agency interviews. And so you have
7 this OMB definition. There is a definition, you
8 know, in the OMB thing. And they say what the
9 heck is that?

10 This is how we --- we're going to hear
11 about what they think spectrum efficiency is.
12 And it's interesting, I think, that all of these
13 people we've been talking to have a different
14 idea of what it is. And they're all doing it to
15 some level. But it's not on some kind of uniform
16 mass thing that the OMB circular says.

17 CO-CHAIR ALDER: Steve?

18 MR. SHARKEY: Right. I'm, you know,
19 I think to Paige's point on what's the most
20 effective, and one of the things that, I guess, I
21 don't see in here is there's a lot of kind of
22 focus on technical implementation of what drives

1 efficiency and techniques that are used.

2 But one of the things that, at least
3 from the commercial perspective, I would say, has
4 really driven efficiency or economic incentives,
5 and, you know, that may be something that should
6 be worked into here. How do we do that?

7 I mean, it's difficult to force
8 somebody to implement a specific technology or
9 technical approach to it. And I think that's the
10 whole basis of an overall economic incentive
11 approach. And I know we're looking at that in
12 other areas for federal users to promote sharing,
13 or to do other activities. But it may be
14 something that we should work into this report as
15 an effective mechanism to help drive efficiency.

16 MALE PARTICIPANT: He needs to respond
17 to the survey, right?

18 MR. KOLODZY: I can't confirm or deny
19 whether he has. I mean, I think we were trying
20 to capture a little bit with Question 8 about
21 what incentives commercial uses to offer
22 customers. But it's a fair --- yes, maybe we

1 just need to --- or also as well is expanding and
2 maybe under --- you were looking at Number 13 or
3 12, I think, at 12.

4 But eight talks about what you do as
5 a commercial provider to incentivize customers to
6 switch to more efficient technologies and how
7 they translate. So maybe we can put some more
8 stuff in there.

9 MALE PARTICIPANT: Yes, because I
10 think it's different of what we incentivize
11 customers to do versus how we, you know, what we
12 do as far as densifying cells, or transitioning
13 to the new technology because it's more ---

14 MALE PARTICIPANT: Well, you're in ---

15 MALE PARTICIPANT: Right, because it's
16 more efficient. Yes.

17 CO-CHAIR ALDER: Jennifer, do you have
18 a comment?

19 MS. WARREN: Yes. I was just waiting
20 for an opportunity. I think this discussion that
21 Steve is raising is part of what will be
22 discussed in Carolyn's subgroup. Because it's a

1 question of what is the transapplicability, if
2 you like, of that concept? And I have a feeling
3 that that's where we would have that discussion.

4 CO-CHAIR ALDER: Well, I personally
5 think this first task is very interesting,
6 because we had it in the past with the adoption
7 of the spectrum relocation fund, and it was
8 really powerful. And I think finding other
9 powerful means like that is a real opportunity
10 but obviously difficult. So I think it's
11 interesting.

12 Any other comments from the phone on
13 this topic?

14 (No audible response)

15 CO-CHAIR ALDER: Paige, did you have
16 any?

17 MS. ATKINS: No.

18 CO-CHAIR ALDER: So thank you very
19 much. Thanks to all the subcommittee members as
20 well as co-chairs. We have definitely gotten
21 feedback. And we're definitely aware that it's
22 been a tough go. We kind of started late. We

1 didn't really get all these things launched until
2 mid-April. And we asked for interim
3 recommendations here in August which is really
4 over the summer. So we realize all that. It's a
5 very compressed timeline.

6 So again, we're going to ask now for
7 November to consolidate into a final set of
8 recommendations that the NTIA can react to
9 formally.

10 I said it earlier but will say it
11 again, because we've talked about this as a
12 group, that there's certainly freedom to say,
13 hey, this is something we don't have a final
14 recommendation on. We recommend, you know,
15 continued work.

16 Please have something for, you know,
17 each of your subgroups. But there's definitely
18 no --- it's not necessary to cover all the
19 questions that have been put in front of you if
20 you feel that some of them you just don't have
21 good answers for and you want to focus on. So
22 it's definitely a degree of freedom that's

1 available to everyone.

2 But with that said, we are going to
3 still shoot for this one -- it's kind of been
4 this one-year experiment where we're going to try
5 and get a wrap-up by November. And then what
6 we'll do is embark on next year with a refreshed
7 set of topics, perhaps some carryovers.

8 Again, with that, thanks also again
9 for everyone getting me everything on time. It
10 made it very easy to go around this time. All
11 right, with that, I think we're at the section
12 where we have opportunity for public comments.
13 Ah, we have a commenter. I don't know if we have
14 a mic available or the ---

15 MALE PARTICIPANT: Come to the front,
16 Mike, and get a mic.

17 (Laughter)

18 MALE PARTICIPANT: Or two mics.

19 (Off the record comments)

20 MALE PARTICIPANT: And please
21 introduce yourself.

22 MR. MARCUS: All right, I'm Mike

1 Marcus, a retired FCC employee and occasional
2 professor at Virginia Tech. I've also been very
3 interested in the specific issue related to those
4 comments of spectrum above 95 gigahertz which I
5 assume qualifies as millimeter wave discussion.
6 And I hope some people can stay around for my
7 paper tomorrow afternoon on this issue.

8 But let me make one point, for
9 example, on propagation. A key issue in above 95
10 gigahertz is protection of passive satellites in
11 NGSO orbits. The key propagation model for that
12 is IGRP676. And there was no publicly available
13 software to do that.

14 NASA has an internal implementation
15 they won't let other people use. May I suggest
16 that ITS either make a copy themselves or get
17 NASA to make their's public available but in
18 order to engineer that.

19 But more importantly, above 95
20 gigahertz, all the spectrum is NG shared. And
21 there has been a lot of friction in how to move
22 above that. Chairman Pai has publicly said he

1 wants to move about 95 gigahertz.

2 I would urge this community to
3 consider, in the iteration, to look at the
4 special problems above 95 gigahertz where sharing
5 is very, very different than at lower frequencies
6 because the physics is very, very different.

7 I do not begrudge the cellular
8 industry more spectrum. There are mobile
9 allocations there. The mobile allocations should
10 stay there. But there are no service rules for
11 anyone above 95 gigahertz. And while the
12 discussion in this group about commercial has
13 seemed to be only for cellular, there are other
14 commercial NG users, other than cellular, and
15 they should be given access to a spectrum above
16 95. Thank you.

17 CO-CHAIR ALDER: Thanks, Mike. Other
18 public commenters?

19 (No audible response)

20 CO-CHAIR ALDER: Do we have any
21 comments on the phone from the public? Oh wait,
22 we have one more in the room. Is that correct?

1 No. Someone waving to Janice. Again, anyone on
2 the phone from the public desire to comment?

3 (No audible response)

4 CO-CHAIR ADLER: Okay, with that we'll
5 close the public comment period. We have an
6 opportunity now on the agenda for remarks from
7 the co-chairs. I think I made my remarks.

8 One of the things I think has been
9 helpful for the group, and this is a comment for
10 the liaisons, feedback from the liaisons has been
11 particularly helpful in refining what is
12 important to each of these subcommittees. So I
13 encourage and thank all the liaisons from the
14 NTIA that have been doing the work. I think
15 that's been very, very valuable.

16 And they've also produced some
17 feedback from these groups that have helped us
18 have visibility. So again, I just wanted to
19 thank the liaisons for their work and encourage
20 their further good work. Mark, do you have
21 anything?

22 CO-CHAIR GIBSON: I'd only like to

1 reiterate what I said earlier. And that is that
2 first of all there are liaisons, and working with
3 NTIA has always been good. But with the, again,
4 I use CBRS as an example, the collaboration
5 that's been going on has been just remarkable.
6 And so I'd like to thank everybody that's
7 involved for the driving to success.

8 I mean, it's been complicated, it's
9 been difficult, but we're all moving in the same
10 direction. And I think that takes a shared goal.
11 So I say on the dais, thank you. That's why I'm
12 standing up here. So thank you.

13 CO-CHAIR ALDER: With that, unless
14 there's any other comments from ---

15 MS. ATKINS: Just thanks to all again.
16 We really appreciate your inputs and your sage
17 wisdom. So thank you very much.

18 CO-CHAIR ALDER: With that, we'll be
19 adjourned.

20 MALE PARTICIPANT: You want to
21 indicate the next meeting time?

22 MALE PARTICIPANT: It's in November.

1 MALE PARTICIPANT: November, yes. I
2 don't think a dates been locked in. David, do we
3 have a date?

4 MALE PARTICIPANT: It's in DC.

5 MALE PARTICIPANT: Dave, are you
6 soliciting venues?

7 (Off the record comments)

8 MALE PARTICIPANT: If you're not,
9 don't talk to Dave.

10 (Off the record comments)

11 MALE PARTICIPANT: All right, thanks,
12 everyone. And hope you enjoy the clips.

13 (Whereupon, the above-entitled matter
14 went off the record at 3:54 p.m.)

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C E R T I F I C A T E

MATTER: Meeting of the Commerce Spectrum
Management Advisory Committee

DATE: 08-15-17

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