

UNITED STATES DEPARTMENT of COMMERCE
COMMERCE SPECTRUM MANAGEMENT
ADVISORY COMMITTEE (CSMAC)

TRANSCRIPT of the MEETING of
Thursday, March 1, 2012
Stanford Institute for
Economic Policy Research
366 Galvez Street, Koret-Taube Room
Stanford, California 94305

CSMAC Members Present:

Larry Adler

David Borth

Michael Calabrese

Martin Cooper

Mark E. Crosby

Gary Epstein

Margaret Feldman

Harold Furchtgott-Roth

H. Mark Gibson

Dale N. Hatfield

Kevin C. Kahn

Doug McGinnis

Mark A. McHenry

Carl Povelites

Richard Reaser, Jr.

Dennis Roberson

Charles M. Rush

Daniel Dean Stancil

Bryan Tramont

Jennifer Warren

National Telecommunications Information
Administration (NTIA) Staff present:

Karl B. Nebbia, Associate Administrator,
Office of Spectrum Management

Lawrence Strickling, Assistant Secretary for
Communications and Information

Bruce M. Washington, Designated Federal
Officer, Chief of Staff, Office of
Spectrum Management

CONTENTS

Welcome and Opening Remarks 4

NTIA Review of CSMAC Recommendations. 10

Reports from the Subcommittees:

 The Search for 500 MHz. 48

 Spectrum Sharing. 67

 Unlicensed Spectrum102

 Spectrum Management Improvements.137

Next Steps/Open Discussion.157

Public Comment.169

Scheduling of Next Meeting.179

Adjournment180

PROCEEDINGS

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22

(9:00 a.m.)

CO-CHAIR FONTES: Okay. Why don't we just go around the table and then we'll call out the names of the people we think are on the phone. And then you can say yes on the phone.

So you want to start, Larry?

MR. STRICKLING: Larry Strickling, NTIA.

DR. ADLER: Larry Adler. I'm with Google.

DR. KAHN: Kevin Kahn, Intel.

MR. EPSTEIN: Gary Epstein, Aspen.

DR. STANCIL: Dan Stancil, North Carolina State.

MS. FELDMAN: Molly Feldman, Verizon Wireless.

MR. POVELITES: Carl Povelites, AT&T.

MS. WARREN: Jennifer Warren, Lockheed Martin.

1 MR. GIBSON: Mark Gibson,
2 Comsearch.

3 MR. HATFIELD: Dale Hatfield. I
4 wear several hats, but probably University of
5 Colorado is the most pronounced.

6 CO-CHAIR FONTES: That'll do for
7 today.

8 MR. HATFIELD: Right.

9 MR. MCGINNIS: Doug McGinnis,
10 Exelon.

11 DR. FURCHTGOTT-ROTH: Harold
12 Furchtgott-Roth, Furchtgott-Roth Economics.

13 MR. NEBBIA: Karl Nebbia, NTIA.

14 CO-CHAIR FONTES: Brian Fontes,
15 National Emergency Member Service, Co-Chair.

16 CO-CHAIR ROSSTON: And Greg
17 Rosston, Stanford.

18 So on the phone. I'm going to go
19 through alphabetically on the phone, so if you
20 can just say your name after that.

21 David Borth.

22 DR. BORTH: Yes, I'm here.

1 CO-CHAIR ROSSTON: Michael

2 Calabrese.

3 Marty Cooper.

4 Susan Crawford.

5 Mark Crosby.

6 David Donovan.

7 Dennis Roberson.

8 Charles Rush.

9 MR. MCGINNIS: It's like they're
10 all hanging up after you call their name.

11 CO-CHAIR ROSSTON: Brian Tramont.

12 MR. TRAMONT: Here.

13 CO-CHAIR ROSSTON: Yay, we got
14 somebody. At least the phone's still working,
15 we know that.

16 Did anyone else join? We heard a
17 bunch of beeps on the phone.

18 DR. MCHENRY: Mark McHenry here.

19 CO-CHAIR ROSSTON: Okay.

20 DR. RUSH: Charley Rush joined.

21 CO-CHAIR ROSSTON: Okay.

22 CO-CHAIR FONTES: Anyone else?

1 Okay. Well, welcome, everyone, here to
2 Stanford. Happy, glad to have you out here.
3 Sorry we didn't have the sunny California
4 weather for you, but it's still California.
5 And we appreciate -- so, you know, there's
6 been an incredible amount of work done and
7 work product done for this meeting. And we
8 appreciate all the hard work and think that
9 there's still more to do. And we're happy to
10 keep addressing the questions that NTIA is
11 posing and to have the back-and-forth.

12 So we're going to start with Larry
13 Strickling giving some opening remarks.

14 CO-CHAIR FONTES: There were three
15 more people that joined the call.

16 CO-CHAIR ROSSTON: Okay. So who
17 just joined?

18 MR. CALABRESE: Michael Calabrese
19 is here.

20 CO-CHAIR ROSSTON: Okay.

21 PHONE PARTICIPANT: David Fritson,
22 the Mitre Corporation.

1 CO-CHAIR FONTES: And was there
2 someone else that joined?

3 PHONE PARTICIPANT: Mark Onpepper,
4 TIA.

5 CO-CHAIR FONTES: Great.

6 MR. COOPER: Yes. Marty Cooper,
7 Dyna.

8 CO-CHAIR FONTES: Hi, Marty.

9 MR. COOPER: Hi.

10 CO-CHAIR FONTES: We're just
11 getting started, everyone.

12 CO-CHAIR ROSSTON: Okay. So,
13 Larry.

14 WELCOME and OPENING REMARKS

15 MR. STRICKLING: Well, thank you,
16 Greg. And thank you for hosting.

17 When we were recruiting Greg to be
18 the Co-Chair of this iteration of CSMAC, one
19 of his conditions was that we hold at least
20 one meeting in California, and for which there
21 really we put up no resistance as to that idea
22 whatsoever because the idea of being out here

1 in the beginning of March, we figured we'd
2 catch some good weather. And I think the
3 weather will still turn nice here for the rest
4 of the day.

5 But anyway, Greg, thank you for
6 hosting --

7 CO-CHAIR ROSSTON: Sure.

8 MR. STRICKLING: -- in this
9 wonderful facility here.

10 I want to welcome all of you who
11 have joined us in person and by phone.
12 Needless to say, this is a busy and a rich
13 time for spectrum issues. Unfortunately, some
14 of them we won't be able to talk about today
15 because they're so new, but I think everyone
16 is aware of the legislation that Congress
17 passed a couple of weeks ago to authorize
18 incentive auctions at the FCC, but also giving
19 NTIA a lot of new work to do, in particular,
20 standing up the first net board to build the
21 \$7 billion public safety network as well as
22 tasking us with a number of very specific

1 spectrum-management issues and some reports
2 that we're going to have to conclude and a
3 rulemaking that we'll have to conduct in the
4 next six months on the issue of the technical
5 review board for federal agency transition
6 plan.

7 So I think some of these topics
8 will be things we'll want to bring back to
9 CSMAC and perhaps have a discussion on it our
10 next session. But the bill just having -- or
11 the law just having been signed about ten days
12 ago, it really -- and the agenda having been
13 set for this meeting before really didn't
14 provide much of an opportunity to get it on
15 today's discussion.

16 So I know folks are still waiting
17 to see our 1755 report, and we'll be talking
18 around it today. I'm hopeful it will come out
19 shortly. We have some slow readers at our
20 sister agency and --

21 (Laughter.)

22 MR. STRICKLING: -- maybe now they

1 will be able to pick up the pace a little bit
2 and get this thing finally cleared and out so
3 that everybody can see it and we can move
4 ahead with a lot of what will be very
5 important tasks coming out of those
6 recommendations.

7 So with that I think we'll go
8 right to today's agenda, and I'll turn it back
9 to Greg and Brian. Thank you.

10 CO-CHAIR FONTES: Great. There
11 were a couple of more people that joined the
12 call during Larry's comments. If we can get
13 your name so we can mark it here on the roll.

14 MR. ROBERTSON: Dennis Roberson
15 here.

16 MR. CROSBY: Mark Crosby here.

17 PHONE PARTICIPANT: Alexander
18 Gavinich, Motorola Mobility.

19 MR. SHARKY: Steve Sharky, T-
20 Mobile.

21 CO-CHAIR FONTES: Okay. I think
22 that was probably it in terms of the new

1 calls.

2 Okay. At this point, Karl.

3 NTIA REVIEW of CSMAC RECOMMENDATIONS

4 MR. NEBBIA: One of the things
5 that we felt was important for us to do as we
6 have been moving forward in the committee work
7 was to return to the recommendations that had
8 been made thus far and to give you feedback
9 regarding the NTIA views on those
10 recommendations.

11 We actually have some reporting
12 requirements under the FACA rules where we
13 need to report, I believe it is, annually
14 regarding how many of the recommendations we
15 have implemented and that sort of thing. And,
16 as we have discussed in the past at times in
17 some of the early recommendations, it was a
18 challenge to figure out exactly what the
19 recommendation was. And certainly the group,
20 I think, has done a terrific job in moving
21 that forward and being more specific about
22 what they were recommending. It doesn't mean

1 that in every case we're not going to have
2 questions, which I think we very likely will.
3 And I will highlight some of those this
4 morning.

5 But, nonetheless, we wanted to get
6 back with you and kind of let you know what
7 our thoughts were on the recommendations that
8 are provided. So we have provided a document
9 to you. You should have that circulated, but
10 there are also copies on the table out there.

11 And, Bruce, I don't know if we can
12 -- can you bring what's left over there, so if
13 anybody hasn't got it, they can -- you can
14 just kind of run them around?

15 MR. WASHINGTON: Sure.

16 MR. NEBBIA: But, nonetheless, let
17 me begin. First of all, we look back over the
18 recommendations from the most recent to the
19 oldest set that we had not provided feedback
20 on. If you will remember, there was a couple
21 summers ago I gave a briefing there on our
22 responses to the initial set of

1 recommendations that we had been provided.

2 So what you have before you
3 includes all the recommendations that have
4 been made since that time, with the exception
5 of the recommendations that were made by a
6 working group that dealt with interference and
7 dynamic sharing. That was kind of an odd
8 mixture of topics for a group. But,
9 nonetheless, our challenge here in putting
10 this together is that in their document there
11 was about 15 pages of individual
12 recommendations. And we just didn't have a
13 chance to get through them all, so they were
14 very, very numerous.

15 So let's start with the "Search
16 for 500 MHz." The first case of using the LTE
17 characteristics that were provided by the
18 Committee. NTIA has, in fact, used those in
19 its analysis of this band, so when that report
20 comes out you will see that they were the
21 characteristics that we did, in fact, use in
22 that effort.

1 I think as we go forward and
2 there's any more discussions between
3 government and industry related to that band,
4 we will probably need more refined
5 characteristics in some cases to try to fine
6 tune any sharing type of interaction or
7 transition, and so on.

8 With respect to -- and please feel
9 free if you have a question along the way, to
10 stop me at any point.

11 In implementing the process --
12 PHONE PARTICIPANT: A question? A
13 question. For those of us that are on the
14 phone, where we would find the materials that
15 you're talking through?

16 MR. NEBBIA: It's -- I think the
17 file name is "NTIA Response to the CSMAC
18 Recommendations." And it's on the website.

19 PHONE PARTICIPANT: Thanks. Got
20 it. Got it.

21 MR. NEBBIA: Okay. So the second
22 thing was setting up this informal process,

1 consistent with applicable laws. We believe
2 and agree that some sort of face-to-face
3 discussions is going to be critical to moving
4 the ball forward in any band, not just the
5 1755-1850, but any band that we relocate from.
6 We don't have many choices, I think, ahead of
7 us, where it's likely that we could, for
8 instance, just move out of a band without any
9 interaction with those who are coming in. And
10 we certainly found in our experience with the
11 1710-1755 move, having understanding between
12 those coming in and those vacating is
13 absolutely critical to the process.

14 In this case we have asked one of
15 our working groups to consider the nature of
16 this, and we'll be talking about that a little
17 bit later.

18 Using the idea --

19 DR. KAHN: Karl?

20 MR. NEBBIA: Excuse me. Yes?

21 DR. KAHN: More generally, and it
22 goes to this point and others I think, there

1 seems to be, you know, a reasonable amount of
2 work getting geared up in places like ATCE on
3 future sharing protocols and, you know, sort
4 of advancements to that whole set of
5 standards, LTE and others, to sort that out.

6 Are you guys at least going to
7 monitor that kind of stuff and hopefully maybe
8 even participate to some degree in that as it
9 goes forward?

10 MR. NEBBIA: Yes. And that was --
11 probably you should mention your name so those
12 --

13 DR. KAHN: Oh, I'm sorry. Kevin
14 Kahn.

15 MR. NEBBIA: -- who are on the
16 phone know who's speaking.

17 But my sense in that is certainly
18 industry is directly working in that for their
19 own sharing reasons, that I think ours are
20 such that or our uses are such that we would
21 probably be looking for the outcome of that
22 kind of work as opposed to trying to influence

1 it around what types of systems the government
2 has. So at this point we're not engaged in it
3 so much as looking for the outcome and see
4 what people are using. And so --

5 DR. KAHN: Yes. I guess my only
6 comment on this is it seems to be a fairly
7 open field with a lot of, you know, early
8 ideas being germinated by, you know, kind of
9 the major players across the commercial side.
10 And the form that those standards evolve
11 toward might be, you know, more or less
12 helpful, right, to the long-term processes
13 that you guys have to deal with, so I -- even
14 if you don't want to engage it in a super
15 direct manner, at least I would strongly
16 suggest you guys monitor carefully, because,
17 --

18 MR. NEBBIA: Okay.

19 DR. KAHN: -- you know, if that
20 goes off in the weeds somewhere, from your
21 perspective that's bad. On the other hand,
22 you know, they might just make some arbitrary

1 choices that can be made in a way that's more
2 helpful or less helpful to some of these, you
3 know, we're moving in, you're moving out, and
4 other similar --

5 MR. NEBBIA: Right.

6 DR. KAHN: -- kinds of things.

7 MR. NEBBIA: Okay. Okay. With
8 respect to the staging issue, certainly we
9 understand the value in doing that. At the
10 same time we have to safeguard agency mission.
11 So if there's staging involved with the
12 process of moving out of a band, we have
13 considerations like the fact that some of the
14 systems may operate across the entire band and
15 may not, in fact, be able to conduct their
16 full mission in a situation where they've lost
17 a number of the channels that were available
18 to them.

19 So I think staging is important,
20 and we'll be looking at that certainly in our
21 1750-18- -- 1755-1850 report, and consider
22 that for the future.

1 But I think as noted in Janice's
2 additional comments, the aspect that some of
3 the systems that we have are very likely to
4 operate across the entire band is going to be
5 an issue that we'll have to work with.

6 MR. EPSTEIN: Karl?

7 MR. NEBBIA: Yes.

8 MR. EPSTEIN: Gary Epstein. You

9 --

10 MR. NEBBIA: Can you get -- can
11 you pull the mic over, Gary? That works for
12 the phone, but not for...

13 MR. EPSTEIN: Do you foresee
14 asking this particular subcommittee once the
15 1755 report is out, to focus in on those
16 specific questions with respect to the report?

17 Because we've been unable to do
18 that, you know, to date, and that may be a
19 next task.

20 MR. NEBBIA: Well, I think --
21 obviously what we've asked initially is what
22 kind of construct you would see in us putting

1 together an industry government forum, staying
2 within the various requirements of the law.

3 My -- my view, I guess, is that in
4 setting up that, that that's where most of
5 that detailed discussion would come up and
6 that for this Committee, you would probably be
7 moving onto other -- you know, other aspects
8 once we've engaged that.

9 We have some thoughts that we'll
10 talk about when that working group comes up as
11 to maybe some other things that they could
12 look at also, at least at this time, so.

13 Okay. The last item was: Making
14 spectrum available to the commercial users on
15 an exclusive use. I think certainly everybody
16 sees that that is what, you know, gives the
17 commercial user the most flexibility, probably
18 the best value in terms of choices and their
19 ability to progress their work plan.

20 However, I think the reality is
21 that we're going to face a couple issues. One
22 is the difficulty of moving some systems out

1 of bands in the future. So we may be in a
2 situation where a shared environment becomes
3 the long-term reality.

4 Another aspect is the fact that,
5 once again, when we moved the last time, where
6 we had -- we had a combination of two types of
7 things in 1755-1850 -- or, excuse me -- 1710-
8 1755. We either had fixed-microwave systems
9 that we knew could be moved in, let's say, one
10 -- one-to-five-year period, depending on
11 snowfall. It seems like that was one of the
12 impacting things, because they're remote areas
13 oftentimes.

14 And then the other systems that we
15 had in there had the entire 1710-1850 range to
16 operate in. And, for the most part, they --
17 they decided that they could live without that
18 lower portion.

19 So, in essence, immediately they
20 moved to a situation where they were using the
21 spectrum above 1755, so there was little in
22 terms of a true kind of transition, you know

1 portions being moved at bits at a time, and so
2 on. In the future, the systems that we have
3 in the 1755-1850 band or other bands the
4 federal agencies have are probably going to
5 experience much longer transitions, parts of
6 them moving over a period of time. And,
7 therefore, the issue of sharing may not be the
8 final outcome that sharing is required. But
9 certainly the transition periods are going to
10 be long enough that somehow we're going to
11 have to work through sharing concepts.

12 So, once again, if the goal still
13 is exclusive spectrum, I think that's
14 certainly an understood goal, but I think many
15 of the practical realities are going to say
16 either in the end we can't get there or the
17 transition is going to be long enough that
18 you're still going to have to deal with these
19 sharing concepts.

20 Okay. Any other questions on --
21 on that group of recommendations?

22 No? Okay. The second one, the

1 spectrum management improvements, I actually
2 inserted in the text here some areas where
3 some feedback that we're looking for, the
4 committee, I think there's agreement all
5 around that we would love to have a database
6 that was clean and perfect. We would like to
7 be able to go through all those records, but
8 we have about 250,000 government records. And
9 even, you know, trying to do them over a one-
10 year period or a five-year period, to think
11 we're going to go through all those records at
12 a level of depth where we know for a fact
13 that, yes, the date is all accurate on these
14 records, would certainly be extremely
15 challenging to do that.

16 So we were looking for more
17 clarity as to how the Committee would expect
18 that that would be done. That is somewhat
19 incorporated in the other recommendations,
20 however, that you recommend a system of
21 priorities or choosing bands that you're going
22 to do, and limiting the work, establishing

1 goals and so on along the way.

2 So I think in this context we
3 would appreciate any guidance that you can
4 provide back as to how you think we should
5 choose the bands that we do. One of the
6 possibilities, of course, is that we do the
7 1755-1850. But actually if we get into a
8 relocation of that, there's going to be a
9 process of the companies laying out their
10 locations and information about their uses.
11 So that may actually be -- the improvement of
12 that data may be incorporated in that process,
13 as opposed to being a separate process. But
14 any, any input that you can give us along the
15 lines of determining what those priorities
16 should be and what you actually think is, you
17 know, certainly critical for us to check in
18 those, so.

19 MR. GIBSON: This is Mark Gibson.

20 CO-CHAIR ROSSTON: Mark.

21 MR. GIBSON: I just want to make
22 -- is this on? I want to make a comment.

1 And, you know, we mentioned in
2 this report and we mentioned in what we're
3 going to present today that it would be
4 helpful to have some visibility into the
5 architecture, at least the data architecture
6 behind FSMS. Because knowing that will help
7 us better give you some direction as to how
8 what we're thinking will impinge on that
9 develop or be able to work through -- with
10 that development.

11 For example, the suggestion about
12 normalizing the data elements and all that,
13 and setting up tables. So if we know that,
14 then -- Dan, and you and I talked about this
15 -- one suggestion would have been just
16 initially do this using software in scripts,
17 you know, because you can clean a lot of data
18 doing that.

19 My next question is: Are you
20 looking for a report back from us on this then
21 as sort of an addendum to the original report?
22 I'm not --

1 MR. NEBBIA: Yes.

2 MR. GIBSON: Okay.

3 MR. NEBBIA: I think that would be
4 very helpful --

5 MR. GIBSON: Okay.

6 MR. NEBBIA: -- just as, you know,
7 a small addendum to what you've got, --

8 MR. GIBSON: Okay.

9 MR. NEBBIA: -- whatever --

10 MR. CROSBY: This is Mark Crosby,
11 Karl and Mark. And what -- then I'm working
12 on the Committee with Mark. I'm going to make
13 -- hopefully we can make the assumption that
14 NTIA is in support. I know it's going to be
15 an arduous process, Karl. And whether it
16 takes one year, two years, three years, five
17 years, or ten years, I assume that this is
18 something that is supported by you and NTIA,
19 and -- because I think that would be in our
20 report.

21 I mean and I know it's difficult,
22 but we ought to pick a date and even if we do

1 it in pieces, I think the end game is still
2 valuable. And I think -- hopefully it's still
3 valuable to NTIA. But so I -- I get a little
4 concerned when you say this is going to be an
5 arduous process.

6 Absolutely. And if it was easy,
7 we wouldn't -- I don't think we'd be talking
8 about. But I think it's something we got to
9 get to. And I just hope that that is -- that
10 view is shared by you and perhaps others at
11 NTIA. That's all.

12 MR. NEBBIA: No. I think
13 certainly it would be a very valuable effort.
14 In fact, in our efforts to work on FSMS, one
15 of the components of the plan was a review of
16 the data. At this point I think one of the
17 challenges is what that entails and how much
18 it costs to do that.

19 And we've noted under point 6 of
20 the recommendation is that the working group
21 attached a particular expected tab to that
22 effort of between 2 and \$4 million. I think

1 that's noteworthy. And that becomes part of
2 the -- part of the issue. But I think even 2
3 to 4 million is probably not a cost that one
4 would associate with a specific effort to go
5 out and verify the data on all 250,000
6 records, that that's still, even for the 2 to
7 4 million, has got to be some sort of focused
8 effort and so on.

9 Now the other possibility of
10 course is that as we're putting together FSMS,
11 and that ties into some of the other
12 recommendations, we are expecting that there
13 is going to be data entry components that
14 screen the data, that funnel the data into
15 proper formats and numbers that make sense and
16 that sort of thing, but we'll also be
17 including in there this idea of a distributed
18 characteristics database related to parts of
19 the equipment, and that will help also.

20 So part of the question here,
21 Mark, in the end, because of the cost, still
22 gets to this issue, well, as we're putting

1 FSMS online, do we use that as the primary
2 technique to ensure that the data is being put
3 in correctly and that it makes sense; or do we
4 go out on some additional, very focused,
5 directed effort on reviewing all the data of
6 these assignments. And so I think that's the
7 challenge here: What do we in a focused way,
8 what can we accomplish that's of value,
9 because certainly reviewing in detail all
10 250,000 is not going to be a 2 to \$4 million
11 effort. It's going to be significantly more
12 than that.

13 Not to mention the fact that even
14 after you review the data, that still doesn't
15 confirm for you that the system is actually at
16 the location and operating. So you then have
17 the choice, well, does the process here
18 involve face-to-face, you know, going out to
19 the sites; 250,000 is too many, obviously, to
20 do that.

21 DR. KAHN: I think -- this is
22 Kevin Kahn.

1 MR. NEBBIA: That's Kevin.

2 DR. KAHN: I think, though, I mean
3 I sympathize with the problem you've got.
4 It's a huge one, so I'm not going to make
5 light of that at all, and finding a way to get
6 there is going to be critical. But, you know,
7 a couple of observations.

8 One, you know, creating FSMS -- I
9 can't get it out of my mouth.

10 MR. NEBBIA: We wrote it just for
11 that purpose.

12 DR. KAHN: Yes. I have yet to be
13 able to say that smoothly, so I'm not even
14 going to try.

15 But, you know, creating what
16 appears to be, right, a much more
17 comprehensive and integrated and
18 interactively-available, automated-available
19 database full of bad data accomplishes
20 nothing, right? I mean, you know, you can
21 have incredible precision and if it's all
22 wrong, this doesn't help anyone, you guys or

1 the people who want to access it.

2 So while I understand the concern
3 in trying to move to the new databases and the
4 new systems, you're going to have to find some
5 way as data goes into that database to at
6 least flag it as it has been verified or not
7 and the level of reliability you associate
8 with it. And there's going to have to be some
9 kind of a score across the databases to, you
10 know, -- whether it's, in fact, good enough to
11 be useful. So I think that's sort of --
12 that's an issue you have to kind of figure out
13 your way around, even without asking for an
14 audit or a review of all of the records you've
15 got.

16 The other thing is that, even
17 having done that, you really need processes
18 and procedures well characterized for
19 maintaining the data quality over time,
20 because even if you did a fantastic review of
21 all your Herculean effort right prior --
22 enough people to take our unemployment rate in

1 half and reviewed all 250,000 records, you
2 know, you say, great, we've got a great
3 database, a year from now is it still a great
4 database? Well, only if on a continuing basis
5 there is a way to validate the data.

6 And I think that's one of the
7 reasons why in the last go around we had a lot
8 of discussions about how do you export the
9 responsibility for the continuing accuracy of
10 that data to the people who are making the
11 entries in the database. How do you force
12 that responsibility to the owner of the
13 record, as opposed to the kind of database
14 itself.

15 And I think comprehending both of
16 those things in some cohesive plan is going to
17 be required or you're going to do an awful lot
18 of work here and wind up, you know, with
19 something which is not a hell of a lot of use
20 in the long run.

21 MR. NEBBIA: Well, certainly, I
22 think, as we transition to the FSMS and I

1 think, once again, the validation checks built
2 into the system will be significantly greater
3 than what we have now. The system
4 characteristics databases and so on will help
5 in that process.

6 I think we're certainly, if
7 nothing else, you will see an improvement over
8 that period of time. Now certainly at the
9 same time, though one could take issue with
10 specific components of our data today, the
11 database has, in fact, functioned in that
12 we've been able to perform spectrum management
13 through the many years and continued to do
14 that without people interfering with each
15 other all the time.

16 So we have been functioning based
17 on what we have. Perfectly? Obviously not,
18 but that's reality. The same way that the
19 Commission is functioning right now
20 essentially on an admin or licensing database,
21 okay. They don't have a compatibility
22 database, and so on. So --

1 DR. KAHN: I agree with that, but
2 I think you're still missing one -- now I
3 could be completely wrong about this, but when
4 I look at what's happening in the radio world
5 here, the sort of sea change that seems to be
6 underlying a lot of this is the notion of
7 automated mechanisms to allow for access to
8 spectrum.

9 And there's a huge difference
10 between saying, well, you know, we're managing
11 -- you know, we're managing to handle things
12 where it means that an engineer goes into this
13 collection of information and makes an
14 evaluation and, you know, et cetera, et
15 cetera. And being in a world where what we're
16 talking about is mechanisms where autonomous
17 systems are on a dynamic basis querying some
18 data in order to figure out whether they can
19 operate or not.

20 Now maybe we're not headed there,
21 right. But all the indications around the
22 industry seem to be that's where people want

1 to go. So while I applaud your ability to
2 manage the spectrum, you know, with the
3 shackles you've got on today, don't
4 underestimate what it means when it's not an
5 educated engineer staring at those pieces of
6 information and making judgments and going,
7 'Oh, yes, but I think I remember, you know,
8 there's this like other guy who's in that
9 band, and we ought to go check on him,' but
10 rather, you know, some wacky algorithm in some
11 radio someplace that's coming in and looking
12 at the database and trying to make a judgment.

13 So I think that's the underlying
14 sea change that I'm worried about, is that if,
15 in fact, the world moves to more of an
16 automated, sharing approach, that the
17 criticality of these databases becomes much,
18 much higher. And the tolerance for errors in
19 them goes way down because it's not a smart
20 person anymore, it's a system.

21 MR. GIBSON: Well, and what you
22 end up having to do then is design a sharing

1 protocol that anticipates bad data.

2 DR. KAHN: Right.

3 MR. GIBSON: And that's kind of
4 what we've done with white spaces.

5 DR. KAHN: Yes.

6 MR. GIBSON: If you compare that
7 to the off-come approach, but that's not what
8 this is all about. So I think I understand
9 what you're saying.

10 I think with respect to the last
11 report, you know, and let me actually see what
12 you think about this. We'll take some of
13 these suggestions and blow them up a little
14 bit, or stand a little bit, and the 2 to \$4
15 million was not for somebody to go out and do
16 site audits. You know, that was basically an
17 office paper type study, but I think I know
18 what we need, so.

19 MR. NEBBIA: And, for instance,
20 most of our assignments are for fixed and
21 mobile --

22 MR. GIBSON: Yes. Yes.

1 MR. NEBBIA: -- systems. Most of
2 them. The vast, vast majority of them. The
3 issue we run into there is they're often in
4 fairly small bands that may not be of much
5 interest to people.

6 So we can go out and do a lot of
7 detail work on 162 to 174, where most of
8 federal land mobile systems are. But does
9 that -- so I think the concept of
10 prioritization is important, yes.

11 DR. KAHN: Yes. Triage is
12 probably the right approach here, yes. No
13 question.

14 MR. STRICKLING: Can I just make a
15 couple comments, though? Because I don't want
16 people to get the wrong impression. These are
17 difficult issues, but Karl and his team are
18 absolutely dedicated to getting good data
19 here.

20 DR. KAHN: Yes.

21 MR. STRICKLING: We have to
22 approach it in a way consistent with the

1 resources we have been given to do these
2 things. So, at a minimum, we should make sure
3 that as FSMS comes online, any new data going
4 into that really ought to meet this standard
5 of data quality, data accuracy. And, to the
6 extent the Subcommittee wants a briefing on
7 FSMS, we should make that happen so that you
8 all can see that that's going to work.

9 Now, in fact, it will continue to
10 be attached to the old database for a number
11 of years. So it will be a gradual transition.
12 And there is a process in place now where
13 agencies are supposed to come back and
14 revalidate the request for spectrum. I think
15 it was at a five-year cycle, Karl?

16 MR. NEBBIA: Yes.

17 MR. STRICKLING: We need to make
18 sure that the standards for that measure up to
19 the demands for data accuracy that we need.

20 Then I think you get to this third
21 category, which is this embedded base of
22 assignments, and what can you do with that.

1 That's where the additional resources are
2 needed.

3 And the thing to keep in mind, it
4 isn't just us. I mean because at the end of
5 the day it's going to be these agencies that
6 have to come up with this, and they're asking
7 where are the resources for as you to perform
8 all this additional work, if you're going to
9 make us go back and deal with that embedded
10 base over a one-, two-, five-year period,
11 whatever it's going to be. So these are all
12 things we want to work out.

13 But there's no question here about
14 the commitment to data accuracy. I mean,
15 Kevin, your point is very well taken, which is
16 we can't have a \$40 million new system and
17 then have crappy data in it. And I think we
18 all recognize that and a lot of work to
19 prevent that from happening.

20 DR. KAHN: Fair enough.

21 (Off mic conversation)

22 MR. HATFIELD: I should know the

1 answer to this, but has a sampling been done
2 of the existing database? Because if you're
3 saying, I think, that some of these bands are
4 not very interesting and therefore they are
5 not a high priority, do you have a sense of
6 are certain records better in certain bands
7 than they are in other that would also give
8 you some idea of what your sort of existing
9 error rate is; has that been done? You know,
10 take a couple hundred, I think you can learn
11 a lot by a couple hundred samples.

12 MR. NEBBIA: Well, I mean
13 certainly where we have had -- yes, thanks
14 Bruce -- where we've had issues related to
15 data accuracy in the past, it has been almost
16 always among these fixed and mobile multi-link
17 type systems. And also because they're so
18 numerous, they're also the ones that tend to
19 be still in the database, even after they've
20 been taken down. Whereas, you would think the
21 FAA air traffic control radars, you would
22 think it's probably not very likely that their

1 locations and how many of them are out there
2 is going to be bad data.

3 There are also all modifications
4 of similar systems, so the system
5 characteristics should be fairly well set. So
6 at least from our culling or running into
7 problems in the past, most of the ones that
8 had been brought to our attention have been
9 fixed or mobile systems, once again, I think
10 possibly due to they're so numerous, people
11 don't take them out of the database when they
12 were gone. And there have been some, you
13 know, obviously data inaccuracies in them.

14 But other types of bands, we
15 looked at the GPS bands. We know the GPS
16 characteristics are what they are. You know,
17 there's -- so I think there is a
18 prioritization that we could do. Am I am --
19 I have been running out of the time that I
20 have.

21 I should note also that we have
22 implemented a system now where the local user

1 needs to provide their name in the assignment
2 process, and then somebody from the Agency
3 itself is also putting down that they've
4 confirmed that the data is correct, so we're
5 at least on an administrative approach trying
6 to move that forward.

7 We also had recommendations, and I
8 appreciate Larry's note about the Agency user,
9 so I have asked Mark that you take a quick
10 look at, you know, you're 2 to \$4 million
11 reference number and say, well, we are we
12 expecting from folks in the field. If, you
13 know, you consider that.

14 On the incentives portion. That
15 was the last recommendation put out by the
16 previous group.

17 Sorry, Jennifer, you had a
18 question before I move on. I didn't mean
19 to...

20 MS. WARREN: I figure your time is
21 extended --

22 MR. NEBBIA: Yes.

1 MS. WARREN: Numbers have
2 questions.

3 CO-CHAIR ROSSTON: Yes. One of
4 the things that Brian and I just talked about
5 is that maybe the idea would be for a call to
6 go to high level and when we get to these
7 different groups, you can come back to the
8 recommendations, because I think, for the most
9 part, we'll have time. But if you have a
10 quick question, that would be great.

11 MS. WARREN: I'll wait, if you
12 want.

13 MR. NEBBIA: Okay. With respect
14 to the incentives aspect, of course the main
15 recommendation was that we study
16 implementation of spectrum fees for the
17 federal government. And I think what you will
18 see here related to our response to that
19 recommendation is, first of all, NTIA did
20 draft a plan on this issue back in the mid
21 2000s. And I think after three years, it was
22 in fact approved, just before the

1 administration changed.

2 So it involved a whole series of
3 subtasks in studying this issue. And
4 essentially due to funding constraints and so
5 on, we've just not taken that up.

6 Further, now the CSMAC
7 recommendation, I think, was a little bit more
8 narrow than what this plan we had laid out.
9 And yet one of the, concerns for me is there
10 is essentially kind of a one-statement
11 recommendation to consider fees and then the
12 built into the recommendation are lists and
13 lists of things to consider in doing that.

14 So essentially the easy part of
15 the study has been done by saying: Please
16 study this. The real work is in looking at
17 all of those difficult challenges. So we've
18 kind of enumerated in here what those are.
19 And we will -- at this point our plan is to at
20 least bring this issue before a policy and
21 plan steering group for their consideration
22 and response. Because ultimately for NTIA to

1 change the method it uses to charge agency
2 fees, we're going to have to have --

3 (Cellphone chime.)

4 MR. NEBBIA: -- we're going to
5 have to have a legislative change. So right
6 now we do not have that authority. So it's
7 going to have to be worked at that level and
8 considered by the administration.

9 Also the recommendation regarding
10 Circular A11, I should note that that was
11 included in the recent law that was passed.
12 And, therefore, that will be taken up. So
13 that's one we didn't even, I guess, get a
14 chance to provide a response on. So we will
15 take that up.

16 Actually, it's for OMB to take up
17 by the recommendation, so OMB will be looking
18 at A11 in the weeks ahead. And, once again,
19 I think that's an area where we'll probably
20 have some discussion of that inside the policy
21 and plan steering group. So I did include all
22 the text of those parts, just so everybody

1 could see what that was.

2 And then the last part of that
3 recommendation was to broaden the CSCA
4 spectrum relocation fund, which the
5 administration supported in the legislation.
6 And that was done, I think, in accordance with
7 the administration's desires in every part
8 except that they did not include planning
9 funds for dealing with unlicensed. They
10 included for other kinds of sharing, included
11 it for relocation. But for coming up with the
12 sharing protocols that we'll need for entrance
13 of unlicensed systems in a band, those funds
14 were not provided under the law. So just one
15 point of clarity there.

16 Now the other part that was in
17 here was the recommendation about creating a
18 spectrum innovation fund, that I know that has
19 been discussed at times, but at this point the
20 administration hasn't taken any position on
21 that. And there certainly is no funding for
22 it in the current budget plan. So that's

1 where that stands.

2 The last theory deals with a set
3 of -- series of recommendations on unlicensed.
4 And I think the biggest issue we had here was
5 the recommendation to create a long-term
6 national spectrum technology roadmap. And, to
7 be honest, as I said, I'm not sure I really
8 understand what that is in this case. So I
9 think we would need more specificity as to
10 what people are expecting us to put together.

11 We do have a number of activities
12 within White House groups looking at sharing
13 activities. Ones within this wireless
14 spectrum research-and-development senior
15 steering group. There's another group call
16 PCAST, which I don't remember the actual, the
17 formal name for that. But that -- those
18 discussions are also going on. So I think
19 we're moving that forward. The administration
20 certainly focused on that.

21 And then also we are including in
22 our 500 MHz search we are going to include

1 looking for unlicensed opportunities for
2 unlicensed uses. I do not like the term
3 unlicensed bands because I think that's not
4 really in accordance with what we end up with.

5 So I think the biggest issue here,
6 and maybe Michael can help us with this in the
7 months for the next meeting, is some better
8 idea of what a national spectrum technology
9 roadmap would be, what would that entail. And
10 I think it would certainly be helpful in doing
11 that, once again, to give a sense of how much
12 you would expect that to cost for us to put
13 together that effort.

14 Now they also recommended that we
15 identify a couple bands for unlicensed access.
16 And we've got in the law two bands suggested.
17 So our only other question then to the
18 Committee: Is there other bands beyond those
19 that you would suggest, because they're the
20 ones at this point we're going to focus on in
21 the 5 GHz range.

22 And then the fourth recommendation

1 about opening unlicensed access to new bands
2 whether on a secondary or a primary basis,
3 which once again in normal spectrum management
4 parlance, they are not terms that we use.
5 They hold neither a secondary nor a primary
6 status. So once again I think we've got to at
7 least use the terminology that's consistent to
8 us, but in this case we are looking for how
9 technical rules would, in fact, support this
10 last recommendation to reserve flexibility in
11 bands in terms of access, and so on.

12 The PCAST -- thank you, Brian --
13 stands for President's Council of Advisors on
14 Science and Technology. And, in fact, one of
15 our members, Mr. Roberson I believe, is
16 involved in that.

17 CO-CHAIR ROSSTON: Well, we have
18 --

19 MR. STRICKLING: Mark here.

20 CO-CHAIR ROSSTON: Mark's here.

21 MR. NEBBIA: Okay. Yes, Mark's
22 here, who was also running the group. So you

1 may get a chance to ask him at the close here
2 what all's involved with that activity.

3 So that's my quick run through on
4 where we stand. And we will be getting back
5 to the interference and dynamic access
6 recommendations in time for our next meeting.
7 We just didn't have time to get into that.

8 So I think we have a good set of
9 recommendations. Some clarification, we're
10 looking for. And be moving ahead.

11 CO-CHAIR ROSSTON: Great. Thanks,
12 Karl.

13 So what we want to do is go
14 through their different reports. And to the
15 extent there were more questions, what I
16 recommended to the different, we had talked to
17 the different co-chairs of the Subcommittees
18 was that to have reactions to Karl's reactions
19 to the reports, so that there will be time in
20 these reports to have a discussion back and
21 forth with Karl and Larry about -- about
22 those. But we should move now to the

1 different committee reports, and we notice we
2 have -- even though the first search for 500
3 MHZ has dominated the discussion at the last
4 couple of meetings, this time we only have ten
5 minutes because they sort of have been on hold
6 waiting for the reports. So I'll turn it over
7 to Gary and Karl.

8 MR. STRICKLING: Karl's going to
9 start.

10 THE SEARCH for 500 MHZ SUBCOMMITTEE'S REPORT

11 MR. POVELITES: This is Karl
12 Povelites. Hopefully you can hear me.

13 Again, we continue to look forward
14 to the release of the 1755-1850 band report.
15 And, perhaps to Larry's point, maybe what we
16 can do is offer some speed-reading courses for
17 other departments, so that we can get that
18 report out.

19 Subsequent to last CSMAC meetings,
20 we got -- we had the recommendations approved
21 by the CSMAC. We then tried to figure out
22 what our next question that we were going to

1 answer was. And, in discussions that Gary and
2 I had with NTIA, we were told to really, not
3 to focus on anything until the report was
4 offered. So --

5 PHONE PARTICIPANT: Could you move
6 closer to the microphone? It's very difficult
7 to hear you from the other end of the phone.

8 MR. POVELITES: I'll try to get
9 closer. Is it on?

10 CO-CHAIR FONTES: Yes, but it may
11 be just the phone line.

12 DR. KAHN: Well, there's two
13 different sets of mic.

14 CO-CHAIR ROSSTON: Is there a
15 phone link down there?

16 MR. POVELITES: Is there a phone
17 link here?

18 CO-CHAIR ROSSTON: The closest one
19 is by Gary, I think.

20 PHONE PARTICIPANT: It's been
21 terrific up until this.

22 MR. POVELITES: I'll try to yell.

1 That won't go. Well, I'll turn it over to
2 Gary real quickly.

3 But, again, we're looking forward
4 to the report. We would like to discuss and
5 find out from NTIA what questions they would
6 like us to address next. I know that there
7 are some thoughts that Karl had about what we
8 could focus on. Again, the 1755-1850 band is
9 extremely important, and we'd like to move
10 forward with that. However we can help NTIA
11 in moving that forward, we'd be happy to do.
12 We look forward to working on that.

13 Gary.

14 MR. EPSTEIN: I don't have very
15 much to add. We, of course, voted on the
16 report last time. And appended to it are
17 Janice's separate statement which call refer
18 to. And then we apologize again to Jennifer
19 Warren, but we want to make sure the public
20 record identifies Jennifer as having concurred
21 in Janice's recommendation.

22 And, as Karl said, we met both

1 with the NTIA folks and with our own
2 Committee, and are ready, willing, and able to
3 take the next step and await guidance from
4 you, but clearly understand it doesn't make
5 any sense until the 1755 report is out.

6 The kind of things that you could
7 ask us to do really have to do both with
8 procedural and substantive aspects of going
9 forward with the sharing type criteria and the
10 procedural aspects of it. So we are ready,
11 willing and able to do that.

12 CO-CHAIR ROSSTON: Are there other
13 comments? I guess Karl wants to address this.
14 But are there people on the phone who would
15 like to pitch in or -

16 Okay. Go ahead, Karl.

17 MR. NEBBIA: Yes. One of the
18 things or what we had, in fact, asked the
19 group as a follow-up question was the idea of
20 providing input on the kind of industry-
21 government mechanism that we might use in
22 order to bring the various parties together to

1 discuss moving forward.

2 And because we didn't have the
3 outcome of the report, there was a limited
4 amount we could really discuss on that. I do
5 note that the Sharing Group, however, has
6 pushed that issue a little bit further forward
7 and described different components of what
8 might be needed in that type of activity, and
9 made reference to our work on the 5 GHz wifi
10 issue and how we progress that in the past.
11 There was interestingly enough done under
12 state departments' ITEU radio preparations.

13 So there is a little bit of an
14 expansion in the sharing study. So I guess
15 part of my thinking at this point. And
16 specifically looking at the fact that we've
17 been asked to put together these transition
18 review panel as part of under the law. And
19 that would apply to any future move that we
20 do. It's not specifically focused on the 1755
21 band, but could be applied to other bands that
22 we either have already kind of put on the

1 table or will put on the table in the future.

2 So I guess a question that may be
3 a useful one to ask is certainly based on the
4 experience the industry had in the first move,
5 1710-1755: What kind of information do they
6 think, do you think that the bidder should
7 have upfront that they did not have last time?

8 And, secondly: What should the
9 nature of one of these transition plans be?

10 Because last time we asked
11 agencies for a transition plan. In some cases
12 an agency said, 'Well, I have a nationwide
13 system. I'll be out of the band in three
14 years.' That was it. That was the full
15 definition of the transition plan.

16 What was of more interest to
17 specific companies as far as I could tell was
18 when they wanted to begin moving in the band
19 they wanted to know for that nationwide system
20 with cities were you vacating first.

21 So I think it would be useful for
22 us to say, okay, how can we better define

1 those transition plans for particularly like
2 nationwide mobile systems, which we know are
3 in that band; for specific-location systems,
4 whether it's telemetry, or whatever, or
5 airborne systems. What would be the nature of
6 a transition plan that's got a medium.

7 Because one thing I hate to try to
8 do is say, okay, I've got a very general
9 order. I'm going to go off and put all this
10 stuff together only to find out that what I
11 put together didn't really meet what people
12 were looking for anyway.

13 Now I do want -- I do want to
14 caution in doing that if we, for instance,
15 say, well, a location-transition plan aspect
16 is what's really critical. They want to know
17 when you're getting out of certain places. I
18 just I think it's important to acknowledge
19 that once the agency lays out that location-
20 based transition information, says, 'Well, I'm
21 getting out of New York in five years,' if
22 your company's intent was to get into New York

1 in the first year, you'll actually have a
2 marker down from their cite saying, 'This is
3 what we told you.'

4 Whereas when it was not specified,
5 then it got into a negotiation between the
6 agency and the company. And, ultimately, I
7 think they worked it out. So I think we need
8 input on what the nature of that should be.
9 And we certainly don't want to get into a
10 situation where by cementing in the transition
11 plans, that we in the end prevent the
12 companies from implementing. So I'll let you
13 --

14 MR. STRICKLING: Karl, to that
15 end, is this a new work stream you want to
16 start here in which --

17 MR. NEBBIA: So this is a new -- I
18 think --

19 MR. POVELITES: -- Committee would
20 take it? I mean, understand, we have to do a
21 rulemaking to create these panels. I think we
22 have -- do we have six months to conclude the

1 rulemaking. But in your all's role as a FACA
2 advising us, it would certainly be useful to
3 get input on these and other issues related to
4 that. I'm not sure which Subcommittee would
5 take on the task.

6 MR. NEBBIA: I think the 500 -- I
7 mean the 500 MHZ Subcommittee is the one
8 that's about this process. So that's -- I
9 think they would be, at least it seemed to me.
10 But it's up to you guys how you want to assign
11 it. But I think there are questions that
12 we're going to need answered as we move
13 forward, because we're going to want to
14 structure in any band we do the information so
15 that it supports the bidding process as much
16 as we can. We realize there's going to be
17 classified data, there's going to be stuff
18 that people can't see. But then this issue
19 about the transition plans and defining what
20 that will be, so.

21 MR. STRICKLING: But I think the
22 other thing people need to keep in mind is

1 that we expect for 1755 it's going to be done
2 a little differently than it was done for 1710
3 in the sense that these consultations that we
4 see happening right out of the gate probably
5 go a long way toward resolving a lot of the
6 issues and providing the information people
7 are going to need to come up with a final
8 approach to how we're going to deal with the
9 portions of that band.

10 So in some respects I think the
11 technical review panel and the appeal board
12 are like solving the last problems we had in
13 1710. And we can actually probably come up
14 with a process with 1755 going forward that
15 may be will alleviate the need, the effort to
16 have the invocation of that more formal
17 process. At least that would be my hope.

18 So I think, you know, we need to
19 keep that in mind in terms of this rulemaking
20 we have to conduct, which will be everybody
21 will be wanting to use the 1710 experience as
22 the basis for detailing what the technical

1 review panel ought to do, yet when you
2 actually look at what I think we're going to
3 need to do on 1755, the old way, just I'm not
4 sure is even going to be applicable.

5 MR. EPSTEIN: Just following up on
6 Larry's point, --

7 CO-CHAIR ROSSTON: Gary.

8 MR. EPSTEIN: -- one of the things
9 that made the first round really successful
10 and we really appreciate it is you assigned
11 specific questions to specific groups, and we
12 could give you answers instead of just
13 guessing.

14 And so here what I'm hearing a
15 little bit vague still. Number one, do we
16 wait for the 1755 report to do something.

17 Number two, I too saw that there
18 was good work done in another committee but on
19 this issue. So, you know, we should figure
20 out collectively who should do this.

21 And number three is let's be real
22 specific on what you want us to focus on

1 because we'll give you better work that way.

2 MR. NEBBIA: I'm sorry.

3 CO-CHAIR ROSSTON: Larry Adler.

4 MR. ADLER: Yes. Just on that
5 point, I think that one of the points of
6 clarity is the Sharing Group was focused on a
7 process to ultimately facilitate sharing
8 versus ultimately facilitate transition. So
9 there may be some differences there.

10 CO-CHAIR ROSSTON: Jennifer
11 Warren.

12 MS. WARREN: Thank you. I guess a
13 couple questions. One is even though I
14 understand why it was directed to the 500 MHz
15 Group, I think if you're talking about a
16 transition plan that's not specific to that
17 band, there will be perhaps a different set of
18 interested members. And I'm not sure that,
19 you know, that necessarily is a logical flow-
20 on. But then I would also ask --

21 MR. EPSTEIN: We welcome
22 expansion.

1 MS. WARREN: Excuse me?

2 MR. EPSTEIN: We welcome
3 additional --

4 MS. WARREN: Yes. Not focused on
5 the 500 Meg. You know, on that.

6 But the other question is, it
7 seems to me, Karl, and you're asking for
8 feedback on transition plans, that it may be
9 nuanced differences if we're talking about
10 vacating spectrum or sharing spectrum. And
11 there should be perhaps some parallels but
12 then also some differences that you would like
13 to see in those two different scenarios.

14 Would that be correct?

15 MR. NEBBIA: Well, certainly by
16 our experience any transition is going to
17 involve some level of sharing. People are
18 going to be wanting to know how close they can
19 get to the incumbents as they're, you know,
20 going out the door.

21 So in that aspect they're very
22 closely linked together, but in general I

1 think you think in terms of transition plans
2 for the incumbent you're thinking of them
3 moving, as opposed to when we're talking about
4 creating a sharing environment, you're not
5 necessarily thinking about the incumbent group
6 changing what they're doing. You're thinking
7 about how people work their way in around the
8 existing group.

9 MS. WARREN: I guess -- if I could
10 follow up?

11 CO-CHAIR ROSSTON: Yes, go ahead.

12 MS. WARREN: I think what I was
13 thinking of where you may have consolidation,
14 so you may not have as wide spread a
15 government use in a band, but there may be
16 consolidation of government operations. And
17 so they haven't -- they've moved from some
18 parts, but they're still sharing a required
19 writ large, instead to me there may be -- I
20 haven't thought this through yet, but to me
21 there may be some questions with respect to
22 that that would be very different from a

1 wholesale relocation. I just want to flag
2 that for whatever group gets the questions.
3 Thank you.

4 MR. NEBBIA: It seemed to me as we
5 have a group looking at the goal of 500 MHz
6 is, in fact, to provide for wireless
7 broadband, there is a transition involved
8 there. At least to me it seemed logical.
9 Whereas sharing can be done. And I mean
10 completely outside of once we meet our ten-
11 year goal, sharing still is an issue, whether
12 we're in the middle of that kind of activity
13 or not, but -- and so.

14 MR. POVELITES: This is Karl. I
15 think we'd like to take that on. We'll make
16 sure that we're not overstepping or doing
17 something that one of the other groups is
18 doing so that there's no redundancy in working
19 with a sharing team, just to make sure that --
20 because I see it somewhat as Jennifer does, is
21 there's probably a transition from -- is it --
22 it's a compendium where you have sharing maybe

1 upfront, but the transition is from sharing
2 then to exclusive use perhaps. So there may
3 be some overlap there, but we'll be happy to
4 work with Larry and his team to make sure
5 we're not being redundant.

6 CO-CHAIR ROSSTON: Mark.

7 MR. GIBSON: Yes. I think there's
8 also a data component to the transition plan
9 because, you know, as evidenced by the way it
10 went last time, the first effort was to get
11 more data beyond what was released. So while
12 I don't want to make any more work for our
13 subgroup, I think we could at least inform one
14 way or the other the data elements necessary
15 and the process, how to improve the process
16 for making that data available.

17 CO-CHAIR ROSSTON: Okay. That's a
18 great transition to spectrum sharing.

19 CO-CHAIR FONTES: Perfect. Our
20 next group, and actually I think in listening
21 to what Karl's presented, and certainly with
22 the willingness of the 500 MHz Group to work

1 with the Sharing Group on trying to address
2 some of these questions, perhaps help Karl
3 refine the questions to be asked, and then to
4 have some type of a coordination working
5 between these two groups may be the answer in
6 trying to address those questions.

7 Now I'd like to turn it over to
8 Larry and Mark.

9 MR. ADLER: Mark's on the phone.

10 CO-CHAIR FONTES: Okay, good.
11 Turn it over to you.

12 SPECTRUM SHARING SUBCOMMITTEE'S REPORT

13 MR. ADLER: Great. Excuse me. So
14 again we're the Sharing Subcommittee, and we
15 were looking at two questions this time.

16 First, I'd like to thank everyone
17 who participated in the Sharing Committee. It
18 was actually, I felt like, a very health and
19 diverse group of people. And I really enjoyed
20 working with everyone this past quarter.

21 So the two questions we were
22 looking at was, first, this issue of systems

1 evolving. How do you deal with sharing where
2 the primary service may continue to evolve.
3 And then the second question was kind of the
4 more general question, which is: What kind of
5 sharing is really workable in the long term,
6 and with in the back of our minds thinking
7 about would part of this 500 MHZ be shared, a
8 shared resource.

9 We ended up splitting the work
10 into two threads. One was technical in nature
11 and the other was more process in nature. So
12 if you look at what is slide 2, the technical
13 update, I'll walk through, but I'll ask Mark
14 to jump in in a minute.

15 Mark McHenry really took a
16 leadership role here and worked through a
17 number of analyses looking at this first
18 question. And we reported some of these last
19 time.

20 But the question of how do you
21 deal with the use change cases of the
22 incumbent, the conclusion that was drawn from

1 the report, and you can see it is: Depending
2 on the scenarios, there's a number of ways to
3 do it, but there's kind of no one size fits
4 all.

5 There are databases, there is
6 sensing, there's a number of approaches. And
7 depending on the scenario and the types of
8 movement that you would expect from the
9 incumbent, be it a way for change, the
10 geographic movement, there was lots of
11 different ways that that could be handled.
12 And we didn't list them all here, but there is
13 a report.

14 We also looked at an isolation
15 analysis, which was what if you just did
16 something very simple and just said we're
17 going to isolate people geographically. And
18 that turns out to be inefficient. That's the
19 big conclusion.

20 So there's definitely a motivation
21 to want to do more sophisticated sharing, and
22 I think everyone here knows that. In order to

1 really promote efficiencies, you want to do
2 something more sophisticated than just
3 isolation zones.

4 In terms of sharing approaches,
5 the group laid out a number of sharing
6 approaches in the documents, again database
7 type, geographic-sharing approaches, time
8 based, sensing based. There really is no one-
9 size-fits-all. And I think it's an obvious
10 conclusion but an important conclusion, and
11 probably one that this Committee should not
12 spend a lot of cycles hoping someone's going
13 to come in with this one-size-fits-all
14 umbrella approach to sharing. Things have to
15 be done much more on a band-by-band basis with
16 detail technical information.

17 So with those kinds of
18 observations and background material, we
19 developed some conclusions, which are on the
20 next page on the Technical Recommendations.

21 I'm going to let Mark, if you're
22 on the phone, walk through the first

1 recommendations, the first couple, which were
2 really around the information that would be
3 needed in order to do this band-by-band stuff.

4 Mark, do you want to walk through
5 those?

6 DR. MCHENRY: Yes, I'm here.

7 So the first recommendation is
8 that there are so many parameters involved and
9 there are no hard requirements from NTIA.
10 We're told we don't want to provide -- we
11 can't provide position, we can't provide
12 frequency mapping. And they want to have
13 unlimited change in case they want to change
14 their operations. There are so many things
15 they would like, we can't get started to
16 design a specific sharing approach.

17 So I think NTIA should make a memo
18 or a document outlining in general what the
19 requirements are in terms of enforcement and
20 what information they'll provide and then
21 specifics. That would be the first step in
22 getting a more concrete sharing approach.

1 And the second recommendation --
2 back to the first. This should kind of be
3 done in the opening, because a lot of these
4 requirements are on the entrant as well as the
5 incumbent. If the incumbent. If the
6 incumbent has a bunch of requirements that
7 drive the spectrum use to zero, the entrant
8 won't like it, and we won't get anywhere. And
9 the entrant has their requirements. It's got
10 to become an open process back and forth to
11 develop these requirements.

12 The second requirement is every
13 scenario, every approach has to have a data-
14 based enforcement approach. The entrants need
15 to register their position. And if something
16 goes wrong, the incumbents have the right to
17 turn the entrants off or to adjust them.
18 Every approach we've seen has that. And every
19 incumbent we've talked to says they want this
20 feature. This is the one feature that fits
21 all the approaches.

22 And the third approach is what

1 Larry just said. Don't pick one now, don't
2 necessarily pick database or sensing. It's so
3 much better to tailor them for the exact
4 situation.

5 You can show that if you pick the
6 wrong approach, you can get horrendous
7 exclusion zones and it's unworkable. And
8 adding the right mix of channel-selection
9 algorithms will get you a little more
10 spectrum, and it doesn't really hurt the
11 incumbent that much.

12 So that's the three technical
13 recommendations so far.

14 MR. ADLER: Yes. I thought that,
15 Karl, you'd appreciate the third
16 recommendation has a low-cost implementation.

17 (Laughter.)

18 CO-CHAIR FONTES: Do you want to
19 comment, Karl?

20 MR. NEBBIA: Yes, just a couple
21 thoughts. First of all, I thought that, at
22 least for me reading this, the most

1 significant response in this is that in the
2 world of sharing and proposed sharing in the
3 future, that the incumbents are not -- they
4 don't have their own protected world anymore.
5 And I think that is really significant.
6 Because as we have written radio regs, whether
7 internationally or domestically over the
8 years, the word "secondary" meant the primary
9 could do whatever they wanted and secondary
10 had to live with whatever that group became.

11 And recently in the international
12 rules, primarily, but I'm not sure there are
13 cases where the FCC's played with this a
14 little bit on the domestic rules, when a new
15 entrant has come into a band, they've
16 specifically written into a footnote that the
17 new entrant will not interfere with the
18 existing and will not, in any way, hinder
19 development of the existing user.

20 So for us at this point to say
21 that in creating future sharing arrangements,
22 the incumbents are going to be limited is

1 significant, I mean very significant. In
2 fact, I can hear, I can feel the shaking of
3 the ground throughout that incumbent world.
4 That's a big, big issue, because they want to
5 continue to develop their business as much as
6 the entrant wants to develop their own.

7 And, in fact, as we -- you know,
8 we get into hear to some of the questions and
9 the actual text aside from the PowerPoint
10 stuff makes it look like the entrant is
11 getting some sort of guaranteed access, which
12 is even a further step, maybe not, you know,
13 viewed by others in the past.

14 So I do think that that is a
15 really significant step that we have to be
16 aware of as we move forward, that once you
17 begin to enter into these arrangements there
18 are going to be limitations on the incumbent
19 as to what they can do in their talking
20 modifications in the future.

21 DR. KAHN: But realistically,
22 right, --

1 MR. NEBBIA: This is Kevin.

2 DR. KAHN: I'm sorry. This is
3 Kevin.

4 MR. NEBBIA: On the microphone,
5 please.

6 DR. KAHN: I'm sorry. Did it
7 again.

8 Realistically, I mean if the
9 sharing is going to be a value rather than
10 just being, you know, kind of a headline item
11 that feels good and never is taken advantage
12 of, some amount of that kind of compromise is
13 going to have to be there, right, because
14 you're talking about asking a new entrant to
15 come in and make a sizable investment of some
16 sort in utilizing this band. And, you know,
17 if the answer is but tomorrow the guy who was
18 there already could do absolutely anything he
19 wants and your investment goes to zero, that's
20 not the kind of environment that's going to
21 generate any real use of the sharing, other
22 than perhaps, you know, the unlicensed guys.

1 And they are -- you know, in the unlicensed
2 things we've talking about, some of the issues
3 as well.

4 So I think it's almost inevitable
5 that some degree of what you're talking about
6 is going to have to happen if we're serious
7 about sharing.

8 CO-CHAIR FONTES: Let's go with
9 Jennifer, then Rick, and then we'll come back.

10 MS. WARREN: Jennifer Warren. I
11 think Kevin's point's a really good one, but
12 I think it's also one that is a two -- sorry
13 -- is a two-way point, which is the investment
14 that's needed.

15 I mean, first of all, this
16 conversation assumes incumbents are not the
17 commercial carriers. Even the first note in
18 the motivations for the process recommendation
19 assumes that, but that may not be the case.
20 But let's just go with that assumption.

21 There may be significant
22 investment required by manufacturers for

1 federal systems, for example, that if that
2 product isn't able to continued to be used
3 and/or sole more broadly than one time or
4 evolve, that's a problem from an investment
5 perspective as well. Because I know we tend
6 not to think about this, but there is an
7 entire industrial base that does R and D,
8 development, product manufacturing, commercial
9 companies with shareholders that have the same
10 investment approach to business.

11 And so we have to think about what
12 does that mean for the investment and R and D
13 needed to develop the new systems, to continue
14 to be able to evolve from both sides, not just
15 the commercial side, quote commercial side.

16 Thank you.

17 CO-CHAIR FONTES: Rick.

18 MR. REASER: I guess the logical
19 thing about all this, so if the objective is
20 to maximize the amount of sharing that you're
21 trying to do, the incumbent's going to have to
22 some give. I mean if you're really trying to

1 share, really share at the maximum extent,
2 then both parties have to be able to
3 negotiate.

4 And so I think that -- I know that
5 the ITU says all those things and all that,
6 but basically the secondary -- it's like you
7 said, the secondary thing is really not
8 sharing. That's sort of on an as-available
9 basis kind of a sharing, which is not really
10 sharing.

11 So I think if you're going to head
12 in that direction, both sides are going to
13 have to give a little.

14 CO-CHAIR FONTES: Larry.

15 MR. ADLER: Yes. I just wanted to
16 point out that, Karl, you're very perceptive
17 in actually reading the details, that the
18 point that was in there was that we think
19 there's ample room, the hypothesis that's
20 backed up by some of the analysis, that you
21 can't have infinite freedom as the incumbent,
22 but you can have a pretty large amount of

1 freedom to do what you need to do. But you
2 have to give up something in order for the new
3 entrant to get some assurances. Of this the
4 incumbent has infinite freedom, then it's
5 very, very hard.

6 So the point is we think that
7 there is a big space of opportunity for mutual
8 benefit. And I want to make sure you...

9 MR. EPSTEIN: It's Gary Epstein
10 again.

11 Reading this very good material,
12 there are two themes which really come through
13 to me. One of the them is the one we're just
14 discussing. And there's a lot of experience
15 in this room, but no matter how many footnotes
16 or sub-footnotes or double sub-footnotes you
17 put and say somebody's secondary, you wind up
18 with a fight ten years down the road about
19 whether or not they're really secondary. It's
20 just inevitable because people have made
21 investments there. And if this is a
22 recognition of that point, well, it's true.

1 It's just to say anything else doesn't work.

2 And the second theme I saw in this
3 report and other report is maybe the
4 ultimately answer to this, and you never
5 really get anywhere, is to move to a world
6 where you have the internet of things, where
7 things call home. And you are able to handle
8 it in that situation. But that raises a very
9 interesting regulatory and economic question,
10 and that is: Do you want to somehow require
11 that devices have that capability in it, or do
12 you want to have cheaper devices that are out
13 there that the marketplace wants but are much
14 less susceptible of being able to resolve
15 sharing problems. I think that is -- the
16 problem may not be an issue for this group,
17 but I think it's an issue that's really out
18 there.

19 CO-CHAIR ROSSTON: By the way,
20 that got picked up quite a bit.

21 DR. KAHN: Yes, I do. I do.

22 CO-CHAIR FONTES: All right.

1 Shall we keep going?

2 MR. NEBBIA: I'd just like to
3 make, I guess, another point related here.
4 One of the issues that always comes up in the
5 federal use of the spectrum is that the time
6 component or intensity component of that use
7 is generally considered to be light, certainly
8 compared with a cell phone type environment.

9 At the same time more and more the
10 cell phone equipment is being built to operate
11 over multiple bands, have different channel
12 selection, and so on. So I thought one of the
13 things that just really didn't draw attention
14 to that may be part of the solution is that
15 it's one thing to say, 'We're going to come up
16 with an arrangement that separates us
17 geographically,' and that's one aspect of
18 sharing. It's another thing that says, 'Well,
19 you're going to have these characteristics and
20 my sensing is going to recognize those
21 characteristics and we're going to recognize
22 this band.'

1 But there's another aspect that
2 just says you're only going to be on about one
3 percent of the time or maybe point five
4 percent of the time, and therefore I -- and
5 because I have a multiband operation, that I'm
6 just going to live with the reality that when
7 you come up on that point five percent of the
8 time, I've been given more spectrum to operate
9 in during that brief period of time, I'm just
10 going to live with less spectrum, that it
11 doesn't take a specific arrangement. It's
12 just takes a willingness to recognize that,
13 yes, I'm going to lose a component of what I
14 have for brief periods of time. But if that's
15 what enables us to make better use of the
16 spectrum, then that may be an answer in and of
17 itself.

18 CO-CHAIR FONTES: Okay. Larry, do
19 you want to continue on so we can kind of work
20 to get back on our schedule?

21 MR. ADLER: Yes. I have till
22 10:20 on this.

1 So the next element was we looked
2 at process. So, as we said in the first
3 technical recommendations, having a general
4 solution was probably fool's gold, and things
5 needed to be much more band-specific.

6 As we looked at the process, there
7 was another insight that I think really
8 emerged, a few insights that emerged in the
9 discussion, and I talked about this last time.
10 But it's really the insight of the people to
11 be willing to participate in the process.

12 You do have contingencies, and I
13 don't want -- I'm not speaking ill about, but
14 this is just kind of the facts, is that
15 there's -- most contingencies want a cleared
16 spectrum. That's their preferred outcome.
17 They would like all the spectrum to be clear
18 for their use.

19 And so when you think of a
20 negotiating position, that's their starting
21 position. And anything that compromises that
22 position is difficult for them to engage in

1 that discussion.

2 So one of the insights in the
3 process that you will see is you need
4 something that people feel like, you know,
5 this is going to happen, this is going to be
6 shared, I need to participate in good faith to
7 figure out the technical parameters to make it
8 happen. Otherwise, you end up with a
9 stalemate.

10 So the process has to have some
11 heft. It has to have some senior oversight,
12 and so forth. That was one of the things I
13 wanted to call out on this.

14 And there's also technical
15 complexity. You need to have the right number
16 of technical experts in the room. It's not a
17 lawyer thing. There's room for the legal part
18 of it, but you need deep technical experts,
19 people like Mark McHenry, et cetera, that can
20 really get into the details.

21 And also the timing of the process
22 is important. As we go through the

1 recommendation you will see that we had a lot
2 of discussion. And I'm not an expert here,
3 but apparently once you get to public notice
4 and comment, agencies can't participate. And
5 so this is a problem that needs to be
6 addressed. You need a process where you can
7 have good, good participation, collaboration,
8 and then of course followed by the actual
9 rulemaking itself.

10 So with that we'll turn to the
11 process recommendation. So, Steve Sharky, are
12 you on the phone?

13 MR. SHARKY: I am, yes.

14 DR. MCHENRY: So Steve drove a lot
15 of this work.

16 So, Steve, you want to work
17 through -- walk us through this?

18 MR. SHARKY: Yes. I'm sorry. I
19 don't have the paper in front of me, so,
20 Larry, I mean I think you're pretty familiar
21 with it. Do you --

22 MR. ADLER: I'm happy to do it,

1 sure.

2 MR. SHARKY: Okay. Thanks.

3 MR. ADLER: Yes. I just want to
4 acknowledge that Steve did put a lot of -- a
5 lot of work in it. So very similar to the
6 recommendation that the 500 MHZ Subcommittee
7 made, this recommendation is a little bit more
8 focused around sharing and has a number of
9 aspects.

10 First, there just needs to be
11 dialogue between the incumbents and the new
12 entrants to develop a specific recommendation.
13 I'm not going to read the text, but I'm going
14 to highlight a few things.

15 The discussion needs to take place
16 between the experts. Got to have the experts
17 in the room. As I just mentioned, that's very
18 important. Again, we don't have let's develop
19 the beat-all, end-all sharing for the entire
20 band and entire globe. It needs to be focused
21 on a band and specific issues. It needs to be
22 early in the process so that you can have

1 participation of agencies, and so forth.

2 It needs to have the senior
3 oversight that we discussed, I discussed a
4 second ago, which gives it credibility that
5 people actually participate in good faith in
6 the process.

7 And of course at the end of the
8 day the expectation is this would go through
9 the official notice process. This would just
10 be something in addition, a supporting
11 activity to get the technical things going.

12 So that's the basis of it.
13 There's lots of -- Rick, and provide a lot of
14 expertise on how this might happen, some of
15 the downfalls of the FACA process, and there's
16 a lot more detail. But this recommendation
17 tries to capture the high-level points of what
18 we want it to do.

19 MR. NEBBIA: Can I just make one
20 quick point?

21 The one part that I think confused
22 me, and maybe it's just a matter of how it's

1 written, is in the middle of that Process
2 Recommendation, it says, "The discussions
3 should be open to any interested parties,"
4 which I think is not a problem, "but must be
5 focused on a limited near of issues or
6 scenarios to develop actionable
7 recommendations [which] would be codified as
8 appropriate..." So I think it's got to be
9 written in a way that it's clear that that
10 ultimately is the end goal, but if looks like
11 those discussions are directing that outcome,
12 we're going to -- the lawyers are going to
13 tell us you've created your own FACA, it has
14 to fall under those rules, and so on.

15 So and maybe it's just a matter of
16 how it's separated in the wording of the text,
17 but if an informal group like that is aimed at
18 giving consensus recommendations, that's what
19 sells -- sets the bells of.

20 MR. ADLER: So maybe the wording
21 of recommendations, that particular language,
22 we need to take a pass on the edits there.

1 CO-CHAIR FONTES: Kevin.

2 DR. KAHN: Yes. This is
3 specifically why earlier I was raising this
4 issue, that on the industry side the
5 discussions that are beginning to happen in
6 places, whether it's ATCE or 3GPP, or some of
7 these other industry-oriented bodies, to try
8 to define interfaces that would be used to
9 query about spectrum's availability, how it's
10 going to be used, et cetera. That stuff's
11 gearing up. And I mean it's being driven by
12 people like Qualcomm and got some Intel people
13 in it, but I mean the typical players that
14 you'd expect to supply equipment into that
15 space.

16 Now, you know, that work's going
17 to go on. And they're going to come up with
18 standards. You know, whether these standards
19 are meaningful or not is a different question.
20 But if we kind of, from the kind of government
21 side of this, kind of ignore that process and
22 don't -- I mean I know Charley said, you know,

1 we'll monitor the output, but what I'm worried
2 about is that by the time the output shows up,
3 we're sort of asking for the next problem in
4 front of us if that output is not compatible
5 with all the thinking that's going on inside
6 the government side of this.

7 And I would sure as hell like to
8 find a way, even at an informal level, for
9 there to be more participation by the
10 government side, both the U.S. and elsewhere
11 in the world, in those deliberations so that
12 the stuff that comes out of that is meaningful
13 and useful, you know, for everybody.

14 So I really encourage you to look
15 at what's starting to bubble there and find,
16 you know, legal ways to engage it at whatever
17 level you can afford to. I mean I understand
18 that like everything else we're talking
19 dollars and money, but the alternative seems
20 to me to be one that's kind of really spooky,
21 because you'll get some standard written by
22 this set of companies that may be a wonderful

1 standard, but meanwhile, you know, government
2 thinking has gone in some other direction and
3 we're back where we started.

4 MR. EPSTEIN: In order not to
5 reinvent the wheel, I wonder whether a lot of
6 these issues have recently been thought about
7 in Dale Hatfield's VTAC-type committee and
8 whether or not there's any learning. A
9 different level of specificity or not.

10 CO-CHAIR ROSSTON: Get the
11 microphone down. Yes.

12 MR. HATFIELD: VTAC's been fairly
13 quiet because I particularly was concerned
14 that we not get ahead of ourselves, that we
15 not talk too much about what we've
16 accomplished until we had accomplished
17 something. And I think I'm getting to the
18 stage now, we are just finishing up our second
19 major report and getting ready to engage on a
20 third one. And I'm feeling confident enough
21 now that I think some of our experience in the
22 multi-stakeholder world now would probably be

1 -- probably would be useful.

2 CO-CHAIR FONTES: Jennifer.

3 MS. WARREN: Sorry for the noise.

4 Jennifer Warren.

5 I want to pick up on the point
6 that Kevin made, because I think it's really
7 important, is that by the time those groups do
8 come out with standards, it's too late. And
9 there does not to be an informal way, that I
10 would suggest is not really just the
11 government users that are really relevant to
12 this discussion that aren't there, but also
13 the manufacturers of the relevant equipment
14 and designers and developers of the relevant
15 equipment that the governments buy.

16 And one of the things that was
17 useful in the 5 GHz process was that there
18 were actually radar engineers at the table
19 that were from the companies developing the
20 radars, as opposed to the government users,
21 who were more setting requirements,
22 performance requirements, et cetera, but may

1 not realize the full range of options that
2 there are, because that's not part of a
3 contract. That's not part of what their
4 mission is.

5 So, you know, informal discussion
6 between and among the wireless manufacturers
7 and the, again, system manufacturers for the
8 other types of systems, whether it's air
9 traffic control or foliage-penetration radars,
10 or aviation radars, whatever they are, that
11 would be very beneficial I think, because
12 after the fact it's too late.

13 And also in the 5 GHz context,
14 while they were looking at what was in place,
15 I think one of the things that was very useful
16 was there was a lot of ongoing development for
17 next-gen radars, and that was able to be
18 factored in.

19 So, again, that may not be
20 familiar to the user that's sitting at the
21 table because they're not part of the
22 acquisition community or they're not, you

1 know, part of that program office.

2 So there's a lot of value to
3 broadening this, but, I'll tell you, I think
4 a lot of the manufacturers aren't going to go
5 a 3BP, whatever, and sit there, because that's
6 not directly relevant to a product that's
7 being developed by them. And I just think
8 there's room for further dialogue that does
9 not happen.

10 DR. KAHN: I mean maybe there's a
11 role for NTIA or NTIA plus FCC to convene a
12 few workshops, you know, and invite the
13 relevant commercial providers of both sets of
14 systems with some of the government people and
15 create a forum just to get some of the
16 relationship discussions going.

17 MS. WARREN: Because I think then
18 you can't -- sorry, Jennifer again. I think
19 then you have to -- again, because some of our
20 technical characteristics of equipment, we
21 have to get -- we would have to get export
22 licenses if we were have to certain

1 conversations in open forum, because they're
2 open to the world.

3 So I know that seems kind of odd
4 and burdensome, but having informal dialogues
5 with U.S. players would be, you know, a
6 starting point.

7 DR. RUSH: This is Charley Rush on
8 the phone here. You know I think you have to
9 appreciate that standards-development
10 organizations like the 3GPP typically are
11 industry as well as being industry driven.
12 And while I'm not -- I don't know the details
13 of the observer status, but I would guess that
14 perhaps governments could at least attend
15 meetings without maybe having a major
16 participation.

17 The work that's undertaken within
18 those standards-development organizations are
19 not as cavalier as perhaps some may believe or
20 at least express, in that a lot of what goes
21 on within the 3GPP, for example, is work that
22 is the result of vendors or operators bringing

1 ideas or proposals to the organization to
2 undertake to develop a standard or an
3 application that they firmly believe they have
4 an opportunity to have implanted within a
5 specific region of the world or within
6 specific countries and consistent with what
7 the regulator has indicated he or she would
8 like to see.

9 So it's not just sitting around
10 saying, 'Okay, well, today I think this and
11 we'll go ahead and develop this,' and then the
12 dead will take the hindmost, and you have to
13 take it or leave it. It doesn't quite work
14 that way.

15 MR. ADLER: All right. So I'm
16 going to wrap up. I'm going to go on then to
17 the next steps or next topics slide.

18 So the group had a discussion
19 about what might be the next topics. We
20 looked at the original questions. The group
21 has kind of felt that we've done what we could
22 on the two questions listed here in kind of

1 the abstract setting. And we looked at some
2 of the other questions around test bed, which
3 is a possible next topic, if that was of
4 interest.

5 Also we felt that Question C would
6 need to be band-specific, I mean more specific
7 than it's currently stated in terms of what
8 could be realistic in terms of sharing
9 acceptable interference.

10 Again, the Question E also would
11 be more specific.

12 So the types of topics we think
13 the group could take on is focus on specific
14 band, a sharing scenario. Mark's going to do
15 a more detailed analysis and produce, you
16 know, something on a specific band.

17 Looking at specifics technologies,
18 like sharing with a specific entrant, radar,
19 or a specific incumbent, we could do that. We
20 could do more of a survey of technology-
21 sharing approaches or we could work with a
22 specific industry segment, utility has been

1 brought up, commercial cellular, unlicensed.
2 But those are some of the ideas. I think this
3 is really a discussion topic that I'd throw
4 out there, is where would you like the group
5 to focus on next. We don't have to
6 necessarily settle it this meeting, but I
7 think the group is feeling like we're ready
8 for another question.

9 CO-CHAIR FONTES: Karl.

10 MR. NEBBIA: Well, certainly one
11 of the ones that I think is being touched on
12 in a number of places that I think would be
13 really helpful and it's kind of a buzzword
14 that is out there right now, is what in fact
15 we could use in terms of a test bed. What
16 that actually means to people. I mean that's
17 certainly something we're going to be looking
18 at in the months ahead. And I think it would
19 be really helpful to get feedback on that
20 issue, what that entails.

21 When the first idea came up a
22 number of years ago, I was in a meeting where

1 everybody nodded their head. And then after
2 the meeting was over, they all went back and
3 said, 'What is a test bed? Is that a band?
4 Is that a place? Is that a method?' What
5 exactly do we think in terms of a test bed is
6 valuable. And certainly the Commission had a
7 rulemaking or NOI I guess on experimental
8 licensing not that long ago, and that sort of
9 thing. So it would be really helpful to get
10 some views back on what the test bed really
11 would entail.

12 MR. ADLER: All right. Without
13 speaking for the whole group, I think we'll
14 look to take that on, and I'll get back to you
15 after conferring.

16 CO-CHAIR FONTES: Great. Are
17 there any other comments, Larry, from your
18 group?

19 MR. ADLER: Any other comments
20 from the members of the Committee who are
21 helping?

22 CO-CHAIR FONTES: Any comments

1 from any individuals on the phone? Great.

2 Thank you, Larry, Mark.

3 CO-CHAIR ROSSTON: Great. So now
4 we're going to turn to the Unlicensed Spectrum
5 Subcommittee Report. And for the people on
6 the phone this is going to be more pleasurable
7 because Michael Calabrese is on the phone, so
8 you should all be able to hear him very easily
9 given his nice, strong, clear voice.

10 So, Michael, I hope you're still
11 on the phone.

12 Michael, you may be on mute.

13 Michael Calabrese?

14 CO-CHAIR FONTES: Going once.

15 Going twice --

16 MR. CALABRESE: Hello?

17 MR. NEBBIA: How are you, Michael.

18 CO-CHAIR ROSSTON: There you are,
19 Michael.

20 MR. CALABRESE: Oh, I'm sorry. I
21 must have hit the mute instead of the unmute.

22 Yeah, I was just saying let me

1 know if I fall short of a strong, clear voice
2 at some point.

3 CO-CHAIR ROSSTON: You did for a
4 while, but now you're okay.

5 UNLICENSED SPECTRUM SUBCOMMITTEE'S REPORT

6 MR. CALABRESE: So apologies for
7 doing this by phone, but we'll make the most
8 of it. Janice Obuchowski co-chairs the
9 Unlicensed Subcommittee and, unfortunately, is
10 in Europe and could not participate. And of
11 course I'd encourage others on the
12 Subcommittee who are there in person to chime
13 in at any point for further clarification.

14 So what I'll do is, I guess, run
15 through our five recommendations. We're
16 really at the point where this report could be
17 adopted by the overall CSMAC if it chooses.
18 The recommendations are really virtually the
19 same as we reviewed in November. We've just
20 made further enhancements and adjustments and
21 added more material to the report itself.

22 So the questions that we have --

1 you know, we hope we've largely wrapped up on
2 concern enforcement. So we were asked to look
3 into how should federal agencies deal with
4 interference, complaints from unlicensed
5 users, how should federal agencies deal with
6 interference that unlicensed users experience,
7 since they don't understand the rules, how to
8 deal with the risk of software modifications
9 that might alter the compatibility
10 characteristics of a device and make it --
11 cause it to interfere with federal systems,
12 and what is the best approach to enforcing
13 rules when the number of -- you know, with
14 these widely distributed products that are
15 kind of a horse-out-of-the-barn situation.

16 So I think what's an important
17 framing is that we really -- our
18 recommendations really distinguish between two
19 very different types of unlicensed wireless
20 operation. There are -- you know, for the
21 most part today, there are untethered consumer
22 Part 15 devices and systems that are typically

1 less expensive because they're unconnected and
2 typically designed to operate on a single
3 band.

4 Then there are, you know, coming
5 along connected equipment that can be required
6 to -- or are required, for example, in the
7 case of the TV whitespace, to call home
8 periodically, such as through a spectrum
9 management databases to receive updates or to
10 take mitigation steps when interference
11 occurs.

12 So with that in mind, our first
13 recommendation is that NTIA should put in
14 place regulatory requirements in coordination
15 with the FCC, which would primarily be through
16 equipment certification that reduce reliance
17 on post hoc regulatory enforcement of
18 interference by relying on technology-based
19 solutions for connected devices. And there,
20 you know, our thought is that NTIA and FCC
21 together should encourage the adoption of
22 technologies that have been designed to

1 operate in a shared-spectrum environment and
2 that can avoid noisy channels and interference
3 through technology such as auto sensing and
4 channel-management capability.

5 In other words, that they would be
6 multi-frequency hopping and connected devices,
7 which really leads straight into
8 Recommendation Number 2, which is a little
9 more specific on this, which is that we
10 recommend that NTIA, again in coordination
11 with FCC, require that an all new unlicensed
12 band or in shared federal bands designated for
13 unlicensed access, that devices should be
14 connected devices that are required
15 periodically to call home to renew the
16 authorization to operate in the band, such as
17 via a certified database, to obtain a firmware
18 update, to be remotely disabled in a
19 particular frequency, or perhaps receive
20 direction to move off that frequency.

21 Under this scenario consumers
22 would not face the burden of interference

1 mitigation, since this should all be
2 automated. And the responsibility would lie
3 more squarely on manufacturers and the
4 equipment-certification process to build in
5 the technology solutions.

6 We understand that these
7 prophylactic technology solutions would
8 increase the cost of devices at the margin,
9 but we thought that's reasonable to impose
10 conditions for unlicensed access, particularly
11 incented a federal band considering the no
12 cost or low cost of unlicensed access.

13 The report also describes I think
14 more than it did in the November draft, in
15 particular, the dynamic-database approach to
16 device reauthorization and updates. And
17 there's also an appendix, B, with a detailed
18 example of how unlicensed device
19 reauthorization via database could work. And
20 Kevin contrasted that and could certainly talk
21 more about that.

22 Recommendation Number 3 is that as

1 a fallback in cases where noncompliant devices
2 are knowingly not operating within the rules
3 or where avoidance-through-technology measures
4 fail, NTIA should recommend that FCC
5 strengthen enforcement measures to buy better
6 deterrents. And that NTIA in coordination
7 with FCC should also be educating policymakers
8 concerning the secondary status of unlicensed
9 devices and shared bands and their obligation
10 to accept interference.

11 So along these lines what we
12 essentially endorse again and list many of the
13 recommendations on enforcement that were in
14 the 2010 Enforcement Subcommittee Report. You
15 know we didn't want to just reinvent that
16 wheel, but we did reiterate ones that we
17 thought were relevant.

18 Recommendation Number 4 is that in
19 cases when it is not a matter of unlicensed
20 devices intentionally operating outside the
21 rules but interference nevertheless occurs,
22 manufacturers should increase consumer

1 education efforts and that consumer awareness
2 will continue to be an important counterpart
3 or backstop to both enforce stronger
4 enforcement and avoidance through technology
5 efforts, although we certainly expect that the
6 avoidance through technology would begin to be
7 the most effective route.

8 And then finally, Recommendation
9 Number 5, the Committee recommends further
10 study of the current regulatory treatment of
11 so-called cheap, dumb devices, in other words,
12 untethered and particularly single-frequency
13 devices, the Committee recommends, generally
14 recommends that in the future such unconnected
15 devices should be restricted to certain bands
16 of spectrum where they are already prevalent,
17 such as 2.4 GHz. Policymakers should consider
18 whether such devices should be even further
19 restricted in the future, phasing out their
20 access to very high-quality bands over an
21 appropriate time period. But we recognize
22 that would require some further study and an

1 extensive transition.

2 And, as an example, we note that
3 under this approach a deadline could be set by
4 which time unconnected devices would be
5 restricted to some appropriate band or
6 multiple bands, but not allowed any longer in
7 others, such as 900 MHz.

8 And then, finally, I won't go
9 through these now, but I'll just note that at
10 the end we have -- because I can come back to
11 this if there's time -- we have possible
12 questions for further study, to which I expect
13 now we will add the couple questions that Karl
14 raised when he went over the NTIA's response
15 to the previous year's Unlicensed Subcommittee
16 recommendation.

17 CO-CHAIR ROSSTON: Okay. Do we
18 have discussion, comments on what Michael has
19 said?

20 Did you want to, Karl? And then
21 Dale after that.

22 MR. NEBBIA: I have a few. First

1 of all, the specific questions that we laid
2 out are -- or were based upon the realities of
3 today. And I appreciate the fact that Michael
4 and the group has laid out some ideas about
5 what we should do moving forward, but
6 unfortunately we do have the reality of the
7 situation today where agencies are being faced
8 with interference cases where there is a
9 public outcry about what's happening to them,
10 even though they have no rights. We're still
11 having some of the garage door processes
12 ongoing, and so on.

13 So I think we still would like
14 some responses as to, and it would be nice to
15 have the Committees say what posturing they
16 think that the federal agency should take
17 under those circumstances. But I also note
18 that the recommendations that we've been
19 given, of course we've got to recognize that
20 it's the FCC that controls the Part 15 rules.
21 NTIA allows the use of federal -- by federal
22 agencies of those devices, and we basically

1 tell them for the most part that they've got
2 to comply with the Commission rules. So
3 they're buying off-the-shelf, unlicensed
4 equipment.

5 They do have a possibility of
6 building some of their own. But, let's face
7 it, the realities are buying the same off-the-
8 shelf equipment that everybody else is.

9 So in reality it's the Commission
10 has to make way in these rules and I see the
11 clear message here that NTIA should make these
12 recommendations toward the Commission,
13 changing their rules to accept these
14 limitations on the unlicensed community.

15 Now, Michael, you are certainly a
16 person that is in a role of being
17 representative of that community, and there
18 may be others here also. So my question here
19 is: If we were to do that, and the Commission
20 were to say, okay, we will open up a
21 rulemaking on this process, what kind of
22 response are we going to get from the

1 unlicensed community with respect to these
2 recommended restrictions?

3 Is this something that the
4 community will buy into? And, Michael, from
5 your knowledge of the community, is this
6 something they would say, yes, this in the end
7 is going to help us out?

8 And, in fact, with, for instance,
9 the untethered devices, the dumb devices and
10 so on, well, they don't cost very much, but I
11 know right now we've got an issue going on in
12 Annapolis at the mall that a lot of people are
13 getting out to their cars and can't get their
14 key mechanisms to work. And these are often
15 in very expensive cars, so the fact that the
16 key mechanism is inexpensive doesn't
17 particularly matter. But magically of course
18 those key fobs are in the same DOD band, not
19 the same specific portion that the garage door
20 openers are in, but they're also in a Defense
21 Department band. So we're likely to see more
22 of that kind of activity over time.

1 So I guess my big question here
2 is: Will the industry get behind such an
3 activity to limit their activity?

4 I mean I think it certainly solves
5 problems if we do that. But so, Michael, what
6 are your thoughts on that?

7 MR. CALABRESE: Yeah. I would --
8 I don't want to claim to speak for, well,
9 either the entire Subcommittee or for the
10 entire unlicensed community, obviously. But
11 for my own perspective and experience, I think
12 that would -- you know, that NTIA being and
13 the federal government being clear about what
14 protections it needs, you know what does it
15 need in order to open sharing to particular
16 bands would be very welcome.

17 So if you look at the TV
18 whitespace experience, the terms of access to
19 the vacant TV channels is really highly
20 restrictive compared to what it is in 2.4 GHz
21 for wifi and other traditional unlicensed
22 uses. And although certainly many of us think

1 it's far more restrictive than it should be,
2 I think -- you know, so, for example, users
3 will pay a cost. There will be a transaction,
4 some sort of fee that will go toward the
5 database administration.

6 There's also the -- you know,
7 devices certainly will be more expensive
8 because of the need to periodically check the
9 database. And even the power limits and so on
10 are much lower, much less robust than they are
11 in 2.4, and yet we call it super wifi, and
12 folks are quite happy to have at it.

13 So I think as long as there's good
14 faith and the federal users are not seeking
15 kind of to ridiculously over protect, that it
16 will be very welcome to simply you know what
17 is it that we need to work around. In other
18 words, what are the terms of use that would
19 allow access to this unused capacity.

20 CO-CHAIR ROSSTON: Dale, did you
21 want to make a remark?

22 DR. HATFIELD: I just wanted to

1 make a couple quick comments. I've been
2 spending the last few weeks, it seemed like,
3 almost totally immersed in the receiver-
4 performance problem and not in the big one
5 that's getting all the publicity, but in the
6 general issue, I would hasten to add, the
7 general issue receiver performance.

8 And it's not clear to me how
9 you're addressing the receiver-performance
10 problem in your draft recommendations,
11 because, as we know, a lot of times
12 interference arises not because anybody's
13 doing anything wrong transmitter-wise, because
14 you're getting inter-mod or something in the
15 receiver. So I'm just sort of curious as to
16 what you've thought about in terms of receiver
17 performance and how your sort of remedies that
18 you talk about work when it's a receiver
19 performance problem.

20 The other thing that's been
21 bothering me a little bit, and I don't want to
22 sound like an apologist for the other parts of

1 the unlicensed, but I get confused not only
2 with the use of "unlicensed" in the sense that
3 Karl was talking about, but it tends to, I
4 think, to me be a band where you can really
5 innovate. You could do all these sort of
6 things without asking permissions.

7 And here, what we're talking about
8 here is nothing like that at all. It's very
9 much about asking permissions and it probably
10 very much has restrictions on what you can do
11 in terms of your devices and stuff like that
12 not to cause interference.

13 So it bothers me that there's --
14 it could be misleading if people think that a
15 tethered sort of device with all these
16 restrictions to prevent, for good reasons,
17 interference is anything like we have today in
18 that chaotic band, because I kind of like
19 those chaotic bands for some forms of
20 innovation, because you can just go do things
21 without getting the government involved at
22 all.

1 Anyway, those are just two
2 comments: The receiver performance issue and
3 what are we really creating or talking about
4 creating here when it's nothing like today's
5 chaotic wifi.

6 DR. KAHN: Well, could I comment
7 to that? I think one of the things we need to
8 be more careful about distinguishing is --
9 sorry.

10 CO-CHAIR ROSSTON: Just your name.

11 DR. KAHN: Kevin Kahn.

12 One of the things we need to be
13 more careful about distinguishing is operation
14 in so-called unlicensed bands, like 2.4 and,
15 to some extent, the 5, although that's sort of
16 in the middle a little bit, and this notion of
17 allowing more unlicensed use of shared bands
18 that are in other purposes. Because I think,
19 you know, in particular things like the 2.4
20 band really are, as you say, pretty chaotic,
21 you can pretty much do what you want. But
22 there's nobody guaranteeing anything there.

1 I think a lot of this was more
2 toward addressing if we were going to allow
3 more unlicensed sharing or devices which are
4 -- you know, licensed-by-rule devices that are
5 allowed to operate in otherwise occupied bands
6 based on something, you know, some sharing.
7 What would be the requirement to allow you
8 there.

9 So there's a good quid pro quo.
10 Yeah, there are some additional restrictions.
11 You're going to have to call in and you're
12 going to have to be willing to turn yourself
13 off until you get fixed if you turn out to be
14 a bad actor, but what you get for that is you
15 might get access to a whole ton of spectrum to
16 do stuff in a well-behaved manner, right. So
17 I think it's probably worth, and we ought --
18 we don't distinguish here it as well as we
19 probably should, but we really should
20 distinguish those two cases because they're
21 actually quite different.

22 DR. HATFIELD: And the resulting

1 public benefits because you get some public
2 benefits, but you also don't -- you lose this
3 chaotic band which allows somebody in the
4 garage to build some devices and go test them.

5 DR. KAHN: You're not going to
6 lose it. It's still --

7 DR. HATFIELD: Yeah. Yeah. Well,
8 --

9 DR. KAHN: It's not going
10 anywhere.

11 DR. HATFIELD: Well, --

12 DR. KAHN: These rules are not as
13 -- like that.

14 DR. HATFIELD: I'm beginning to
15 sound like an advocate here, and I'm not.
16 When we say that, though, there are people who
17 make the case that we ought to have more
18 chaotic bands.

19 DR. KAHN: Fair enough. And
20 that's --

21 DR. HATFIELD: That's a very
22 legitimate trade-off.

1 DR. KAHN: Yeah, that's a separate
2 question.

3 DR. HATFIELD: The question of
4 over -- over-constrained opportunity for
5 people --

6 DR. KAHN: Yeah, that's a separate
7 question -- which is should we --

8 DR. HATFIELD: Yeah.

9 DR. KAHN: -- designate some
10 additional chaotic bands.

11 DR. HATFIELD: Yeah.

12 DR. KAHN: All right. But that's
13 not really what this was addressing.

14 MR. CALABRESE: Yeah. And we
15 began discussing that question about should
16 there be, you know, additional designated
17 bands for unlicensed, and we haven't gotten
18 beyond sort of a listing of pros and cons.
19 But, as Kevin said, this set of
20 recommendations, you know, when we're talking
21 about a requirement of connected devices,
22 we're really -- what we're really thinking

1 about in particular is sharing with federal
2 primaries, you know, in bands that will be
3 occupied by primaries that need some form of
4 protection or assurance.

5 DR. HATFIELD: I'll be quiet, but
6 it's more than just being tethered. It
7 probably means that you're going to be
8 constrained somewhat in your modulation in
9 some of those other things to be able to
10 assure compatibility and so forth. So I have
11 a hunch it's going to end up more than just
12 you have to be tethered, but you have to be
13 operating in certain ways in terms of your
14 waveforms and things like that, perhaps.

15 DR. KAHN: Yeah, but that's true
16 even in the 5 GHz, right, with the sharing
17 arrangement with the radars, right. I mean so
18 that --

19 DR. HATFIELD: Is that --

20 DR. KAHN: -- that almost goes
21 without saying if surety --

22 DR. HATFIELD: Is that good or

1 bad, is what I'm --

2 CO-CHAIR ROSSTON: So, Mark.

3 MR. GIBSON: Yeah. I just want to
4 go back to the point -- this is Mark Gibson --
5 the point, the question Karl asked of Michael
6 five minutes or so ago, and that's the user
7 community and, you know, with respect to how
8 they're going to adopt this or embrace this.

9 And I don't think it's the user
10 community, I think it's the manufacturers.
11 Because I think if you look at the situation
12 we have in whitespace, you've got unlicensed
13 devices that have interference rights over
14 other unlicensed devices by virtue of them
15 being able to register in the database. A
16 very complex process, that when you talk to
17 the mic users they're not even sure how to do.

18 And, you know, I'm not going to
19 sit here and have it on the public record that
20 the mic guys are responsible for it, but all
21 you got to do is read the press, so they've
22 got to be at the table, I think, and it's not

1 -- in the end it's not the people using the
2 mics -- and I notice these are wired -- it's
3 got to be the manufacturers, because the
4 people buy what the manufacturers sell.

5 So I put that to you, Michael.
6 You know we need to kind of reach out to them
7 at some point in this process.

8 CO-CHAIR ROSSTON: Harold.

9 DR. FURCHTGOTT-ROTH: Karl, again
10 this is Harold Furchtgott-Roth, in answer to
11 your question.

12 I think if NTIA makes a proposal
13 to the Commission -- first of all, the
14 Commission's going to take it very seriously.
15 And it's NTIA almost on behalf of federal
16 users, which I think begins to answer some of
17 the issues that have been raised here at the
18 table this morning.

19 The discussion in the Subcommittee
20 was very much about unlicensed use within the
21 context of federal bands, if you will. There
22 was discussion, as Michael mentioned, about

1 should there be created a new band, and I
2 don't think the Subcommittee was willing to
3 reach a consensus on that.

4 But, Karl, I think if NTIA went
5 and said this is something that we'd like to
6 have the Commission address but primarily in
7 the context of unlicensed use in federal
8 bands, then I think that might give the
9 context that the Commission would look at.

10 MR. NEBBIA: This is Karl.

11 That certainly would be a
12 significant undertaking, because on many
13 rulemakings the Commission does, we clearly
14 respond in a case where they're doing
15 something, we say, and what you're doing
16 impacts federal users in such-and-such a way.
17 For us to initiate a rulemaking on this, on
18 behalf of the administration, and I think
19 that's how it would be viewed, is basically
20 for us to conclude upfront that we think
21 industry should, in fact, make all these
22 changes.

1 And for us to get onboard with
2 taking the administration going forward and
3 saying they think industry should do this or
4 that is a little bit more significant than us
5 responding on behalf of federal users in a
6 normal rulemaking. So I think we certainly
7 have to have that kind of internal policy
8 discussion before we would press that very
9 publicly.

10 But one other thing I just want to
11 take note of in this process is that
12 ultimately I think we have a process, whether
13 it's through the chaotic bands or the other
14 more organized bands, we have a set up here
15 that really benefits an industry of people and
16 certainly benefits U.S. consumer users, and so
17 on.

18 And I think the structure that
19 we've created, I think, makes the way for
20 that. And if that structure doesn't work, we
21 begin to cast doubt on it. We begin to cast
22 -- you know, create issues for it.

1 And certainly on the garage door
2 issue, I think the resolution or the real
3 movement forward on that issue came partly by
4 DOD being willing to talk with the
5 manufacturers, but ultimately the
6 manufacturers accepting their responsibility
7 of going back to their customers. Whereas in
8 the initial days of the problem they kept
9 saying: It's DOD. Call your Congressman.
10 And that was the manufacturers' approach. But
11 once they finally came to a point of saying
12 this is in all of our interests to make this
13 work, this structure that we have, then they
14 got onboard, I think, in the information
15 process. And I think ultimately, as we lay
16 out, well, the FCC and NTIA need to talk to
17 Congressional people or need to make the
18 public known, the industry that supports this
19 really needs to play a huge role in that part.
20 And if they come onboard and say, 'Well,
21 here's how we solve this problem,' that's
22 different from them saying, 'No, let's keep

1 pressing home with the political angle to get
2 DOD off of the spectrum,' so.

3 CO-CHAIR ROSSTON: Jennifer.

4 MS. WARREN: Jennifer Warren.

5 Two questions. Actually one for
6 Karl and then one for Michael.

7 Karl, I'm only familiar with one
8 proceeding where NTIA has initiated a request
9 for a change at the FCC. And it didn't really
10 get -- I think it's been pending five to ten
11 years, perhaps lack of industry engagement has
12 been part of that. But other than that, which
13 I encourage you to pursue, what -- are there
14 other examples of where there has been, you
15 know, successful action by the FCC at
16 initiated rule-change requests?

17 And then my second question is to
18 Michael.

19 Michael, in the context of the
20 education of consumers, about what it means to
21 be unlicensed, did labeling come up as an
22 issue? And I don't mean in the instruction

1 manual at the back where it says Part 15.
2 We've always been challenged with having that
3 mean anything to a user. But I know in the
4 past when labeling has come up, that has been
5 rejected soundly by policymakers and some of
6 the industry representatives.

7 So that question is to Michael.
8 The first question to Karl.

9 MR. NEBBIA: Well, I think the one
10 rulemaking you're talking about is probably
11 the most notable case where we've asked for
12 something and I think it's actually closer to
13 20 years --

14 MS. WARREN: Oh, sorry.

15 MR. NEBBIA: -- we've been waiting
16 for the response. But the place actually
17 where we do it is generally NTIA formulates
18 the outcomes of every WRC and puts a proposal
19 on the table to the Commission of a lot of
20 allocation changes and generally -- so that's
21 the place where we have done this the most in
22 the past, --

1 MS. WARREN: Okay.

2 MR. NEBBIA: -- but it's not
3 something we do very regularly.

4 MS. WARREN: Thank you.

5 CO-CHAIR ROSSTON: Michael, did
6 you want to respond to the question? Then
7 we'll get to Rick.

8 MR. CALABRESE: Yeah, sure. And,
9 you know, again others can pipe up if they
10 remember more about this. We did discuss that
11 in the sense that we -- you know, I remember
12 someone suggested that the labeling
13 requirements should be more strict because
14 there's a tendency for manufacturers, for
15 example, they may include the information but
16 bury it in an instruction manual or some other
17 insert in a box that consumers throw out when
18 they first open it.

19 But that tends to fall so squarely
20 in the FCC's side of things, that we didn't
21 pursue it in any greater detail, although if
22 NTIA wants us to, we can try.

1 CO-CHAIR ROSSTON: Okay.

2 DR. KAHN: Although I think we
3 also did observe in the Committee that
4 realistically consumers haven't got a clue
5 what these things are. They don't even know
6 they're radios half the time. And to expect
7 that somehow we can educate them, you know,
8 about what they've got in a way that does some
9 good, was probably -- you know, it was a
10 wonderful idea for all of the wireless
11 professors in the world who didn't want to go
12 for tenure, they could set up commercial shop
13 educating consumers, but realistically it
14 wasn't going to happen.

15 CO-CHAIR ROSSTON: So that was
16 Kevin Kahn.

17 DR. KAHN: Yes.

18 CO-CHAIR ROSSTON: And now we have
19 Rick Reaser.

20 MR. REASER: Yeah. I don't want
21 to diminish the role of the manufacturers and
22 the people who build these things, but I think

1 that the regulator needs to take a stronger
2 role in this whole matter, really. I have one
3 of those garage door openers and I think I may
4 have told you about it.

5 It didn't work and, you know, I'm
6 like sort of an engineer, so I needed to fix
7 that thing because this could last forever
8 given the proper attention. And what I found
9 out was when I called the manufacturer, they
10 were not permitted to sell repair parts.
11 They're not permitted to sell any of this
12 stuff. He says, 'You have one of these bad
13 frequency band, so your only option is to buy
14 a whole new head, the rail, everything, and
15 you have to replace the entire unit.'

16 Now I happened to find one on
17 eBay, a card, and I found out that I bought a
18 card and it turned out the sensor, other
19 sensor was broken, it wasn't even the card,
20 but I got it to work. But the manufacturer
21 had instructions they were not allowed to even
22 sell repair parts or anything to get everybody

1 out of that band that was the radar band.

2 Now fortunately I live by a big
3 UHF radar, so I don't have a problem with it,
4 but, you know, there was some -- they had a
5 rule told that they were not allowed to sell
6 this stuff. I think it's important for
7 regulators to try to help these problems, not
8 just leave it up to manufacturers. Because
9 they would have been happy probably to keep --
10 actually they probably wanted me to change out
11 every year my garage door opener. I won't --
12 I passed it. But I just think the regulator
13 does have a role, an important role in this.

14 CO-CHAIR ROSSTON: So, Michael,
15 you had suggested that you thought possibly
16 bringing this up for a vote to get the
17 Commission recommendation. I think we've had
18 enough discussion and also not sort of having
19 not brought up as an idea that with would vote
20 on these as recommendations at this meeting,
21 then maybe we move that to the next meeting
22 and say that you'll -- that we'll make sure

1 the people are aware that they're going to be
2 asked to vote on the recommendations at the
3 next meeting, if that sounds okay with you?

4 MR. CALABRESE: Yes, that's fine.
5 I just wanted to, you know, -- I just wanted
6 to convey that we thought -- you know, we
7 thought you certainly could adopt it if we
8 were ready. But we can wait and perhaps even
9 make some additional refinement.

10 MR. ADLER: Yeah, we're in the
11 same boat. This is Larry. We're in the same
12 boat. I mean we had kind of had consensus on
13 the --

14 CO-CHAIR ROSSTON: Yeah.

15 MR. ADLER: -- Sharing
16 Subcommittee, so these are before the full
17 Committee.

18 CO-CHAIR ROSSTON: So I think
19 we'll make sure that the -- you know, that
20 these have been discussed at this meeting, and
21 then they can come up -- that people should be
22 aware, and we'll make clear in a cover note

1 and everything that they'll be available for
2 the next meeting.

3 MR. NEBBIA: And we'll try to
4 provide any informal comments that we have
5 back, so you can make mods. I think on the
6 unlicensed side we certainly would appreciate
7 consistency in the terminology referring to
8 these different bands, because I just think
9 the terminology generally is wrong with
10 respect to what we actually use, so.

11 CO-CHAIR ROSSTON: Okay. So why
12 don't we -- I'm good at enforcing ten-minute
13 breaks, so we will take a ten-minute break and
14 be back here in ten minutes.

15 CO-CHAIR FONTES: It's currently
16 11:02.

17 MR. NEBBIA: Just very quickly.
18 Yeah, I know we are going to take a break, but
19 they did provide us a document on an
20 interference-clearing website that I hope we
21 would come back to at the next meeting. And
22 also they did provide a list at the end of

1 their item that I think I would certainly like
2 to be as clear as possible that any answers
3 that we can get on the questions as originally
4 asked would be helpful, but also looking at
5 this list on page 11, the aspect about how we
6 should accommodate unlicensed operations in an
7 inventory, I think would really be helpful to
8 know where those products are. I'd like to
9 hear what your thoughts on there -- on that.

10 And then I also think the idea of
11 exclusive bands, I think is something worth
12 looking at since that was mentioned as a
13 possibility in the national broadband plan,
14 but we need to be more specific about it. I
15 don't think a discussion of pros and cons --
16 I mean if folks really think there are certain
17 bands that that can be done, I'd like to hear
18 what they are. But another conversation of the
19 goods and bads of doing that, I'm not sure is
20 much help to us.

21 CO-CHAIR ROSSTON: Okay, great.

22 CO-CHAIR FONTES: It's now 11:03.

1 CO-CHAIR ROSSTON: Ten minutes
2 starts. And, Mark, you're ready to go in ten
3 minutes.

4 (Recess taken from 11:03 a.m. to 11:16
5 a.m.)

6 CO-CHAIR FONTES: Thank you.
7 Okay. Next item on the agenda, everybody back
8 on the phone hopefully, everybody's back in
9 the room here, the next item on the agenda is
10 the Spectrum Management Improvements
11 Subcommittee's Work.

12 And, Mark, are you making the
13 presentation?

14 MR. GIBSON: Yup.

15 CO-CHAIR FONTES: I know Bryan is
16 on the call as well.

17 MR. GIBSON: And Bryan will add
18 whatever comments he wants to.

19 CO-CHAIR FONTES: Great.

20 MR. TRAMONT: Mr. Gibson is doing
21 -- will do a more-than-adequate job in my
22 absence, I am certain.

1 SPECTRUM MANAGEMENT IMPROVEMENTS

2 SUBCOMMITTEE'S REPORT

3 MR. GIBSON: My co-chair is so
4 kind.

5 Okay. Well, this is the second
6 report. And what we were looking at was the
7 data types necessary to support what we might
8 call full-scale spectrum management, including
9 compatibility analysis and frequency
10 selection, and how do we get to those
11 datasets.

12 That's a paraphrase of the
13 question that was in the workplan. Another
14 aspect of that question is: Is this
15 important, which I think we say yes. So cross
16 that off.

17 The approach we took was to kind
18 of break this down and look at the data
19 elements necessary to do spectrum planning or
20 spectrum analysis and spectrum management.
21 And then looking at other areas, specifically
22 receive-only type operations, unlicensed

1 operations, and then kind of stepping out into
2 the future world a little bit with waveform
3 data and the data necessary to support it,
4 dynamic spectrum access and cog. radio.

5 We made a comment about the FSMS
6 that I won't belabor. So we're still looking
7 forward to getting our FSMS brief.

8 So if you look on page 4, and this
9 was presented, I believe, in Boulder, it was
10 either in Boulder or it was in November. The
11 elements necessary for spectrum planning.

12 You know this isn't really
13 exhaustive. It's representative. You know
14 you could dwell down on this. And I think in
15 our databases, we have over 150 elements that
16 we use for spectrum planning. But this is it
17 and so we can talk about that as necessary.
18 But, like I said, I put this out there in one
19 of the earlier meetings.

20 Then we talked about receive-only
21 devices and what that constitutes, and we'll
22 deal with that when we get into the

1 recommendations. Some of that was addressed
2 in the law that just came out or the bill that
3 just came out. And we really haven't had a
4 chance to go back and tie this back to that,
5 given I think it came out the day before we
6 finished this.

7 The other discussion was on
8 licensed devices and how we can address that.
9 I want to point to an error in the document
10 that you all have, which I have subsequently
11 fixed in an updated document.

12 Contacting the FCC, there are
13 60,000 unlicensed devices, not 160,000. That
14 was an error that I made when I looked at the
15 Commission's Experimental Equipment
16 Authorization Database, and I saw 160,000, and
17 they corrected me on that. So I will send out
18 an updated -- on that --

19 CO-CHAIR FONTES: Okay, Mark,
20 could you -- could somebody on the phone
21 please put us on mute -- is that how I sound?
22 That's terrible.

1 MR. GIBSON: Wow. I think it's on
2 mute.

3 CO-CHAIR FONTES: For those on the
4 phone, okay. Great. Thank you.

5 MR. GIBSON: Then on page 6 we
6 discussed a little bit about the waveform data
7 and how we would use that. You know that
8 overlaps with some of what Larry Adler's work
9 group is doing.

10 And then, finally, we talked a
11 little bit about the data necessary to support
12 cog. radio.

13 So the first recommendation was:
14 Develop a set of -- this is consistent with
15 the recommendation we made in the last report,
16 this set of distributed databases that are
17 normalized. We suggested that the NTIA should
18 look, and we think this is being done with
19 FSMS development, so if that's what's being
20 done, that's great, to flesh out the data
21 necessary for radio antenna and subsequent
22 ancillary databases that will support

1 waveform, as we talk about later on.

2 For example, curve data related to
3 carrier-to-interference data; Ti performance,
4 you know, filter data. So that's what we
5 suggested in the first recommendation.
6 Essentially, just get better data on the radio
7 and antenna.

8 The second recommendation was to
9 support receive-only devices. And consistent
10 with what came out in the bill, you know, we
11 kind of used a little bit of that language and
12 we sort of refer to it in here. The idea
13 behind a radio receive-only device is that
14 they could be, you know as we've seen, a class
15 of devices that won't operate with a specific
16 type of transmitter. And it's been
17 overhanging discussions that we've had for
18 some time. So we suggested that, you know,
19 consistent with what's in the recommendation,
20 that NTIA should look at how they deal with
21 those types of devices, starting at
22 characterizing what types of receive-only

1 devices that are out there.

2 And you know we could probably
3 flesh this out a little bit more as we
4 probably have to, but you could look at the
5 ones that are, you know, of great note and
6 then work on down to ones that may be somewhat
7 more arcane. So we may take a stab at that in
8 the future.

9 The other thing was to accommodate
10 unlicensed devices. One suggestion was to
11 connect with the FCC's Equipment Authorization
12 system. They've made available an API for
13 database administrators for whitespace. And
14 I'm not sure how that would work with FSMS or
15 even with GMF, but at least it's available.

16 It's not a be-all and end-all
17 database of information for unlicensed
18 devices. What it will probably do is give you
19 a better sense of what type of devices you're
20 talking about. But, nonetheless, it's a
21 resource that's there that we use a lot to
22 identify, you know, what devices are operating

1 in what spectrum. And further collaboration
2 could occur between the NTIA and the
3 Commission to flesh that out a little better
4 for interference mitigation -- interference
5 management.

6 Recommendation 4 was to establish
7 a framework for waveform data. That's kind of
8 a sub recommendation off of the first
9 recommendation. Essentially, this is to
10 accommodate devices that will actually be
11 operating in a cognitive fashion, that will
12 use either policies or databases, but will
13 actually have information within the database
14 to do its own interference analysis. So we're
15 thinking of things like Ti curves, Ci curves,
16 and that sort of thing, and then even other
17 waveform data, and so supporting that there
18 was an appendix that described some example
19 waveform data that comes out of the IIT's
20 WiNCom area that Dennis Roberson submitted.

21 And, 5, this is sort of a
22 highfalutin one. It's just monitor the

1 developments in dynamic spectrum access and
2 just keep track of that. I realize that's
3 probably a little nebulous, but the idea is
4 that there are developments ongoing through a
5 lot of the work that's being done even right
6 now in whitespace, that might overhang what
7 NTIA does or that NTIA could learn from.

8 So the suggestion in this
9 recommendation is just that NTIA just keep
10 track of that. And, again, we can flesh that
11 out as we see fit.

12 I believe that was -- yeah, so
13 that's the report of the Spectrum Management
14 Committee.

15 CO-CHAIR FONTES: Great. Bry, do
16 you have any other comments to add to Mark's
17 presentation? Tramont?

18 MR. TRAMONT: Sorry. I had you on
19 mute. I apologize. No, I --

20 CO-CHAIR FONTES: Story of my
21 life. Okay, great.

22 I'd like to open it up to

1 discussion. Any comments, questions?

2 Karl.

3 MR. NEBBIA: Yeah. Just once
4 again, Mark, I think in some of the other
5 areas we've often talked about maybe policy
6 perspective changes, and those things
7 generally don't link themselves very directly
8 to dollars. But in this case when you're
9 talking about improvements in our system,
10 almost every proposal you make requires some
11 undertaking to be. And, anyway, you can give
12 some sense of estimate as to what you think
13 that's going to cost, both at NTIA and agency
14 levels, I think would certainly be important.

15 I did want to note your reference
16 in here to dedicated unlicensed bands on page
17 5, which -- which I've already crossed over,
18 and we'll work on some other words for that.
19 But I think, you know, how much each of these
20 cost I think is a significant component of
21 moving them forward.

22 MR. GIBSON: Okay. We'll have

1 another pass at this and flesh out a little
2 more, and also try to make the responses
3 consistent with some of the comments you made
4 early on. Because we get a better sense of
5 what you're looking for now. Thank you.

6 CO-CHAIR FONTES: Great. Rick.

7 MR. REASER: I wanted to ask the
8 question that I had earlier when you talked
9 about, it was like 2 to \$4 million to do the
10 checking over the database and so forth. This
11 sort of relates from our Committee.

12 Has there been any thought about
13 sort of opening up what you can to let people
14 fix stuff on their own? I mean I'll be
15 honest, I made this comment before, if I could
16 fix every record that our company has, I would
17 do it just because out of pure -- to fix it.
18 Because we have a lot of errors on things in
19 our -- for the things we build in terms of all
20 that. And updating some of them.

21 But the process to update anything
22 is just incredible for us. You know, to

1 noteholders, it takes a year and a half for
2 something to get processed or to change the --
3 reverse part numbers on a GPS antenna, by the
4 way, it took us a year and a half to get that
5 fixed.

6 It just seems like there might be
7 some opportunity if -- and I know that the
8 federal agencies want to maintain control over
9 that, but there's a lot of things that we
10 could do very quickly, including they need to
11 be in charge of all that. But if they could
12 somehow let us help.

13 And there are other mechanisms
14 that people could help with those things as
15 well, because everybody has way too much to do
16 in every level that we work with, from an
17 industry contractor all the way up to you.
18 And so some of our stuff gets delayed.

19 A certification will sit at just
20 the next level, which is a major command level
21 for a year, just -- I mean we get assignments
22 in the meantime to do that. But like, my God,

1 by the time we get stuff actually formally
2 approved, the program has been terminated, I
3 mean like four years later.

4 So it just seems like there might
5 be some other mechanisms rather than the same
6 old ones doing the same old people doing the
7 same old things because their plate's just a
8 hundred miles tall. It just seems like -- or
9 we say we're not going to do it. I mean you
10 got to make a decision here.

11 MR. NEBBIA: Sure.

12 MR. REASER: That's my comment.

13 CO-CHAIR FONTES: Thank you, Rick.

14 Are there other comments?

15 Karl.

16 MR. NEBBIA: I've got a response.

17 Yeah, I certainly think there are probably
18 places where we look at some of our processes
19 where you probably say we just probably
20 shouldn't do that. We should cut this down,
21 cut that down. We're looking at the spectrum
22 certification process. Which of those do we

1 actually need to look at, which do we need to
2 review in depth and which don't.

3 Also there may be processes where
4 we can come up where an agency supplies
5 someone who could do the review essentially on
6 our behalf where all we have to do is review
7 the outcome, and that sort of thing.

8 I think also as we look at, for
9 instance, databases of unlicensed devices, and
10 so on. If somebody in the industry found that
11 in their interest to produce such a database,
12 that we could go out and check out, and when
13 we're making a choice, that certainly is
14 easier than us having to go back and come up
15 with -- you know, go to the Commission and
16 petition them to please create a database that
17 shows us this and that.

18 I mean we're already running into
19 issues as we try to discuss the data that
20 we're putting in FSMS and what's required for
21 these analyses and so on. And asking the
22 Commission, 'Well, what will you do with all

1 these data requirements on your side,' because
2 we're going to be interacting in our databases
3 and shared bands and so on. And I know
4 there's a lot of concern over there about each
5 one of those things would require them to go
6 back out with a rulemaking, demanding more
7 data from all their constituents, and so on.

8 But I do think you're right, Rick.
9 There are probably places where we could
10 consider how could we get industry or the
11 user, not -- I don't want to say the user
12 groups, meaning the end users, but the
13 manufacturers involved with certain things to
14 possibly work on some of these component
15 pieces to simplify the job that we have.

16 I mean we already rely heavily on
17 our agency users to help us in the process.
18 That's what the IRAC's about, the Frequency
19 Assignment Subcommittee, for instance,
20 although we do look at the data that comes in
21 to make sure as far as we can tell the data's
22 correct. It's the agencies themselves who

1 analyze the request and determine whether it's
2 going to bother them, so we're already heavily
3 reliant on them. But I think that's an aspect
4 as we look at these tasks that are going to
5 cost something. Maybe we can look at who
6 might actually be willing to do them.

7 MR. GIBSON: Let me just -- this
8 is Mark again, one quick comment.

9 You know with whitespace there is
10 a database of unlicensed devices. I'm not
11 sure how good it is just yet, but in time it
12 will be the database that commands how these
13 devices operate. And the rules require that
14 certain devices register in there, so you'll
15 be able to use that.

16 And then as it matures there will
17 be other metrics we can pull out of that to
18 help with this as well. And also that this be
19 sort of a de facto -- actually a de jure
20 database of unlicensed wireless -- unlicensed
21 and licensed microphone operation. So I'm not
22 sure that that is -- you know, it's a

1 microcosm of all the unlicensed use, but we
2 can do some statistical analysis on it,
3 perhaps, and maybe make some determinations,
4 but it will be there.

5 MR. NEBBIA: Great.

6 CO-CHAIR FONTES: David, do you
7 have a comment?

8 DR. STANCIL: Dan Stancil, NC
9 State.

10 CO-CHAIR FONTES: I'm sorry.

11 DR. STANCIL: I was just thinking
12 about combining the ideas of Rick and then
13 Kevin had mentioned earlier about updating the
14 database that if it -- Rick was -- Kevin was
15 talking about how perhaps flags could be set
16 so you would know how reliable the data was,
17 how recently has this been checked and so
18 forth, or who checked it and that sort of
19 thing.

20 If you opened it up and sort of
21 some of the databases up in a Wikipedia style
22 so that anybody can go in and change them, of

1 course then there would be the same questions
2 with Wikipedia about how accurate is the
3 information. But if you -- if there were
4 intermediate flags, like you had to identify
5 who had updated it, you could say, okay, has
6 this been -- has this update been authorized
7 by -- or verified by NTIA or was it the
8 manufacturer, or something else.

9 And I would imagine with some sort
10 of open kind of Wikipedia style approach, that
11 the overall accuracy -- or errors of the
12 database over time would gradually diminish.
13 Just combining those two thoughts sort of.

14 CO-CHAIR FONTES: Great. Thank
15 you, Dan.

16 Greg.

17 CO-CHAIR ROSSTON: This is Greg.
18 Thinking about something you said earlier made
19 me think that you have 250,000 records, or
20 something like that. It seems like that one
21 of the things we should be thinking about in
22 all of our recommendations is prioritization,

1 that a lot of these are probably in bands that
2 are never going to be shared, and we don't
3 need to update those. We want to set it up in
4 a way that we look at the bands that are going
5 to be prioritized -- going to be possibly
6 available for sharing and get those done first
7 and not look -- you know sort of the industry
8 can update other things, but your resource is
9 -- should be focused on really doing it in a
10 small subset and in some sort of order. And
11 maybe that could be put into the
12 recommendation.

13 MR. GIBSON: This is Mark.

14 And that was implicit in the
15 recommendation. We'll just make it explicit,
16 because when we were looking at this we
17 realized that they're not going to look at the
18 whole database at once and try to do it all at
19 once. Karl and I had some follow-up
20 discussion, and the intent was we'd start
21 probably with the 500 MHz we're looking at.

22 Ideally since some of that -- and

1 that spectrum is part of the next tranche that
2 gets released, presumably that we'd have to go
3 through that and not put it on industry to go
4 back and forth to try and make the corrections
5 in real time. So we'll go back and make those
6 recommendations more explicit in another
7 draft.

8 CO-CHAIR FONTES: Yeah. And I
9 think Dale presented a recommendation earlier
10 in the discussion about rather than doing a
11 census of all the band, if you will, you could
12 do a sample to kind of get an error rate.

13 MR. GIBSON: Right.

14 CO-CHAIR FONTES: And that can
15 give you a read as to whether or not
16 additional work needs to be done to do a
17 deeper dive in that particular band you're
18 examining.

19 MR. GIBSON: And some are worse
20 than others, that's true.

21 DR. HATFIELD: I'm just saying too
22 I realize I'm a broken record here, but you

1 not only have to worry about the band, you
2 have to worry about the bands on either side
3 in some of these cases too. So you can't just
4 focus on just the band. Sorry. I think I
5 have a one-track mind today.

6 CO-CHAIR FONTES: That's an
7 excellent point, Dale.

8 MR. GIBSON: Good to be
9 consistent.

10 CO-CHAIR FONTES: Okay. Any more
11 discussion?

12 MR. ROBERTSON: As an aside, Dale,
13 when you get a chance I need to talk to you --
14 this is Dennis -- on exactly that subject.

15 CO-CHAIR FONTES: Great. There we
16 go.

17 Any further discussion of Mark's
18 presentation? Great. Okay. We're onto the
19 next agenda item and we're pretty much --
20 pretty close to schedule. This is the Next
21 Steps/Open Discussion.

22 NEXT STEPS/OPEN DISCUSSION

1 CO-CHAIR FONTES: I'd like to
2 start out actually myself and have you think
3 about this as you make the recommendations.
4 We had an opportunity to speak to some of the
5 folks last night who sat around the dinner at
6 the lovely hotel -- or the inn, excuse me.
7 And one of the things, you know every now and
8 then you keep putting yourself back into the
9 chair of the policymaker. And we're going
10 through each of the recommendations and each
11 Committee will make several recommendations
12 over the course of all the work that we're
13 doing in the CSMAC.

14 And if I were sitting in Larry's
15 chair or Julius Genachowski's chair or
16 anybody's chair that's a policymaker that has
17 to make fiscal decisions, each recommendation
18 comes with associated cost. And so what I
19 think would be helpful in all the
20 recommendations that are being made, and we're
21 doing this actually in the CSMAC, in the
22 Committee that Larry Fleury and I chair, we're

1 actually prioritizing the recommendations. In
2 the case in CSMAC we're prioritizing the
3 standard -- CSRAC, excuse me -- prioritizing
4 the standards that needs to be done
5 immediately midterm and long term.

6 And it just helps kind of focus
7 what work needs to be done in the order, if
8 you will, in terms of priority. And then in
9 reality, some of these recommendations may be
10 listed as recommendations or they may be
11 listed as kind of items of interest or factors
12 in your deliberation, rather than specific
13 recommendation.

14 So I'm just going to open that up.
15 I think this would be helpful. Sometimes in
16 some cases it may be even doable to try to
17 provide a dollar figure associated with the
18 recommendation, to kind of get an impact, but
19 you may not be able to fully provide that type
20 of information just because you may not know
21 all the information necessary associated with
22 the recommendation.

1 So I'm just going to throw that
2 out there for your comment or deliberation.
3 Any comments on that.

4 Gary.

5 MR. EPSTEIN: Obviously I think
6 it's a good idea, but one of the things you're
7 going to have to face is the fact that as
8 we've -- we knew before and we learned again
9 today that there's a lot of overlapping
10 recommendations.

11 CO-CHAIR FONTES: Um-hum.

12 MR. EPSTEIN: And so it's got to
13 get up to the full Committee level for that to
14 make any sense at all. I don't know quite how
15 you're going to do that. We can make
16 recommendations as subcommittees, but when you
17 put the whole thing together, somebody's going
18 to have to look at it and do what you're
19 suggesting.

20 CO-CHAIR FONTES: Thank you.

21 Jennifer.

22 MS. WARREN: This is Jennifer

1 Warren.

2 No, I think that's a really good
3 idea, but also I think focus on creating a
4 more integrated CSMAC output, because right
5 now we've got kind of stovepiped, if you like,
6 outputs that we all vote on, but that have
7 been created and developed and discussed, but
8 not really, I think, prioritized in any way.
9 It's kind of just shot across the transom.
10 And I think that could be a really good value,
11 so.

12 CO-CHAIR FONTES: Yeah, it'll be
13 work, to your point, Gary, because we all have
14 our vested interests and our specific
15 recommendations. But as a collective group,
16 coming together and prioritizing the
17 recommendations will, I think, in large part
18 provide a roadmap, in large part be able to
19 identify a recommendation and distinguishes a
20 recommendation from perhaps a course of action
21 you may wish to consider.

22 MR. REASER: Yeah, I agree. This

1 is Rick Reaser. I agree it would be a good
2 idea for us to prioritize our recommendations
3 and maybe recategorize some of them as advice,
4 or something like that.

5 The other thing we talked about,
6 though, and it would be interesting to see Mr.
7 Strickling's reaction to this one, not only
8 prioritizing our recommendations but you know
9 one of the things that sort of came across me
10 listening to Karl and his -- he really only
11 has 20 people that actually do spectrum
12 management, when it comes right down to it,
13 because the rest of them do lots of other
14 things. But maybe NTIA would like some ideas
15 or some advice about how he might prioritize
16 his own work in terms of OSM, and so forth.
17 You have like a billion things to do, all
18 these recommendations have come out for years
19 and years and years, and you don't have
20 anybody to work it and no budget to do it.

21 What I was going to recommend in
22 addition to prioritizing our own

1 recommendations on the CSMAC, the NTIA OSM may
2 be interested in having us take a look at
3 their giant laundry list of things and maybe
4 giving them some ideas about what we think is
5 important from our perspective, in terms of
6 prioritization of that.

7 They have very few people, a very
8 small budget to do way more things than is
9 humanly possible. And so that might be
10 something that might be of help to them, may
11 not be. But I just want to toss that out
12 there, something we talked about at dinner
13 last night.

14 MR. STRICKLING: So this is Larry.
15 And -- although I think we'll definitely let
16 Karl respond to that as well. Part of our
17 issue is we have way too many people trying to
18 set priorities for us. Right now we're --

19 (Laughter.)

20 MR. STRICKLING: We have a Hill
21 report that's due in a couple of weeks, where
22 again they basically said go do these things.

1 And they did it in an appropriations report.
2 And of course there was no money for any of
3 this, but it was kind of like just do it. So,
4 you know, I think it's a testament to the
5 incredible job Karl and his people are doing,
6 that they are managing through all of these
7 issues. And we haven't even talked about the
8 kind of resources we had to put onto Light
9 Squared in the last 12 months and some of the
10 other issues that have come into us without
11 any warning or any preplanning.

12 So I don't know how helpful it
13 would be for you folks to kind of go through
14 the entire list. I mean that, in effect, is
15 what they're paying Karl and me to do. And we
16 have to balance a tremendous number of
17 competing interests as we determine how to
18 allocate resources. But at the end of the day
19 Karl has to get the spectrum assignments done
20 for these agencies.

21 So it kind of begins and ends with
22 making sure we can get that done, because we

1 can't just say, 'Oh, well, let's take all
2 those people for three months and put them on
3 one of these interesting tasks here as much as
4 we might like to,' and even where it might
5 lead to some improvements down the road. So
6 we have to figure out ways to kind of keep
7 adding to the airplane while it's still
8 flying.

9 But, Karl, I don't know if you
10 have other thoughts you want to share on this.

11 MR. NEBBIA: Yeah. I mean I think
12 one of the challenges is certainly when we are
13 assigned things by law, we don't really have
14 a choice. So would an evaluation of the
15 priorities of those things be helpful,
16 probably not. I'm going to have to do them.
17 You know we need to do them anyway, so.

18 There are probably areas of the
19 work that we do where you have contact with
20 it. I know there are a certain number of you
21 that actually do have direct contact with our
22 processes regularly through your companies or

1 working with agencies and so on. And if there
2 are things that you feel like we could just --
3 we don't need to do, I think that's worth
4 discussing so that we could simplify some of
5 the processes we have.

6 And also you know as you run into
7 some of our workplan, if you see things that
8 we're studying there that we probably don't
9 need to study because we've got engineers
10 working on this task and that task, I mean we
11 still -- the presidential memo from the
12 previous administration is still in effect.
13 And we've got a list of topics there we're
14 supposed to work too. So I just think there's
15 a certain amount it could help in areas that
16 you particularly have contact with, but I'm
17 not sure we're going to be able to make much
18 of --

19 MR. REASER: So let me tell you
20 that the reason I brought this up was that
21 sometimes it's helpful to the agency to have
22 an outside source sort of point out the fact

1 that you're totally overwhelmed, worked, and
2 swamped because people may not realize that.
3 They just think NTIA has got four letters,
4 must have four billion people in that thing to
5 work on this, you know. So that was sort of
6 the -- one of the issues I'd say.

7 Another thing, we could be the
8 prioritizer of the prioritizers. I wouldn't
9 mind doing that job.

10 CO-CHAIR FONTES: Okay. Well, I
11 just put that out for comment. And I think it
12 would be helpful just as you work on your
13 individual, to Jennifer's point, stovepipe
14 committee activities, if you were to try to do
15 some prioritization of your recommendations
16 and look at it in terms of short term, medium
17 term, long term type of priorities.

18 And then also take a look at them
19 to see how many of them truly are
20 recommendations in the true sense of the word
21 of recommendations for change or things that
22 could be considered by NTIA as advisement, if

1 you will, and how to achieve what it is that
2 ultimately we're recommending. So I think
3 that that may -- I hope that will help you
4 out.

5 MR. NEBBIA: I think one thing we
6 could consider is putting together, I think
7 Jennifer's right, it would be easier to come
8 up with the prioritization when the whole
9 Committee's considered something and fits it
10 in with the other recommendations that have
11 been met. So I think if we pull like we've
12 done in our document, pull each of the
13 recommendations up and maybe ask you to look
14 at it in terms of priority, in terms of is
15 this easy to do versus hard to do, shortterm
16 versus long term, and then specifically with
17 respect to high value or low value.

18 And we look at tasks that we're
19 trying to change within NTIA, we're always
20 asked to consider them: Are there high-value
21 items that are easy to do versus hard to do.

22 And then ultimately I think to

1 prioritize the list, if you're able to do
2 that. And because we realize you have limited
3 time too and focusing the recommendations into
4 ones that are things that we could get done
5 and prioritize as opposed to just continually
6 adding to the list has certainly got a lot of
7 value to it.

8 CO-CHAIR FONTES: Sure. And I
9 think it would be helpful too, and we can work
10 with Bruce in just trying to pull a list of
11 recommendations that have been made already,
12 so that we can have a chance to review those
13 and begin to start the thinking process of how
14 to rank them in terms of shortterm, long term,
15 intermediate, et cetera, and the value
16 associated with it.

17 At this time I would like to open
18 it up for public comment. During our meetings
19 we have the opportunity for the public to
20 provide comment. So right now the floor is
21 open.

22 PUBLIC COMMENT

1 MR. SNIDER: I have a question.

2 CO-CHAIR FONTES: Could you
3 identify yourself, please?

4 MR. SNIDER: Yeah. My name is Jim
5 Snider.

6 CO-CHAIR FONTES: Thank you. Go
7 ahead, please.

8 MR. SNIDER: Hi. This is Jim
9 Snider. Can you hear me?

10 CO-CHAIR FONTES: Perfectly.

11 MR. SNIDER: Yeah, great. So,
12 first of all, I wanted to say that the webcast
13 quality was quite high and I could follow it.
14 And I appreciate that.

15 A few questions that I have about
16 the webcast. The notice that goes to the
17 Federal Register doesn't actually mention
18 whether the meeting will be webcast. Since
19 this is several thousand miles away and it's
20 expensive to fly, you'd have to make a
21 reservation ahead of time. Knowing whether it
22 is going to be webcast or not -- rather than

1 having to wait basically till the last minute
2 to find out it would be, you know, a great
3 courtesy for members of the public to have
4 that information ahead of time, given the
5 cost.

6 Another issue is that the main
7 work of the CSMAC is really done in
8 Subcommittee. I was not able to find any
9 Subcommittee information on the website.
10 Perhaps I missed it. I don't know. And the
11 reports often don't include any Subcommittee
12 information. Since that is the key working
13 unit of CSMAC, it would be helpful if you
14 would publish that.

15 Do you have any thoughts about or
16 problems with publishing the names of
17 Subcommittee members on the website and all
18 the relevant Subcommittee reports? The
19 question is to Brian.

20 CO-CHAIR FONTES: Sure. The
21 appointments of the Subcommittee or the people
22 assigned to subcommittees is generally

1 available. I don't know, is that already on
2 the website. Bruce, do you know?

3 MR. WASHINGTON: The Subcommittee
4 people are in the committee, so we could post
5 the Subcommittees on the website.

6 CO-CHAIR FONTES: Yeah. That
7 should not be an issue, Jim.

8 MR. SNIDER: Okay. Well, it would
9 be nice to be posted on the website and on the
10 Subcommittee reports.

11 CO-CHAIR FONTES: Oh, I see what
12 you're saying, to identify the individuals who
13 worked on the reports in the Subcommittee, so
14 that --

15 MR. SNIDER: Yeah. Yeah, --

16 CO-CHAIR FONTES: -- the
17 Subcommittee's identified in the report.

18 MR. SNIDER: -- titles as co-
19 chairs, or whatever it is -- also to be
20 designated.

21 CO-CHAIR FONTES: Kevin.

22 DR. KAHN: Yeah, Kevin Kahn.

1 Officially I just wonder what the status of
2 that is. I mean from what I can tell, we are
3 allowed to drop into any of the Subcommittees
4 and participate, so --

5 CO-CHAIR FONTES: That's correct.

6 DR. KAHN: -- those Subcommittees
7 are -- while we try to, from an organizational
8 perspective of holding meetings and things,
9 the core group is sort of scheduling them, and
10 whatnot. I don't believe they're in any way
11 exclusionary as to who on this larger group is
12 part of it, so --

13 MR. SNIDER: Well, if that's the
14 case, that could raise a FACA concern, because
15 at some point it would be treated as a
16 Committee of the Whole, so that would be
17 problematic, actually, if -- I mean it would
18 depend on how many were there. And then
19 there's no enforcement mechanism. If nobody
20 knows --

21 MR. REASER: Mr. Chairman, --

22 MR. SNIDER: -- a violation. I'm

1 not saying that there's enough people in
2 setting these Subcommittees to reach that
3 direction, but it would be a concern. So I
4 think in terms of consideration for FACA and
5 just public transparency, if you listed the
6 co-chairs for each Committee and for each
7 Subcommittee. If there is a fixed body, and
8 I think people need to know how many people
9 are intended if it's larger than a core group.

10 CO-CHAIR FONTES: Okay, Jim, thank
11 you. And what I'll do is --

12 MR. SNIDER: Anyway, let me just
13 go on. I'm just about done. It would be
14 helpful to me, when I call the Designated
15 Federal Officer for CSMAC and I ask for
16 information, and he says he won't talk to me,
17 I have to put everything through, make a
18 formal FOIA request, even if he knows that he
19 doesn't have the information, I think that's
20 a problem. I think CSMAC should agree that if
21 their document isn't available, it would be
22 polite and considerate for the public to just

1 be told that it isn't available.

2 I'll just give you two very quick
3 examples. I asked for the webcasting budget
4 last May after it was announced that it would
5 cost \$6,000 to cover it and you weren't going
6 to be webcasting anymore. And also that
7 subsequently when I was told that 50 percent
8 of the meetings were going to be webcast, I
9 asked if there was any written -- if that was
10 written down anywhere as a policy, and I was
11 told I could not ask those questions, I had to
12 do a FOIA request.

13 It takes me many months in going
14 through a whole process to get an answer to
15 something that should take a couple seconds.
16 And it would save NTIA money, why pay a high-
17 priced lawyer to go through and write all
18 these letters out telling me, you know, what
19 the FOIA -- that the fees are and whatnot and
20 going back and forth, when you can just have
21 simply said, no, we don't actually have those
22 documents.

1 So I guess the question is if
2 somebody requested documents and it's clearly
3 known that it doesn't exist, why can't the
4 Designated Federal Official just say it
5 doesn't exist. Does that sound reasonable to
6 you, instead of making somebody go through
7 such a process?

8 CO-CHAIR FONTES: Jim, thank you
9 for comments. And what I'll do on this, I've
10 not had any previous conversations on this
11 matter with the Designated Officer, allow me
12 to work offline with the Designated Officer in
13 trying to address some of your concerns; is
14 that fair?

15 MR. SNIDER: Okay. And just one
16 last point of clarification. At the last two
17 meetings, Brian, you said that you didn't want
18 to take procedural questions and public
19 comment because that's part of the notice, and
20 it was done during the meeting and during the
21 summer, when there was no option cause the
22 phone quality was quite poor, but it came up

1 at the last meeting. You didn't insist on
2 that.

3 But I would like to be clear. Do
4 you have a policy about not allowing public
5 comment on the process, the CSMAC procedures,
6 or is that not a policy?

7 CO-CHAIR FONTES: Do I have a
8 policy on CSMAC procedures; is that the
9 question?

10 MR. SNIDER: Well, you announced
11 at both the summer meeting and the fall CSMAC
12 meeting that you only wanted questions during
13 public comment or comments relating to
14 specifically spectrum issues rather than
15 process issues. So I wanted to clarify. Is
16 that something that you are making a policy.
17 What was the nature of those statements?
18 Because I don't know whether to prepare formal
19 comments or not when I don't know whether, you
20 know, they'll be accepted. I mean you have
21 to, as a practical matter, allow me to speak
22 this time and during the fall meeting. Again,

1 over the summer there was a technical problem.
2 But I'd like to know. You know, you made
3 those statements. I want to clarify, you
4 know, what you meant or whether you were just
5 making some type of general advisory, you
6 know, -- putting up an issue for discussion.

7 CO-CHAIR FONTES: Okay. Again I
8 apologize, Jim, for -- you know, I'm trying to
9 remember what I actually said when I said it.
10 What I'd like to do is, if I could, just pick
11 up a conversation with you offline to --

12 MR. SNIDER: Okay.

13 CO-CHAIR FONTES: -- to understand
14 the question more clearly, frankly, regarding
15 policy. I think the purpose of --

16 MR. SNIDER: Well, I just went to
17 your own statement that you made publicly not
18 once but twice --

19 CO-CHAIR FONTES: Okay. And
20 that's fair.

21 MR. SNIDER: -- into the record,
22 yeah.

1 CO-CHAIR FONTES: That's fair.

2 But I mean I just need to go back and take a
3 look at the statement. I don't have it in
4 front of me, so I'd prefer just to, if I
5 could, take it offline --

6 MR. SNIDER: Okay.

7 CO-CHAIR FONTES: -- with you and
8 give you a call.

9 MR. SNIDER: Okay, fine.

10 CO-CHAIR FONTES: Do you have his
11 number, by the way? A way to reach him?
12 Okay.

13 MR. WASHINGTON: Yes.

14 CO-CHAIR FONTES: Are there other
15 -- thank you, Jim.

16 Are there other folks who have
17 comments at this point, public comments?
18 Okay. Thank you. The next item on the agenda
19 is scheduling our next meeting.

20 And, Bruce, I'll turn that over to
21 you.

22 MR. WASHINGTON: So welcome,

1 everyone. To close out, the next scheduled
2 CSMAC is July 25th in Boulder, Colorado.

3 Jennifer, you looked at me. I
4 thought I coordinated with you -- 25th. In
5 concert with the NTIA's AISART. And that's
6 it.

7 CO-CHAIR FONTES: Okay. Perhaps
8 between now and then we could also work on --
9 that was the area where we had a problem with
10 the conference bridge, so we may want to be
11 able to try to address that ahead of time.

12 Great. I want to thank everybody
13 for their time today.

14 Larry, do you have any concluding
15 comments?

16 MR. STRICKLING: Thank you. I
17 thought it was a very productive meeting.

18 CO-CHAIR FONTES: Great. We stand
19 adjourned. Thank you very much.

20 (The meeting was adjourned at
21 11:53 o'clock a.m.)
22

A				
ability 21:19 36:1	activities 48:11,13 167:14	47:5,20 48:19 115:5 125:18 126:2 166:12	65:11 93:14 98:11 100:18 170:7,21 171:4 180:11	68:5 77:17 82:4 84:16 124:10,16 175:14
able 9:14 11:1 19:15 24:7 26:9 31:13 34:12 55:2 55:11 79:2,14 80:2 82:7,14 95:17 102:8 122:9 123:15 152:15 159:19 161:18 166:17 169:1 171:8 180:11	activity 51:2 56:8 66:12 89:11 113:22 114:3,3 actor 119:14 actual 48:16 76:9 87:8 add 54:15 110:13 116:6 137:17 145:16 added 103:21 addendum 26:21 27:7 adding 74:8 165:7 169:6 addition 89:10 162:22 additional 20:2 30:4 40:1,8 64:3 119:10 121:10,16 134:9 156:16 address 54:6 55:13 68:1,6 125:6 140:8 176:13 180:11 addressed 87:6 140:1 addressing 7:10 116:9 119:2 121:13 adjourned 180:19 180:20 Adjournment 3:22 adjust 73:17 adjustments 103:20 Adler 1:14 4:11,11 63:3,4 68:9,13 74:14 80:15 84:21 87:22 88:3 90:20 98:15 101:12,19 134:10,15 Adler's 141:8 admin 34:20 administration 2:11 45:1 46:8	administration's 47:7 administrative 43:5 Administrator 2:13 administrators 143:13 adopt 123:8 134:7 adopted 103:17 adoption 105:21 advancements 17:4 advantage 77:11 advice 162:3,15 advisement 167:22 advising 60:2 Advisors 50:13 advisory 1:3 178:5 advocate 120:15 afford 92:17 agencies 23:4 39:13 40:5 57:11 87:4 89:1 104:3,5 111:7,22 148:8 151:22 164:20 166:1 agency 10:5,20 19:10 43:2,8 46:1 57:12 58:19 59:6 111:16 146:13 150:4 151:17 166:21 agenda 10:12 11:8 137:7,9 157:19 179:18 ago 9:17 10:12 13:21 89:4 100:22 101:8 123:6 agree 16:2 35:1 161:22 162:1 174:20 agreement 24:4 ahead 11:4 16:6 46:18 51:10 55:16	aimed 90:17 air 41:21 95:8 airborne 58:5 airplane 165:7 AISART 180:5 Alexander 11:17 algorithm 36:10 algorithms 74:9 alleviate 61:15 allocate 164:18 allocation 129:20 allow 35:7 115:19 119:2,7 176:11 177:21 allowed 110:6 119:5 132:21 133:5 173:3 allowing 118:17 177:4 allows 111:21 120:3 all's 51:2 60:1 alphabetically 5:19 alter 104:9 alternative 92:19 amount 7:6 17:1 56:4 77:12 79:20 80:22 166:15 ample 80:19 analyses 69:17 150:21 analysis 14:19 70:15 80:20 99:15 138:9,20 144:14 153:2 analyze 152:1 ancillary 141:22 and/or 79:3 angle 128:1 Annapolis 113:12 announced 175:4 177:10 annually 12:13 answer 41:1 53:1	answered 60:12 answers 62:12 136:2 antenna 141:21 142:7 148:3 anticipates 37:1 anybody 13:13 153:22 162:20 anybody's 116:12 158:16 anymore 36:20 75:4 175:6 anyway 9:5 58:12 118:1 146:11 165:17 174:12 API 143:12 apologies 103:6 apologist 116:22 apologize 54:18 145:19 178:8 apparently 87:3 appeal 61:11 appears 31:16 appended 54:16 appendix 107:17 144:18 applaud 36:1 applicable 16:1 62:4 application 98:3 applied 56:21 apply 56:19 appointments 171:21 appreciate 7:5,8 25:3 43:8 62:10 74:15 97:9 111:3 135:6 170:14 approach 36:16 37:7 38:12,22 43:5 61:8 71:14 72:16,22 73:13,14 73:18,22 74:6 79:10 104:12
absence 137:22				
absolutely 16:13 28:6 38:18 77:18				
abstract 99:1				
accept 108:10 112:13				
acceptable 99:9				
accepted 177:20				
accepting 127:6				
access 32:1 35:7 49:15 50:1,11 51:5 76:11 106:13 107:10,12 109:20 114:18 115:19 119:15 139:4 145:1				
accommodate 136:6 143:9 144:10				
accomplish 30:8				
accomplished 93:16,16				
accomplishes 31:19				
accuracy 33:9 39:5 39:19 40:14 41:15 154:11				
accurate 24:13 154:2				
achieve 168:1				
acknowledge 58:18 88:4				
acquisition 95:22				
action 128:15 161:20				
actionable 90:6				

107:15 110:3 127:10 138:17 154:10 approaches 70:6 71:4,6,7 73:21 99:21 appropriate 90:8 109:21 110:5 appropriations 164:1 approved 44:22 52:20 149:2 arbitrary 18:22 arcane 143:7 architecture 26:5,5 arduous 27:15 28:5 area 46:19 144:20 180:9 areas 22:12 24:2 138:21 146:5 165:18 166:15 arises 116:12 arrangement 83:16 84:11 122:17 arrangements 75:21 76:17 aside 76:9 157:12 asked 16:14 20:21 43:9 55:18 56:17 57:10 68:3 104:2 123:5 129:11 134:2 136:4 168:20 175:3,9 asking 20:14 32:13 40:6 64:7 77:14 92:3 117:6,9 150:21 aspect 20:2 22:4 44:14 58:15 64:21 83:17 84:1 136:5 138:14 152:3 aspects 21:7 55:8 55:10 88:9 Aspen 4:14 assign 60:10 assigned 62:10 165:13 171:22	assignment 43:1 151:19 assignments 30:6 37:20 39:22 148:21 164:19 Assistant 2:17 associate 2:13 29:4 32:7 associated 158:18 159:17,21 169:16 assume 27:17 assumes 78:16,19 assumption 27:13 78:20 assurance 122:4 assurances 81:3 assure 122:10 as-available 80:8 ATCE 17:2 91:6 attached 28:21 39:10 attend 97:14 attention 42:8 83:13 132:8 AT&T 4:20 auctions 9:18 audit 32:14 audits 37:16 authority 46:6 authorization 106:16 140:16 143:11 authorize 9:17 authorized 154:6 auto 106:3 automated 35:7 36:16 107:2 automated-avail... 31:18 autonomous 35:16 availability 91:9 available 19:17 21:14 67:16 135:1 143:12,15 155:6 172:1 174:21 175:1 aviation 95:10	avoid 106:2 avoidance 109:4,6 avoidance-throu... 108:3 await 55:3 aware 9:16 76:16 134:1,22 awareness 109:1 awful 33:17 a.m 4:2 137:4,5 180:21 A11 46:10,18 <hr/> B <hr/> B 2:13 107:17 back 10:8 11:8 13:6 13:17 25:4 26:20 39:13 40:9 44:7 44:20 51:4,20 69:6 73:2,10 78:9 84:20 93:3 101:2 101:10,14 110:10 123:4 127:7 129:1 135:5,14,21 137:7 137:8 140:4,4 150:14 151:6 156:4,5 158:8 175:20 179:2 backed 80:20 background 71:18 backstop 109:3 back-and-forth 7:11 bad 18:21 31:19 37:1 42:2 119:14 123:1 132:12 bads 136:19 balance 164:16 ball 16:4 band 14:19 15:3 16:4,5,8 19:12,14 20:4 23:3 36:9 47:13 52:14 54:8 56:21 57:13,18 58:3 60:14 61:9 63:17 65:15 75:15 77:16 83:22 88:20	88:21 99:14,16 101:3 105:3 106:12,16 107:11 110:5 113:18,21 117:4,18 118:20 120:3 125:1 132:13 133:1,1 156:11,17 157:1,4 bands 22:1 23:3 24:21 25:5 38:4 41:3,6 42:14,15 49:3,15,16,18 50:1,11 56:21 83:11 106:12 108:9 109:15,20 110:6 114:16 117:19 118:14,17 119:5 120:18 121:10,17 122:2 124:21 125:8 126:13,14 135:8 136:11,17 146:16 151:3 155:1,4 157:2 band-by-band 71:15 72:3 band-specific 85:5 99:6 base 39:21 40:10 79:7 based 34:16 57:3 58:20 71:8,8 73:14 111:2 119:6 basically 37:16 80:6 111:22 125:19 163:22 171:1 basis 33:4 35:17 50:2 61:22 71:15 80:9 89:12 beat-all 88:19 bed 99:2 100:15 101:3,5,10 beeps 6:17 began 121:15 beginning 9:1 91:5 120:14	begins 124:16 164:21 behalf 124:15 125:18 126:5 150:6 belabor 139:6 believe 12:13 16:1 50:15 97:19 98:3 139:9 145:12 173:10 bells 90:19 beneficial 95:11 benefit 81:8 benefits 120:1,2 126:15,16 best 21:18 104:12 better 26:7 41:6 49:7 57:22 63:1 74:3 84:15 108:5 142:6 143:19 144:3 147:4 beyond 49:18 67:11 121:18 be-all 143:16 bidder 57:6 bidding 60:15 big 70:19 76:4,4 81:7 114:1 116:4 133:2 biggest 48:4 49:5 bill 10:10 140:2 142:10 billion 9:21 162:17 167:4 bit 11:1 16:17 37:14,14 45:7 56:6,13 62:15 75:14 82:20 88:7 116:21 118:16 126:4 139:2 141:6 141:11 142:11 143:3 bits 23:1 blow 37:13 board 9:20 10:5 61:11 boat 134:11,12
---	---	--	---	--

bodies 91:7	83:10	72:13 78:19 105:7	149:22	142:22
body 174:7	bunch 6:17 73:6	120:17 125:14	certified 106:17	charge 46:1 148:11
Borth 1:14 5:21,22	burden 106:22	129:11 146:8	cetera 35:14,15	Charles 1:23 6:8
bother 152:2	burdensome 97:4	159:2 173:14	86:19 91:10 94:22	Charley 6:20 91:22
bothering 116:21	bury 130:16	cases 15:5 57:11	169:15	97:7
bothers 117:13	business 76:5 79:10	69:21 75:13 108:1	chair 158:9,15,15	cheap 109:11
bought 132:17	busy 9:12	108:19 111:8	158:16,22	cheaper 82:12
Boulder 139:9,10	buy 94:15 108:5	119:20 157:3	Chairman 173:21	check 25:17 36:9
180:2	113:4 124:4	159:16	chairs 172:19	115:8 150:12
box 130:17	132:13	cast 126:21,21	challenge 12:18	checked 153:17,18
break 135:13,18	buying 112:3,7	catch 9:2	14:9 30:7	checking 147:10
138:18	buzzword 100:13	category 39:21	challenged 129:2	checks 34:1
breaks 135:13		cause 104:11	challenges 28:17	Chief 2:21
Brian 5:14 6:11	C	117:12 176:21	45:17 165:12	chime 46:3 103:12
11:9 44:4 50:12	C 1:19 99:5	caution 58:14	challenging 24:15	choice 30:17
171:19 176:17	Calabrese 1:15 6:2	cavalier 97:19	chance 14:13 46:14	150:13 165:14
bridge 180:10	7:18,18 102:7,13	cell 83:8,10	51:1 140:4 157:13	choices 16:6 19:1
brief 84:9,14 139:7	102:16,20 103:6	Cellphone 46:3	169:12	21:18
briefing 13:21 39:6	114:7 121:14	cellular 100:1	change 35:5 36:14	choose 25:5
bring 10:8 13:12	130:8 134:4	cementing 59:10	46:1,5 69:21 70:9	chooses 103:17
45:20 55:22	California 1:10 7:3	census 156:11	72:13,13 128:9	choosing 24:21
bringing 97:22	7:4 8:20	certain 41:6,6	133:10 148:2	Ci 144:15
133:16	call 4:5 6:10 7:15	58:17 96:22	153:22 167:21	Circular 46:10
broadband 66:7	11:12 44:5 48:15	109:15 122:13	168:19	circulated 13:9
136:13	54:17 82:7 86:13	136:16 137:22	changed 45:1	circumstances
broaden 47:3	105:7 106:15	151:13 152:14	changes 125:22	111:17
broadening 96:3	115:11 119:11	165:20 166:15	129:20 146:6	cite 59:2
broadly 79:3	127:9 137:16	certainly 12:19	changing 65:6	cities 57:20
broken 132:19	138:8 174:14	16:10 17:17 19:8	112:13	claim 114:8
156:22	179:8	19:20 21:15 23:9	channel 83:11	clarification 51:9
brought 42:8 100:1	called 132:9	23:14 24:14 25:17	channels 19:17	103:13 176:16
133:19 166:20	calls 12:1	28:13 30:9 33:21	106:2 114:19	clarify 177:15
Bruce 2:20 13:11	capability 82:11	34:6,8 41:13	channel-manage...	178:3
41:14 169:10	106:4	47:21 48:20 49:10	106:4	clarity 24:17 47:15
172:2 179:20	capacity 115:19	57:3 59:9 60:2	channel-selection	63:6
Bry 145:15	capture 89:17	64:15 67:21 83:7	74:8	class 142:14
Bryan 1:24 137:15	card 132:17,18,19	100:10,17 101:6	chaotic 117:18,19	classified 60:17
137:17	careful 118:8,13	107:20 109:5	118:5,20 120:3,18	clean 24:6 26:17
bubble 92:15	carefully 18:16	112:15 114:4,22	121:10 126:13	clear 85:17 90:9
budget 47:22	Carl 1:21 4:19	115:7 125:11	characteristics	102:9 103:1
162:20 163:8	Carolina 4:16	126:6,16 127:1	14:17,21 15:5	112:11 114:13
175:3	carriers 78:17	134:7 135:6 136:1	29:18 34:4 42:5	116:8 134:22
build 9:20 107:4	carrier-to-interfe...	146:14 149:17	42:16 83:19,21	136:2 177:3
120:4 131:22	142:3	150:13 165:12	96:20 104:10	cleared 11:2 85:15
147:19	cars 113:13,15	169:6	characterized	clearly 55:4 125:13
building 112:6	case 13:1 14:16	certification	32:18	176:2 178:14
built 34:1 45:12	16:14 48:8 50:8	105:16 148:19	characterizing	close 51:1 64:18

157:20 180:1 closely 64:22 closer 53:6,9 129:12 closest 53:18 clue 131:4 codified 90:7 cog 139:4 141:12 cognitive 144:11 cohesive 33:16 collaboration 87:7 144:1 collection 35:13 collective 161:15 collectively 62:20 Colorado 5:5 180:2 combination 22:6 combining 153:12 154:13 come 10:18 21:5 39:13 40:6 44:7 61:7,13 71:13 75:15 77:15 78:9 81:12 83:15 84:7 91:17 94:8 110:10 127:20 128:21 129:4 134:21 135:21 150:4,14 162:18 164:10 168:7 comes 14:20 21:10 39:3 83:4 92:12 144:19 151:20 158:18 162:12 coming 11:5 16:9 16:12 36:11 47:11 105:4 161:16 command 148:20 commands 152:12 comment 3:17 18:6 25:22 74:19 87:4 118:6 139:5 147:15 149:12 152:8 153:7 160:2 167:11 169:18,20 169:22 176:19 177:5,13	comments 11:12 20:2 38:15 55:13 101:17,19,22 110:18 116:1 118:2 135:4 137:18 145:16 146:1 147:3 149:14 160:3 176:9 177:13,19 179:17,17 180:15 COMMERCE 1:1 1:2 commercial 18:9 21:14,17 78:17 79:8,15,15 96:13 100:1 131:12 Commission 34:19 101:6 112:2,9,12 112:19 124:13 125:6,9,13 129:19 133:17 144:3 150:15,22 Commission's 124:14 140:15 commitment 40:14 committee 1:3 12:6 14:18 21:6 24:4 24:17 27:12 49:18 52:1 55:2 59:19 62:18 68:17 71:11 93:7 101:20 109:9 109:13 131:3 134:17 145:14 147:11 158:11,22 160:13 167:14 172:4 173:16 174:6 Committees 111:15 Committee's 168:9 Communications 2:18 community 95:22 112:14,17 113:1,4 113:5 114:10 123:7,10 companies 25:9 57:17 59:12 79:9	92:22 94:19 165:22 company 59:6 147:16 company's 58:22 compare 37:6 compared 83:8 114:20 compatibility 34:21 104:9 122:10 138:9 compatible 92:4 compendium 66:22 competing 164:17 complaints 104:4 completely 35:3 66:10 complex 123:16 complexity 86:15 comply 112:2 component 67:8 83:6,6 84:13 146:20 151:14 components 28:15 29:13 34:10 56:7 comprehending 33:15 comprehensive 31:17 compromise 77:12 compromises 85:21 Comsearch 5:2 concept 38:9 concepts 23:11,19 concern 32:2 104:2 151:4 173:14 174:3 concerned 28:4 93:13 concerning 108:8 concerns 45:9 176:13 concert 180:5 conclude 10:2 59:22 125:20 concluding 180:14 conclusion 69:22	70:19 71:10,10 conclusions 71:19 concrete 72:22 concurred 54:20 conditions 8:19 107:10 conduct 10:3 19:15 61:20 conference 180:10 conferring 101:15 confident 93:20 confirm 30:15 confirmed 43:4 confused 89:21 117:1 Congress 9:16 Congressional 127:17 Congressman 127:9 connect 143:11 connected 105:5,19 106:6,14 121:21 cons 121:18 136:15 consensus 90:18 125:3 134:12 consider 16:15 19:21 43:13 45:11 45:13 109:17 151:10 161:21 168:6,20 considerate 174:22 consideration 45:21 174:4 considerations 19:13 considered 46:8 83:7 167:22 168:9 considering 107:11 consistency 135:7 consistent 16:1 38:22 50:7 98:6 141:14 142:9,19 147:3 157:9 consolidation 65:13,16 constituents 151:7	constitutes 139:21 constrained 122:8 constraints 45:4 construct 20:22 consultations 61:3 consumer 104:21 108:22 109:1 126:16 consumers 106:21 128:20 130:17 131:4,13 contact 165:19,21 166:16 Contacting 140:12 CONTENTS 3:1 context 25:2 95:13 124:21 125:7,9 128:19 contingencies 85:12,15 continually 169:5 continue 39:9 52:13 69:2 76:5 79:13 84:19 109:2 continued 34:13 79:2 continuing 33:4,9 contract 95:3 contractor 148:17 contrasted 107:20 control 41:21 95:9 148:8 controls 111:20 convene 96:11 conversation 40:21 78:16 178:11 conversations 97:1 176:10 conversion 136:18 convey 134:6 Cooper 1:15 6:3 8:6,6,9 coordinated 180:4 coordination 68:4 105:14 106:10 108:6 copies 13:10
--	--	--	--	--

core 173:9 174:9	101:16,22 102:3	CSCA 47:3	database 24:5	define 57:22 91:8
Corporation 7:22	102:14,18 103:3	CSMAC 1:3,13 3:3	29:18 31:19 32:5	defining 60:19
correct 43:4 64:14	110:17 115:20	8:18 10:9 12:3	33:3,4,11,13	definitely 70:20
151:22 173:5	118:10 123:2	15:17 45:6 52:19	34:11,20,22 36:12	163:15
corrected 140:17	124:8 128:3 130:5	52:21 103:17	39:10 41:2,19	definition 57:15
corrections 156:4	131:1,15,18	158:13,21 159:2	42:11 71:6 74:2	degree 17:8 78:5
correctly 30:3	133:14 134:14,18	161:4 163:1 171:7	106:17 107:19	delayed 148:18
cost 29:3,21 49:12	135:11,15 136:21	171:13 174:15,20	115:5,9 123:15	deliberation
107:8,12,12	136:22 137:1,6,15	177:5,8,11 180:2	140:16 143:13,17	159:12 160:2
113:10 115:3	137:19 138:3	CSRAC 159:3	144:13 147:10	deliberations 92:11
146:13,20 152:5	140:19 141:3	culling 42:6	150:11,16 152:10	demanding 151:6
158:18 171:5	145:15,20 147:6	curious 116:15	152:12,20 153:14	demands 39:19
175:5	149:13 153:6,10	current 47:22	154:12 155:18	Dennis 1:22 6:7
costs 28:18	154:14,17 156:8	109:10	databases 32:3,9	11:14 144:20
Council 50:13	156:14 157:6,10	currently 99:7	34:4 36:17 70:5	157:14
counterpart 109:2	157:15 158:1	135:15	105:9 139:15	Department 1:1
countries 98:6	160:11,20 161:12	curve 142:2	141:16,22 144:12	113:21
couple 9:17 11:11	167:10 169:8	curves 144:15,15	150:9 151:2	departments 52:17
13:20 21:21 31:7	170:2,6,10 171:20	customers 127:7	153:21	56:12
38:15 41:10,11	172:6,11,16,21	cut 149:20,21	datasets 138:11	depend 173:18
49:15 52:4 63:13	173:5 174:10	cycle 39:15	data's 151:21	depending 22:10
72:1 74:20 110:13	176:8 177:7 178:7	cycles 71:12	date 20:18 24:13	70:1,7
116:1 163:21	178:13,19 179:1,7		27:22	depth 24:12 150:2
175:15	179:10,14 180:7		David 1:14 5:21 6:6	described 56:7
course 25:6 29:10	180:18	D	7:21 153:6	144:18
44:14 54:15 87:8	co-chairs 51:17	D 79:7,12	day 9:4 40:5 89:8	describes 107:13
89:7 103:11	103:8 174:6	Dale 1:19 5:3 93:7	140:5 164:18	design 36:22 72:16
111:19 113:17	crappy 40:17	110:21 115:20	days 10:11 127:8	designate 121:9
154:1 158:12	Crawford 6:4	156:9 157:7,12	de 152:19,19	designated 2:20
161:20 164:2	create 48:5 59:21	Dan 4:15 26:14	dead 98:12	106:12 121:16
courses 52:16	96:15 126:22	153:8 154:15	deadline 110:3	172:20 174:14
courtesy 171:3	150:16	Daniel 1:23	deal 18:13 23:18	176:4,11,12
cover 134:22 175:5	created 90:13	data 25:12 26:5,12	40:9 61:8 69:1,21	designed 105:2,22
co-chair 4:3 5:6,14	125:1 126:19	26:17 28:16 29:5	104:3,5,8 139:22	designers 94:14
5:15,16 6:1,11,13	161:7	29:13,14,14 30:2	142:20	desires 47:7
6:19,21,22 7:14	creating 31:8,15	30:5,14 31:19	dealing 47:9	detail 30:9 38:7
7:16,20 8:1,5,8,10	47:17 65:4 75:21	32:5,19 33:5,10	deals 48:2	71:16 89:16
8:12,18 9:7 11:10	118:3,4 161:3	34:10 35:18 37:1	dealt 14:6	130:21
11:21 25:20 44:3	credibility 89:4	38:18 39:3,5,5,19	Dean 1:23	detailed 21:5 99:15
50:17,20 51:11	criteria 55:9	40:14,17 41:15	decided 22:17	107:17
53:10,14,18 55:12	critical 16:3,13	42:2,13 43:4	decision 149:10	detailing 61:22
62:7 63:3,10	25:17 31:6 58:16	60:17 67:8,11,14	decisions 158:17	details 80:17 86:20
65:11 67:6,17,19	criticality 36:17	67:16 73:13 138:7	dedicated 38:18	97:12
68:10 74:18 78:8	Crosby 1:16 6:5	138:18 139:3,3	146:16	determinations
79:17 80:14 82:19	11:16,16 27:10,10	141:6,11,20 142:2	deep 86:18	153:3
82:22 84:18 91:1	cross 138:15	142:3,4,6 144:7	deeper 156:17	determine 152:1
93:10 94:2 100:9	crossed 146:17	144:17,19 150:19	Defense 113:20	164:17
		151:1,7,20 153:16		

determining 25:15	difficult 27:21	distributed 29:17	120:14,19,21	effect 164:14
deterrents 108:6	38:17 45:17 53:6	104:14 141:16	121:1,3,6,8,9,11	166:12
develop 26:9 73:11	85:22	dive 156:17	121:12 122:5,15	effective 109:7
76:5,6 79:13	difficulty 21:22	diverse 68:19	122:19,20,22	efficiencies 71:1
88:12,18 90:6	diminish 131:21	doable 159:16	124:9 131:2,17	effort 14:22 28:13
98:2,11 141:14	154:12	document 13:8	153:8,11 156:21	28:22 29:4,8 30:5
developed 71:19	dinner 158:5	14:10 72:18	172:22 173:6	30:11 32:21 49:13
96:7 161:7	163:12	135:19 140:9,11	draft 44:20 107:14	61:15 67:10
developers 94:14	direct 18:15 165:21	168:12 174:21	116:10 156:7	efforts 28:14 109:1
developing 94:19	directed 30:5 63:14	documents 71:6	draw 83:13	109:5
development 26:10	directing 90:11	175:22 176:2	drawn 69:22	either 22:8 23:16
75:19 79:8 95:16	direction 26:7	DOD 113:18 127:4	drive 73:7	56:22 114:9
141:19	80:12 93:2 106:20	127:9 128:2	driven 91:11 97:11	139:10 144:12
developments	174:3	doing 19:9 26:18	drop 173:3	157:2
145:1,4	directly 17:18 96:6	45:13 49:10 58:14	drove 87:14	element 85:1
device 104:10	146:7	65:6 66:16,18	due 42:10 45:4	elements 26:12
107:16,18 117:15	disabled 106:18	103:7 116:13	163:21	67:14 138:19
142:13	discuss 54:4 56:1,4	125:14,15 136:19	dumb 109:11 113:9	139:11,15
devices 82:11,12	130:10 150:19	137:20 141:9	dwell 139:14	embedded 39:21
104:22 105:19	discussed 12:16	149:6,6 155:9	Dyna 8:7	40:9
106:6,13,14 107:8	47:19 89:3,3	156:10 158:13,21	dynamic 14:7	embrace 123:8
108:1,9,20 109:11	134:20 141:6	164:5 167:9	35:17 51:5 139:4	emerged 85:8,8
109:13,15,18	161:7	dollar 159:17	145:1	Emergency 5:15
110:4 111:22	discussing 81:14	dollars 92:19 146:8	dynamic-database	enables 84:15
113:9,9 115:7	121:15 166:4	domestic 75:14	107:15	encourage 92:14
117:11 119:3,4	discussion 3:15	domestically 75:7		103:11 105:21
120:4 121:21	10:9,15 21:5	dominated 52:3	E	128:13
123:13,14 139:21	46:20 51:20 52:3	Donovan 6:6	E 1:16 99:10	ended 69:9
140:8,13 142:9,15	85:9 86:1 87:2	door 64:20 111:11	earlier 91:3 139:19	endorse 108:12
142:21 143:1,10	88:15 94:12 95:5	113:19 127:1	147:8 153:13	ends 164:21
143:18,19,22	98:18 100:3	132:3 133:11	154:18 156:9	end-all 88:19
144:10 150:9	110:18 124:19,22	double 81:16	early 12:17 18:7	143:16
152:10,13,14	126:8 133:18	doubt 126:21	88:22 147:4	enforce 109:3
dialogue 88:11	136:15 140:7	Doug 1:20 5:9	easier 150:14 168:7	enforcement 72:19
96:8	146:1 155:20	downfalls 89:15	easily 102:8	73:14 104:2
dialogues 97:4	156:10 157:11,17	DR 4:11,13,15 5:11	easy 28:6 45:14	105:17 108:5,13
difference 35:9	157:21,22 178:6	5:22 6:18,20	168:15,21	108:14 109:4
differences 63:9	discussions 15:2	16:19,21 17:13	eBay 132:17	173:19
64:9,12	16:3 33:8 48:18	18:5,19 19:6	economic 1:8 82:9	enforcing 104:12
different 44:7	53:1 90:2,11 91:5	30:21 31:2,12	Economics 5:12	135:12
51:14,16,17 52:1	96:16 142:17	35:1 37:2,5 38:11	edits 90:22	engage 18:14 85:22
53:13 56:7 63:17	distinguish 104:18	38:20 40:20 53:12	educate 131:7	92:16 93:19
64:13 65:22 70:11	119:18,20	72:6 76:21 77:2,6	educated 36:5	engaged 18:2 21:8
83:11 91:19 93:9	distinguishes	82:21 87:14 91:2	educating 108:7	engagement 128:11
104:19 119:21	161:19	96:10 97:7 115:22	131:13	engineer 35:12
127:22 135:8	distinguishing	118:6,11 119:22	education 109:1	36:5 132:6
differently 61:2	118:8,13	120:5,7,9,11,12	128:20	engineers 94:18

166:9	estimate 146:12	109:5 110:12	55:18 56:16 66:6	feedback 12:8
enhancements	et 35:14,14 86:19	131:6	76:2,7 95:12	13:19 24:3 64:8
103:20	91:10 94:22	expectation 89:8	100:14 111:3	100:19
enjoyed 68:19	169:15	expected 28:21	113:8,15 125:21	feel 15:8 76:2 86:4
ensure 30:2	Europe 103:10	expecting 29:12	160:7 166:22	166:2
entail 49:9 101:11	evaluation 35:14	43:12 48:10	facto 152:19	feeling 93:20 100:7
entails 28:17	165:14	expensive 105:1	factored 95:18	feels 77:11
100:20	everybody 11:3	113:15 115:7	factors 159:11	fees 44:16 45:11
enter 76:17	21:15 46:22 61:20	170:20	facts 85:14	46:2 175:19
entire 19:14 20:4	92:13 101:1 112:8	experience 16:10	fail 108:4	Feldman 1:17 4:17
22:15 79:7 88:19	132:22 137:7	23:5 57:4 61:21	fair 40:20 120:19	4:17
88:20 114:9,10	148:15 180:12	64:16 81:14 93:21	176:14 178:20	felt 12:5 68:18
132:15 164:14	everybody's 137:8	104:6 114:11,18	179:1	98:21 99:5
entrance 47:12	evidenced 67:9	experimental 101:7	fairly 18:6 38:4	field 18:7 43:12
entrant 73:4,7,9	evolve 18:10 69:2	140:15	42:5 93:12	fight 81:18
75:15,17 76:6,10	79:4,14	expert 87:2	faith 86:6 89:5	figure 12:18 32:12
77:14 81:3 99:18	evolving 69:1	expertise 89:14	115:14	35:18 43:20 52:21
entrants 73:14,17	exact 74:3	experts 86:16,18	fall 90:14 103:1	62:19 86:7 159:17
88:12	exactly 12:18 101:5	88:16,16	130:19 177:11,22	165:6
entries 33:11	157:14	explicit 155:15	fallback 108:1	figured 9:1
entry 29:13	examining 156:18	156:6	familiar 87:20	file 15:17
enumerated 45:18	example 26:11 79:1	export 33:8 96:21	95:20 128:7	filter 142:4
environment 22:2	97:21 105:6	express 97:20	fantastic 32:20	final 23:8 61:7
65:4 77:20 83:8	107:18 110:2	extended 43:21	far 12:8 57:17	finally 11:2 109:8
106:1	115:2 130:15	extensive 110:1	74:13 115:1	110:8 127:11
Epstein 1:17 4:14	142:2 144:18	extent 39:6 51:15	151:21	141:10
4:14 20:6,8,8,13	examples 128:14	80:1 118:15	fashion 144:11	find 15:14 32:4
54:14 62:5,8	175:3	extremely 24:14	FCC 9:18 96:11	54:5 58:10 92:8
63:21 64:2 81:9,9	excellent 157:7	54:9	105:15,20 106:11	92:15 132:16
93:4 160:5,12	exception 14:4		108:4,7 111:20	171:2,8
equipment 29:19	exclusion 74:7	F	127:16 128:9,15	finding 31:5
83:10 91:14 94:13	exclusionary	FAA 41:21	140:12	fine 15:5 134:4
94:15 96:20 105:5	173:11	FACA 12:12 60:1	FCC's 75:13	179:9
105:16 112:4,8	exclusive 21:15	89:15 90:13	130:20 143:11	finished 140:6
140:15 143:11	23:13 67:2 136:11	173:14 174:4	feature 73:20,20	finishing 93:18
equipment-certif...	excuse 16:20 22:7	face 21:21 106:22	federal 2:20 10:5	firmly 98:3
107:4	64:1 68:13 158:6	112:6 160:7	23:4 38:8 44:17	firmware 106:17
error 41:9 140:9,14	159:3	faced 111:7	79:1 83:5 104:3,5	first 9:20 13:17
156:12	Exelon 5:10	face-to-face 16:2	104:11 106:12	14:16 44:19 52:2
errors 36:18	exhaustive 139:13	30:18	107:11 111:16,21	57:4,20 59:1 62:9
147:18 154:11	exist 176:3,5	facilitate 63:7,8	111:21 114:13	67:10 68:16,22
essence 22:19	existing 41:2,8 65:8	facility 9:9	115:14 122:1	69:17 71:22 72:1
essentially 34:20	75:18,19	fact 14:18,21 19:13	124:15,21 125:7	72:7,21 73:2
45:4,10,14 108:12	expansion 56:14	19:15 22:4 24:12	125:16 126:5	74:21 78:15,17
142:6 144:9 150:5	63:22	28:14 30:13 32:10	148:8 170:17	85:2 88:10 100:21
establish 144:6	expect 24:17 49:12	34:11 36:15 39:9	174:15 176:4	105:12 110:22
establishing 24:22	61:1 70:8 91:14	44:22 50:9,14	fee 115:4	124:13 129:8

130:18 141:13 142:5 144:8 155:6 170:12 fiscal 158:17 fit 145:11 fits 70:3 73:20 168:9 five 27:16 58:21 84:3,7 103:15 123:6 128:10 five-year 24:10 39:15 40:10 fix 132:6 147:14,16 147:17 fixed 37:20 41:16 42:9 119:13 140:11 148:5 174:7 fixed-microwave 22:8 flag 32:6 66:1 flags 153:15 154:4 flesh 141:20 143:3 144:3 145:10 147:1 Fleury 158:22 flexibility 21:17 50:10 floor 169:20 flow 63:19 fly 170:20 flying 165:8 fobs 113:18 focus 20:15 49:20 53:3 54:8 62:22 99:13 100:5 157:4 159:6 161:3 focused 29:7 30:4,7 48:20 56:20 63:6 64:4 88:8,20 90:5 155:9 focusing 169:3 FOIA 174:18 175:12,19 foliage-penetrati... 95:9 folks 10:16 43:12	55:1 115:12 136:16 158:5 164:13 179:16 follow 65:10 170:13 followed 87:8 following 62:5 follow-up 55:19 155:19 Fontes 4:3 5:6,14 5:14 6:22 7:14 8:1,5,8,10 11:10 11:21 53:10 67:19 68:10 74:18 78:8 79:17 80:14 82:22 84:18 91:1 94:2 100:9 101:16,22 102:14 135:15 136:22 137:6,15 137:19 140:19 141:3 145:15,20 147:6 149:13 153:6,10 154:14 156:8,14 157:6,10 157:15 158:1 160:11,20 161:12 167:10 169:8 170:2,6,10 171:20 172:6,11,16,21 173:5 174:10 176:8 177:7 178:7 178:13,19 179:1,7 179:10,14 180:7 180:18 fool's 85:4 footnote 75:16 footnotes 81:15 force 33:11 foresee 20:13 forever 132:7 form 18:10 122:3 formal 48:17 61:16 174:18 177:18 formally 149:1 formats 29:15 forms 117:19 formulates 129:17	forth 51:21 73:10 86:12 89:1 122:10 147:10 153:18 156:4 162:16 175:20 fortunately 133:2 forum 21:1 96:15 97:1 forward 12:6,21 15:1 16:4 17:9 43:6 48:19 52:13 54:3,10,11,12 55:9 56:1,6 60:13 61:14 76:16 111:5 126:2 127:3 139:7 146:21 found 16:10 132:8 132:17 150:10 four 149:3 167:3,4 fourth 49:22 framework 144:7 framing 104:17 frankly 178:14 free 15:9 freedom 80:21 81:1 81:4 frequency 72:12 106:19,20 132:13 138:9 151:18 Fritson 7:21 front 87:19 92:4 179:4 FSMS 26:6 28:14 29:10 30:1 31:8 33:22 39:3,7 139:5,7 141:19 143:14 150:20 full 19:16 31:19 57:14 95:1 134:16 160:13 fully 159:19 full-scale 138:8 functioned 34:11 functioning 34:16 34:19 fund 47:4,18 funding 45:4 47:21	funds 47:9,13 funnel 29:14 Furchtgott-Roth 1:18 5:11,12,12 124:9,10 further 45:6 56:6 76:12 96:8 103:13 103:20 109:9,18 109:22 110:12 144:1 157:17 future 17:3 19:22 22:1 23:2 56:19 57:1 75:3,21 76:20 109:14,19 139:2 143:8 <hr/> G <hr/> Galvez 1:9 game 28:1 garage 111:11 113:19 120:4 127:1 132:3 133:11 Gary 1:17 4:14 20:8,11 52:7 53:1 53:19 54:2,13 62:7 81:9 160:4 161:13 gate 61:4 Gavinich 11:18 geared 17:2 gearing 91:11 Genachowski's 158:15 general 58:8 64:22 69:4 72:18 85:3 116:6,7 178:5 generally 16:21 83:7 109:13 129:17,20 135:9 146:7 171:22 generate 77:21 geographic 70:10 geographically 70:17 83:17 geographic-shari... 71:7	germinated 18:8 getting 8:11 17:2 38:18 51:4 58:17 58:21 72:22 76:11 93:17,19 113:13 116:5,14 117:21 139:7 GHz 49:21 56:9 94:17 95:13 109:17 114:20 122:16 giant 163:3 Gibson 1:18 5:1,1 25:19,19,21 27:2 27:5,8 36:21 37:3 37:6,22 67:7 123:3,4 137:14,17 137:20 138:3 141:1,5 146:22 152:7 155:13 156:13,19 157:8 give 12:8 25:14 26:7 41:7 49:11 62:12 63:1 79:22 80:13 81:2 125:8 143:18 146:11 156:15 175:2 179:8 given 39:1 84:8 102:9 111:19 132:8 140:5 171:4 gives 21:16 89:4 giving 7:13 9:18 90:18 163:4 glad 7:2 globe 88:20 GMF 143:15 go 4:4 5:18 11:7 15:1 24:7,11 29:4 30:4 33:7 36:1,9 37:15 38:6 40:9 44:6 51:13 54:1 55:16 58:9 61:5 65:11 78:8,20 86:22 89:8 91:17 96:4 98:11,16 110:8 115:4
--	--	--	---	---

117:20 120:4	102:4,6,14,15	136:21 137:19	half 33:1 131:6	133:7 136:20
123:4 131:11	112:22 113:7,11	141:4,20 143:5	148:1,4	148:12,14 151:17
137:2 140:4	119:2,11,12 120:5	145:15,21 147:6	hand 18:21	152:18 163:10
150:12,14,15	120:9 122:7,11	153:5 154:14	handle 35:11 82:7	166:15 168:3
151:5 153:22	123:8,18 124:14	157:15,18 170:11	handled 70:11	helpful 18:12 19:2
156:2,3,5 157:16	126:2 127:7	171:2 180:12,18	hanging 6:10	19:2 26:4 27:4
163:22 164:13	131:14 134:1	greater 34:2	happen 39:7 78:6	49:10 100:13,19
170:6 174:13	135:18 146:13	130:21	86:5,8 89:14 91:5	101:9 136:4,7
175:17 176:6	149:9 151:2 152:2	Greg 5:16 8:16,17	96:9 131:14	158:19 159:15
179:2	152:4 155:2,4,5	9:5 11:9 154:16	happened 132:16	164:12 165:15
goal 23:12,14 66:5	155:17 158:9	154:17	happening 35:4	166:21 167:12
66:11 90:10	159:14 160:1,7,15	ground 76:3	40:19 61:4 111:9	169:9 171:13
goals 25:1	160:17 162:21	group 12:19 14:6,8	happy 7:2,9 54:11	174:14
God 148:22	165:16 166:17	21:10 23:21 28:20	67:3 87:22 115:12	helping 101:21
goes 16:22 17:9	170:22 175:5,8,13	43:16 45:21 46:21	133:9	helps 159:6
18:20 32:5 35:12	175:20	48:15,15 50:22	hard 7:8 72:9 81:5	Herculean 32:21
36:19 73:16 77:19	gold 85:4	55:19 56:5 63:6	168:15,21	Hi 8:8,9 170:8
97:20 122:20	good 9:2 32:10	63:15 65:5,8 66:2	Harold 1:18 5:11	high 41:5 44:6
170:16	38:18 51:8 62:18	66:5 67:20,22	124:8,10	168:17 170:13
going 5:18 7:12	68:10 77:11 78:11	68:1,19 71:5	hasten 116:6	175:16
10:2 13:1 16:3	81:11 86:6 87:7,7	75:10 82:16 90:17	hate 58:7	higher 36:18
17:6 20:4 21:21	89:5 115:13	98:18,20 99:13	Hatfield 1:19 5:3,3	highfalutin 144:22
23:4,9,10,15,17	117:16 119:9	100:4,7 101:13,18	5:8 40:22 93:12	highlight 13:3
23:18 24:11,21	122:22 131:9	111:4 141:9	115:22 119:22	88:14
25:8 26:3 27:12	135:12 152:11	161:15 173:9,11	120:7,11,14,21	highly 114:19
27:14 28:4 29:13	157:8 160:6 161:2	174:9	121:3,8,11 122:5	high-level 89:17
30:10,11,18 31:4	161:10 162:1	groups 16:15 44:7	122:19,22 156:21	high-quality
31:6,14 32:4,8	goods 136:19	48:12 62:11 66:17	Hatfield's 93:7	109:20
33:16,17 36:6	Google 4:12	68:5 94:7 151:12	hats 5:4	high-value 168:20
39:3,8 40:5,8,11	gotten 121:17	guaranteed 76:11	head 80:11 101:1	Hill 163:20
42:2 46:2,4,7	government 15:3	guaranteeing	132:14	hinder 75:18
48:18,22 49:20	18:1 21:1 24:8	118:22	headed 35:20	hindmost 98:12
52:8,22 55:8 58:9	44:17 55:21 65:15	guess 18:5 21:3	headline 77:10	hit 102:21
60:12,13,16,17	65:16 91:20 92:6	46:13 55:13 56:14	health 68:18	hoc 105:17
61:1,7,8,14 62:2,4	92:10 93:1 94:11	57:2 63:12 65:9	hear 52:12 53:7	hold 8:19 50:5 52:5
64:16,18,20 70:17	94:20 96:14	79:18 83:3 97:13	76:2,8 102:8	holding 173:8
71:12,21 75:22	114:13 117:21	101:7 103:14	136:9,17 170:9	home 82:7 105:7
76:18 77:9,13,20	governments 94:15	114:1 176:1	heard 6:16	106:15 128:1
78:6 79:21 80:11	97:14	guessing 62:13	hearing 62:14	honest 48:7 147:15
80:12 83:1,15,19	GPS 42:15,15	guidance 25:3 55:3	heavily 151:16	hope 28:9 61:17
83:20,21 84:2,6	148:3	guy 36:8 77:17	152:2	102:10 104:1
84:10,13 86:5,5	gradual 39:11	guys 17:6 18:13,16	heft 86:11	135:20 168:3
88:13,13 89:11	gradually 154:12	31:22 60:10 77:22	hell 33:19 92:7	hopeful 10:18
90:12,12 91:10,16	great 8:5 11:10	123:20	Hello 102:16	hopefully 17:7
91:17 92:5 96:4	33:2,2,3 44:10	<hr/>	help 26:6 29:19	27:13 28:2 52:12
96:16 98:16,16	51:11 67:18 68:13	H	31:22 34:4 49:6	137:8
99:14 100:17	101:16 102:1,3	H 1:18	54:10 68:2 113:7	hoping 71:12

60:3 61:6 78:2 83:4 88:21 90:5 93:6 124:17 126:22 150:19 164:7,10 167:6 177:14,15 item 21:13 77:10 136:1 137:7,9 157:19 179:18 items 159:11 168:21 iteration 8:18 ITEU 56:12 ITU 80:5 it'll 161:12	18:5,19 19:6 30:21,22 31:2,12 35:1 37:2,5 38:11 38:20 40:20 53:12 76:21 77:2,6 82:21 91:2 96:10 118:6,11,11 120:5 120:9,12,19 121:1 121:6,9,12 122:15 122:20 131:2,16 131:17 172:22,22 173:6 Karl 2:13 5:13 12:2 16:19 20:6 27:11 27:15 38:17 39:15 51:12,21 52:7,11 54:7,22 55:13,16 59:14 64:7 66:14 68:2 74:15,19 80:16 100:9 110:13,20 117:3 123:5 124:9 125:4 125:10 128:6,7 129:8 146:2 149:15 155:19 162:10 163:16 164:5,15,19 165:9 Karl's 51:18 52:8 67:21 keep 7:10 40:3 60:22 61:19 83:1 127:22 133:9 145:2,9 158:8 165:6 kept 127:8 Kevin 1:19 4:13 17:13 30:22 31:1 40:15 77:1,3 91:1 94:6 107:20 118:11 121:19 131:16 153:13,14 172:21,22 Kevin's 78:11 key 113:14,16,18 171:12 kind 13:6,14 14:7 17:7,22 18:8	20:22 22:22 32:9 32:12 33:13 37:3 45:10,18 55:6,20 56:22 57:5 66:12 69:3,4 70:3 73:2 77:10,12,20 80:9 84:19 85:14 91:20 91:20,21 92:20 97:3 98:21,22 100:13 104:15 112:21 113:22 115:15 117:18 124:6 126:7 134:12 138:4,17 139:1 142:11 144:7 154:10 156:12 159:6,11 159:18 161:5,9 164:3,8,13,21 165:6 kinds 19:6 47:10 71:17 knew 22:9 160:8 know 6:15 7:5 10:16 13:6,11 17:1,3,16 18:7,8 18:11,19,22 19:3 20:18 21:7,16 22:22 24:9,12 25:17 26:1,13,17 27:6,14,21 30:18 31:6,8,15,20 32:10 33:2,18 35:10,11,14 36:2 36:7,10 37:11,16 37:17 40:22 41:9 42:13,15,16 43:10 43:13 47:18 54:6 57:19 58:2,16 61:18 62:19 63:19 64:5,18,19 67:9 76:7,12 77:10,16 77:22 78:1 79:5 80:4 86:4 91:16 91:18,22,22 92:13 92:16 93:1 95:5 96:1,12 97:3,5,8	97:12 99:16 103:1 104:1,13,20 105:4 105:20 108:15 113:11 114:12,14 115:2,6,16 116:11 118:19 119:4,6 121:16,20 122:2 123:7,18 124:6 126:22 128:15 129:3 130:9,11 131:5,7,9 132:5 133:4 134:5,6,19 135:18 136:8 137:15 139:12,13 141:7 142:4,10,14 142:18 143:2,5,22 146:19 147:22 148:7 150:15 151:3 152:9,22 153:16 155:7 158:7 159:20 160:14 162:8 164:4,12 165:9,17 165:20 166:6 167:5 171:2,10 172:1,2 174:8 175:18 177:18,19 177:20 178:2,2,4 178:6,8 knowing 26:6 170:21 knowingly 108:2 knowledge 113:5 known 127:18 176:3 knows 70:22 173:20 174:18 Koret-Taube 1:9	142:11 large 65:19 80:22 161:17,18 largely 104:1 larger 173:11 174:9 Larry 1:14 4:8,9,11 7:12 8:13 51:21 63:3 67:4 68:8 74:1 80:14 84:18 87:20 101:17 102:2 134:11 141:8 158:22 163:14 180:14 Larry's 11:12 43:8 52:15 62:6 158:14 late 94:8 95:12 Laughter 10:21 74:17 163:19 laundry 163:3 law 10:11 21:2 46:11 47:14 49:16 56:18 140:2 165:13 Lawrence 2:17 laws 16:1 lawyer 86:17 175:17 lawyers 90:12 lay 127:15 laying 25:9 lays 58:19 lead 165:5 leadership 69:16 leads 106:7 learn 41:10 145:7 learned 160:8 learning 93:8 leave 98:13 133:8 left 13:12 legal 86:17 92:16 legislation 9:16 47:5 legislative 46:5 legitimate 120:22 letters 167:3 175:18
J				
Janice 103:8 Janice's 20:1 54:17 54:21 Jennifer 1:25 4:21 43:17 54:18,20 63:10 66:20 78:9 78:10 94:2,4 96:18 128:3,4 160:21,22 180:3 Jennifer's 167:13 168:7 Jim 170:4,8 172:7 174:10 176:8 178:8 179:15 job 12:20 137:21 151:15 164:5 167:9 join 6:16 joined 6:20 7:15,17 8:2 9:11 11:11 Jr 1:22 judgment 36:12 judgments 36:6 Julius 158:15 July 180:2 jump 69:14 jure 152:19				
K				
Kahn 1:19 4:13,13 16:19,21 17:13,14				

let's 14:15 22:9 62:21 78:8,20 88:18 112:6 127:22 165:1	88:7 106:8 116:21 118:16 126:4 139:2 141:6,11 142:11 143:3 144:3 145:3 147:1	56:16 58:12 66:5 68:15,22 69:17 95:14 99:17 100:17 136:4,12 138:6,21 139:6 147:5 149:21 155:16,21	mall 113:12 manage 36:2 management 1:2 2:14,22 3:13 24:1 34:12 50:3 105:9 137:10 138:1,8,20 144:5 145:13 162:12 managing 35:10,11 164:6 manner 18:15 119:16 manual 129:1 130:16 manufacturer 132:9,20 154:8 manufacturers 78:22 94:13 95:6 95:7 96:4 107:3 108:22 123:10 124:3,4 127:5,6 127:10 130:14 131:21 133:8 151:13 manufacturing 79:8 mapping 72:12 March 1:6 9:1 Margaret 1:17 margin 107:8 mark 1:16,18,21 5:1 6:5,18 8:3 11:13,16 25:19,20 27:10,11,12 29:21 43:9 50:19 67:6 68:8 69:13,15 71:21 72:4 86:19 102:2 123:2,4 137:2,12 140:19 146:4 152:8 155:13 marker 59:2 marketplace 82:13 Mark's 50:20,21 68:9 99:14 145:16 157:17 Martin 1:15 4:22	Marty 6:3 8:6,8 material 71:18 81:11 103:21 materials 15:14 matter 81:15 89:22 90:15 108:19 113:17 132:2 176:11 177:21 matures 152:16 maximize 79:20 maximum 80:1 McGinnis 1:20 5:9 5:9 6:9 McHenry 1:21 6:18,18 69:15 72:6 86:19 87:14 mean 12:22 27:21 31:2,20 40:4,14 41:12 43:18 59:20 60:7 66:9 76:1 77:8 78:15 79:12 79:22 87:20 91:11 91:13,22 92:17 96:10 99:6 100:16 114:4 122:17 128:22 129:3 134:12 136:16 147:14 148:21 149:3,9 150:18 151:16 164:14 165:11 166:10 173:2,17 177:20 179:2 meaning 151:12 meaningful 91:19 92:12 means 35:12 36:4 100:16 122:7 128:20 meant 75:8 178:4 measure 39:18 measures 108:3,5 mechanism 55:21 113:16 173:19 mechanisms 35:7 35:16 113:14 148:13 149:5
level 24:12 32:7 44:6 46:7 64:17 92:8,17 93:9 148:16,20,20 160:13 levels 146:14 licensed 140:8 152:21 licensed-by-rule 119:4 licenses 96:22 licensing 34:20 101:8 lie 107:2 life 145:21 light 31:5 83:7 164:8 limit 114:3 limitations 76:18 112:14 limited 56:3 75:22 90:5 169:2 limiting 24:22 limits 115:9 line 53:11 lines 25:15 108:11 link 53:15,17 146:7 linked 64:22 list 70:12 108:12 135:22 136:5 163:3 164:14 166:13 169:1,6,10 listed 98:22 159:10 159:11 174:5 listening 67:20 162:10 listing 121:18 lists 45:12,13 little 11:1 16:16 22:21 28:3 37:13 37:14 45:7 56:6 56:13 61:2 62:15 74:9 75:14 80:13	live 22:17 75:10 84:6,10 133:2 local 42:22 location 30:16 58:19 locations 25:10 42:1 location-transition 58:15 Lockheed 4:22 logical 63:19 66:8 79:18 long 23:10,17 33:20 61:5 69:5 101:8 115:13 159:5 167:17 168:16 169:14 longer 23:5 110:6 long-term 18:12 22:3 48:5 look 13:17 21:12 35:4 43:10 52:13 54:12 62:2 69:12 76:10 92:14 101:14 104:2 114:17 123:11 125:9 138:18 139:8 141:18 142:20 143:4 149:18 150:1,8 151:20 152:4,5 155:4,7,17 160:18 163:2 167:16,18 168:13,18 179:3 looked 42:15 70:14 85:1,6 98:20 99:1 140:14 180:3 looking 17:21 18:3 19:20 24:3,16 26:20 36:11 45:16 46:17 48:12 49:1 50:8 51:10 54:3	lose 84:13 120:2,6 lost 19:16 lot 9:19 11:4 18:7 26:17 33:7,17,19 35:6 38:6 40:18 41:11 61:5 71:12 73:3 81:14 87:1 87:14 88:4,5 89:13,16 93:5 95:16 96:2,4 97:20 113:12 116:11 119:1 129:19 143:21 145:5 147:18 148:9 151:4 155:1 160:9 169:6 lots 70:10 89:13 162:13 love 24:5 lovely 158:6 low 107:12 168:17 lower 22:18 115:10 low-cost 74:16 LTE 14:16 17:5	<hr/> M <hr/> M 1:23 2:20 magically 113:17 main 44:14 171:6 maintain 148:8 maintaining 32:19 major 18:9 93:19 97:15 148:20 majority 38:2 making 21:13 33:10 36:6 67:16 137:12 150:13 164:22 176:6 177:16 178:5	

110:2,9 111:17 126:11 134:22 143:5 146:15 noted 20:1 28:19 noteholders 148:1 noteworthy 29:1 notice 52:1 87:3 89:9 124:2 170:16 176:19 notion 35:6 118:16 November 103:19 107:14 139:10 NTIA 2:11 3:3 4:10 5:13 7:10 9:19 12:3,9 14:18 15:17 27:14,18 28:3,11 44:19 45:22 53:2 54:5 54:10 55:1 72:9 72:17 96:11,11 105:13,20 106:10 108:4,6 111:21 112:11 114:12 124:12,15 125:4 127:16 128:8 129:17 130:22 141:17 142:20 144:2 145:7,7,9 146:13 154:7 162:14 163:1 167:3,22 168:19 175:16 NTIA's 110:14 180:5 nuanced 64:9 number 9:22 19:17 39:10 43:11 48:11 62:15,17,21 69:17 70:2,6 71:5 86:15 88:8 100:12,22 104:13 106:8 107:22 108:18 109:9 164:16 165:20 179:11 numbers 29:15 44:1 148:3 numerous 14:14	41:18 42:10 <hr/> O <hr/> objective 79:19 obligation 108:9 observations 31:7 71:18 observe 131:3 observer 97:13 obtain 106:17 Obuchowski 103:8 obvious 71:9 obviously 20:21 30:19 34:17 42:13 114:10 160:5 occupied 119:5 122:3 occur 144:2 occurs 105:11 108:21 odd 14:7 97:3 offer 52:16 offered 53:4 office 2:14,21 37:17 96:1 Officer 2:21 174:15 176:11,12 official 89:9 176:4 Officially 173:1 offline 176:12 178:11 179:5 off-come 37:7 off-the 112:7 off-the-shelf 112:3 oftentimes 22:13 Oh 17:13 36:7 102:20 129:14 165:1 172:11 okay 4:3 6:19,21 7:1,16,20 8:12 11:21 12:2 15:21 18:18 19:7,7 21:13 23:20,22 27:2,5,8 34:21 44:13 50:21 55:16 57:22 58:8 67:17 68:10 84:18 88:2	98:10 103:4 110:17 112:20 130:1 131:1 134:3 135:11 136:21 137:7 138:5 140:19 141:4 145:21 146:22 154:5 157:10,18 167:10 172:8 174:10 176:15 178:7,12,19 179:6 179:9,12,18 180:7 old 39:10 62:3 149:6,6,7 oldest 13:19 OMB 46:16,17 onboard 126:1 127:14,20 once 20:14 21:8 22:5 23:12 34:1 42:9 46:18 49:11 50:3,6 58:19 66:10 76:16 87:3 102:14 127:11 146:3 155:18,19 178:18 ones 41:18 42:7 48:13 49:20 100:11 108:16 143:5,6 149:6 169:4 one-size-fits-all 71:13 one-statement 45:10 one-to-five-year 22:10 one-track 157:5 ongoing 95:16 111:12 145:4 online 30:1 39:3 Onpepper 8:3 open 18:7 73:10 90:3 97:1,2 112:20 114:15 130:18 145:22 154:10 159:14	169:17,21 opened 153:20 opener 133:11 openers 113:20 132:3 opening 3:2 7:13 8:14 50:1 73:3 147:13 operate 19:14 20:4 22:16 35:19 83:10 84:8 105:2 106:1 106:16 119:5 142:15 152:13 operating 30:16 108:2,20 122:13 143:22 144:11 operation 84:5 104:20 118:13 152:21 operations 65:16 72:14 136:6 138:22 139:1 operators 97:22 opportunities 49:1 opportunity 10:14 81:7 98:4 121:4 148:7 158:4 169:19 opposed 17:22 25:13 33:13 65:3 94:20 169:5 option 132:13 176:21 options 95:1 order 35:18 55:22 58:9 70:22 72:3 81:2 93:4 114:15 155:10 159:7 organization 98:1 organizational 173:7 organizations 97:10,18 organized 126:14 original 26:21 98:20 originally 136:3	OSM 162:16 163:1 ought 27:22 36:9 39:4 62:1 119:17 120:17 outcome 17:21 18:3 23:8 56:3 85:16 90:11 150:7 outcomes 129:18 outcry 111:9 outlining 72:18 output 92:1,2,4 161:4 outputs 161:6 outside 66:10 108:20 166:22 overall 103:17 154:11 overhang 145:6 overhanging 142:17 overlap 67:3 overlapping 160:9 overlaps 141:8 oversight 86:11 89:3 overstepping 66:16 overwhelmed 167:1 over-constrained 121:4 owner 33:12 o'clock 180:21 <hr/> P <hr/> pace 11:1 page 71:20 136:5 139:8 141:5 146:16 pages 14:11 panel 56:18 61:11 62:1 panels 59:21 paper 37:17 87:19 parallels 64:11 parameters 72:8 86:7 paraphrase 138:12
--	---	--	---	---

parlance 50:4	32:22 33:10 34:14	phone 4:6,7 5:18	plus 96:11	post 105:17 172:4
part 22:16 29:1,2	35:22 38:5,16	5:19 6:17 7:21	point 12:2 15:10	posted 172:9
29:20 44:9 45:14	42:10 48:10 55:14	8:3 9:11 11:17	16:22 18:2 28:16	posturing 111:15
47:2,7,16 56:15	58:11 60:18,22	15:12,14,19 17:16	28:19 40:15 45:19	Povelites 1:21 4:19
56:18 69:7 83:14	61:6 64:17 65:7	20:12 53:5,7,11	47:15,19 49:20	4:19 52:11,12
86:17 89:21 95:2	68:19 70:17 81:20	53:15,16,20 55:14	52:15 56:15 62:6	53:8,16,22 59:19
95:3,21 96:1	85:10 86:4,19	68:9 71:22 83:8	63:5 75:20 78:13	66:14
104:21,22 111:20	89:5 91:12,12	83:10 87:12 97:8	80:16,18 81:6,22	power 115:9
112:1 127:19	96:14 100:16	102:1,6,7,11	83:3 84:3,7 89:20	PowerPoint 76:9
128:12 129:1	102:5 113:12	103:7 137:8	94:5 97:6 103:2	practical 23:15
148:3 156:1	117:14 120:16	140:20 141:4	103:13,16 123:4,5	177:21
161:17,18 163:16	121:5 124:1,4	176:22	124:7 127:11	precision 31:21
173:12 176:19	126:15 127:17	phone's 6:14	140:9 157:7	prefer 179:4
PARTICIPANT	131:22 134:1,21	pick 11:1 27:22	161:13 166:22	preferred 85:16
7:21 8:3 11:17	147:13 148:14	74:1,2,5 94:5	167:13 173:15	preparations 56:12
15:12,19 53:5,20	149:6 162:11	178:10	176:16 179:17	prepare 177:18
participate 17:8	163:7,17 164:5	picked 82:20	points 63:5 89:17	preplanning
85:11 86:6 87:4	165:2 167:2,4	pieces 28:1 36:5	point's 78:11	164:11
89:5 103:10 173:4	171:21 172:4	151:15	policies 144:12	present 1:13 2:11
participated 68:17	174:1,8,8	pipe 130:9	policy 1:8 45:20	26:3
participation 87:7	percent 84:3,4,7	pitch 55:15	46:20 126:7 146:5	presentation
89:1 92:9 97:16	175:7	place 39:12 88:15	175:10 177:4,6,8	137:13 145:17
particular 9:19	perceptive 80:16	95:14 101:4	177:16 178:15	157:18
20:14 28:21 90:21	perfect 24:6 67:19	105:14 129:16,21	policymaker 158:9	presented 67:21
106:19 107:15	Perfectly 34:17	places 17:2 58:17	158:16	139:9 156:9
114:15 118:19	170:10	91:6 100:12	policymakers	presidential 166:11
122:1 156:17	perform 34:12 40:7	149:18 151:9	108:7 109:17	President's 50:13
particularly 58:1	performance 94:22	plan 10:6 21:19	129:5	press 123:21 126:8
93:13 107:10	116:4,7,17,19	28:15 33:16 44:20	polite 174:22	pressing 128:1
109:12 113:17	118:2 142:3	45:8,19,21 46:21	political 128:1	presumably 156:2
166:16	period 22:10 23:6	47:22 57:11,15	poor 176:22	pretty 80:22 87:20
parties 55:22 80:2	24:10,10 34:8	58:6,15 63:16	portion 22:18	118:20,21 157:19
90:3	40:10 84:9 109:21	67:8 136:13	43:14 113:19	157:20
partly 127:3	periodically 105:8	planning 47:8	portions 23:1 61:9	prevalent 109:16
parts 23:5 29:18	106:15 115:8	138:19 139:11,16	posing 7:11	prevent 40:19
46:22 65:18	periods 23:9 84:14	plans 57:9 58:1	position 47:20	59:11 117:16
116:22 132:10,22	permissions 117:6	59:11 60:19 64:8	72:11 73:15 85:20	previous 43:16
pass 90:22 147:1	117:9	65:1	85:21,22	110:15 166:12
passed 9:17 46:11	permitted 132:10	plate's 149:7	possibilities 25:6	176:10
133:12	132:11	play 127:19	possibility 29:9	priced 175:17
pay 115:3 175:16	person 9:11 36:20	played 75:13	112:5 136:13	primaries 122:2,3
paying 164:15	103:12 112:16	players 18:9 91:13	possible 99:3	primarily 75:12
PCAST 48:16	perspective 18:21	97:5	110:11 136:2	105:15 125:6
50:12	79:5 114:11 146:6	please 15:8 45:15	163:9	primary 30:1 50:2
pending 128:10	163:5 173:8	77:5 140:21	possibly 42:10	50:5 69:2 75:8
people 4:5 7:15	petition 150:16	150:16 170:3,7	133:15 151:14	prior 32:21
11:11 18:4 32:1	phasing 109:19	pleasurable 102:6	155:5	priorities 24:21

25:15 163:18 165:15 167:17 prioritization 38:10 42:18 154:22 163:6 167:15 168:8 prioritize 162:2,15 169:1,5 prioritized 155:5 161:8 prioritizer 167:8 prioritizers 167:8 prioritizing 159:1 159:2,3 161:16 162:8,22 priority 41:5 159:8 168:14 pro 119:9 probably 5:4 11:22 15:4 17:11,21 21:6,17 23:4 29:3 38:12 41:22 46:19 61:4,13 66:21 71:11 85:4 93:22 94:1 117:9 119:17 119:19 122:7 129:10 131:9 133:9,10 143:2,4 143:18 145:3 149:17,19,19 151:9 155:1,21 165:16,18 166:8 problem 31:3 79:4 82:16 87:5 90:4 92:3 116:4,10,19 127:8,21 133:3 174:20 178:1 180:9 problematic 173:17 problems 42:7 61:12 82:15 114:5 133:7 171:16 procedural 55:8,10 176:18 procedures 32:18 177:5,8	proceeding 128:8 PROCEEDINGS 4:1 process 15:11,22 16:13 19:12 25:9 25:12,13 27:15 28:5 30:17 34:5 39:12 43:2 60:8 60:15 61:14,17 63:7 67:15,15 69:11 73:10 78:18 85:2,6,11 86:3,10 86:21 87:6,11 88:22 89:6,9,15 90:1 91:21 94:17 107:4 112:21 123:16 124:7 126:11,12 127:15 147:21 149:22 151:17 169:13 175:14 176:7 177:5,15 processed 148:2 processes 18:12 32:17 111:11 149:18 150:3 165:22 166:5 produce 99:15 150:11 product 7:7 79:2,8 96:6 productive 180:17 products 104:14 136:8 professors 131:11 program 96:1 149:2 progress 21:19 56:10 promote 71:1 pronounced 5:5 proper 29:15 132:8 prophylactic 107:7 proposal 124:12 129:18 146:10 proposals 98:1 proposed 75:2	pros 121:18 136:15 protect 115:15 protected 75:4 protection 122:4 protections 114:14 protocol 37:1 protocols 17:3 47:12 provide 10:14 25:4 43:1 46:14 66:6 72:10,11,11,20 89:13 135:4,19,22 159:17,19 161:18 169:20 provided 13:8,8,19 14:1,17 47:14 providers 96:13 providing 55:20 61:6 public 3:17 9:21 54:19 87:3 111:9 120:1,1 123:19 127:18 169:18,19 169:22 171:3 174:5,22 176:18 177:4,13 179:17 publicity 116:5 publicly 126:9 178:17 publish 171:14 publishing 171:16 pull 20:11 152:17 168:11,12 169:10 pure 147:17 purpose 31:11 178:15 purposes 118:18 pursue 128:13 130:21 pushed 56:6 put 8:21 30:2 43:15 48:10 49:12 56:17 56:22 57:1 58:9 58:11 81:17 88:4 105:13 124:5 139:18 140:21 155:11 156:3	160:17 164:8 165:2 167:11 174:17 puts 129:18 putting 14:9 20:22 29:10,22 43:3 150:20 158:8 168:6 178:6 <hr/> Q <hr/> Qualcomm 91:12 quality 32:19 39:5 170:13 176:22 quarter 68:20 query 91:9 querying 35:17 question 15:9,12,13 26:19 29:20 38:13 40:13 43:18 44:10 49:17 52:22 55:19 57:2 64:6 69:3,4 69:18,20 82:9 91:19 99:5,10 100:8 112:18 114:1 121:2,3,7 121:15 123:5 124:11 128:17 129:7,8 130:6 138:13,14 147:8 170:1 171:19 176:1 177:9 178:14 questions 7:10 13:2 20:16 23:20 44:2 51:15 54:5 60:11 62:11 63:13 65:21 66:2 68:2,3,6,15 68:21 76:8 98:20 98:22 99:2 103:22 110:12,13 111:1 128:5 136:3 146:1 154:1 170:15 175:11 176:18 177:12 quick 43:9 44:10 51:3 89:20 116:1 152:8 175:2	quickly 54:2 135:17 148:10 quid 119:9 quiet 93:13 122:5 quite 82:20 98:13 115:12 119:21 160:14 170:13 176:22 quo 119:9 quote 79:15 <hr/> R <hr/> R 79:7,12 radar 94:18 99:18 133:1,3 radars 41:21 94:20 95:9,10,17 122:17 radio 35:4 36:11 56:12 75:6 139:4 141:12,21 142:6 142:13 radios 131:6 rail 132:14 raise 173:14 raised 110:14 124:17 raises 82:8 raising 91:3 range 22:15 49:21 95:1 rank 169:14 rate 32:22 41:9 156:12 reach 124:6 125:3 174:2 179:11 reaction 162:7 reactions 51:18,18 read 88:13 123:21 156:15 readers 10:19 reading 74:22 80:17 81:11 ready 55:2,10 93:19 100:7 134:8 137:2 real 45:16 54:2 62:21 77:21 127:2
--	--	--	--	--

156:5 realistic 99:8 realistically 76:21 77:8 131:4,13 realities 23:15 111:2 112:7 reality 21:20 22:3 34:18 84:6 111:6 112:9 159:9 realize 60:16 95:1 145:2 156:22 167:2 169:2 realized 155:17 really 8:21 10:12 10:13 32:17 39:4 48:7 49:4 53:2 55:7 56:4 58:11 58:16 62:9,10 68:19 69:5,15 71:1,8 72:2 74:10 75:5 76:15 78:11 79:22 80:1,7,9 81:12,19 82:5,17 83:13 85:7,10 86:20 92:14,20 94:6,10,11 100:3 100:13,19 101:9 101:10 103:16,18 104:17,18 106:7 114:19 117:4 118:3,20 119:19 121:13,22,22 126:15 127:19 128:9 132:2 136:7 136:16 139:12 140:3 155:9 161:2 161:8,10 162:10 165:13 171:7 Reaser 1:22 79:18 131:19,20 147:7 149:12 161:22 162:1 166:19 173:21 reason 166:20 reasonable 17:1 107:9 176:5 reasons 17:19 33:7	117:16 reauthorization 107:16,19 recategorize 162:3 receive 105:9 106:19 receiver 116:3,7,15 116:16,18 118:2 receiver-perform... 116:9 receive-only 138:22 139:20 142:9,13,22 Recess 137:4 recognition 81:22 recognize 40:18 83:20,21 84:12 109:21 111:19 recommend 24:20 106:10 108:4 162:21 recommendation 12:19 28:20 43:15 44:15,19 45:7,11 45:12 46:9,17 47:3,17 48:5 49:22 50:10 54:21 72:7 73:1 74:16 78:18 87:1,11 88:6,7,12 89:16 90:2 105:13 106:8 107:22 108:18 109:8 110:16 133:17 141:13,15 142:5,8,19 144:6 144:8,9 145:9 155:12,15 156:9 158:17 159:13,18 159:22 161:19,20 recommendations 3:3 11:6 12:3,7,10 12:14,17 13:7,18 14:1,3,5,12 15:18 23:21 24:19 29:12 43:7 44:8 48:3 51:6,9 52:20 71:20 72:1 74:13	85:3 90:7,18,21 103:15,18 104:18 108:13 111:18 112:12 116:10 121:20 133:20 134:2 140:1 154:22 156:6 158:3,10,11,20 159:1,9,10 160:10 160:16 161:15,17 162:2,8,18 163:1 167:15,20,21 168:10,13 169:3 169:11 recommended 49:14 51:16 113:2 recommending 12:22 168:2 recommends 109:9 109:13,14 record 33:13 54:20 123:19 147:16 156:22 178:21 records 24:7,8,11 24:14 29:6 32:14 33:1 41:6 154:19 recruiting 8:17 reduce 105:16 redundancy 66:18 redundant 67:5 refer 54:17 142:12 reference 43:11 56:9 146:15 referring 135:7 refine 68:3 refined 15:4 refinement 134:9 regarding 12:9,14 46:9 178:14 region 98:5 register 73:15 123:15 152:14 170:17 regs 75:6 regularly 130:3 165:22 regulator 98:7	132:1 133:12 regulators 133:7 regulatory 82:9 105:14,17 109:10 reinvent 93:5 108:15 reiterate 108:16 rejected 129:5 related 15:3 29:18 41:14 44:18 60:3 83:3 142:2 relates 147:11 relating 177:13 relationship 96:16 release 52:14 released 67:11 156:2 relevant 94:11,13 94:14 96:6,13 108:17 171:18 reliability 32:7 reliable 153:16 reliance 105:16 reliant 152:3 relocate 16:5 relocation 25:8 47:4,11 66:1 rely 151:16 relying 105:18 remark 115:21 remarks 3:2 7:13 8:14 remedies 116:17 remember 13:20 36:7 48:16 130:10 130:11 178:9 remote 22:12 remotely 106:18 renew 106:15 repair 132:10,22 replace 132:15 report 10:17 12:13 14:19 19:21 20:15 20:16 26:2,20,21 27:20 37:11 52:10 52:14,18 53:3 54:4,16 55:5 56:3	62:16 68:12 70:1 70:13 82:3,3 93:19 102:5 103:5 103:16,21 107:13 108:14 138:2,6 141:15 145:13 163:21 164:1 172:17 reported 69:18 reporting 12:11 reports 3:4 10:1 51:14,19,20 52:1 52:6 171:11,18 172:10,13 representative 112:17 139:13 representatives 129:6 request 39:14 128:8 152:1 174:18 175:12 requested 176:2 requests 128:16 require 82:10 106:11 109:22 151:5 152:13 required 23:8 33:17 65:18 78:22 105:5,6 106:14 150:20 requirement 73:12 119:7 121:21 requirements 12:12 21:2 72:9 72:19 73:4,6,9,11 94:21,22 105:14 130:13 151:1 requires 146:10 Research 1:8 research-and-de... 48:14 reservation 170:21 reserve 50:10 resistance 8:21 resolution 127:2 resolve 82:14 resolving 61:5
---	--	---	--	--

resource 69:8 143:21 155:8	149:13 151:8 153:12,14 162:1	115:20 118:10 123:2 124:8 128:3	174:1 says 58:20 73:19	sell 124:4 132:10 132:11,22 133:5
resources 39:1 40:1 40:7 164:8,18	ridiculously 115:15 right 5:8 11:8	130:5 131:1,15,18 133:14 134:14,18	80:5 83:18 84:2 90:2 129:1 132:12	sells 90:19 send 140:17
respect 15:8 19:8 20:16 37:10 44:13	18:12 19:5 31:16 31:20 32:21 34:19	135:11 136:21 137:1 154:17	174:16 scenario 70:7 73:13	senior 48:14 86:11 89:2
65:21 113:1 123:7 135:10 168:17	35:21 37:2 38:12 46:5 61:4 73:16	round 62:9 route 109:7	99:14 106:21 scenarios 64:13	sense 17:17 29:15 30:3 41:5 49:11
respects 61:10 respond 125:14	74:8 76:22 77:13 82:22 86:15 98:15	rule 133:5 rulemaking 10:3	70:2 90:6 schedule 84:20	55:5 61:3 117:2 130:11 143:19
130:6 163:16 responding 126:5	100:14 101:12 113:11 119:16	59:21 60:1 61:19 87:9 101:7 112:21	157:20 scheduled 180:1	146:12 147:4 160:14 167:20
response 15:17 44:18 45:22 46:14	121:12 122:16,17 145:5 151:8	125:17 126:6 129:10 151:6	scheduling 3:20 173:9 179:19	sensing 70:6 71:8 74:2 83:20 106:3
75:1 110:14 112:22 129:16	156:13 161:4 162:12 163:18	rulemakings 125:13	Science 50:14 score 32:9	sensor 132:18,19 separate 25:13
149:16 responses 13:22	168:7 169:20 rights 111:10	rules 12:12 50:9 75:12,14 90:14	screen 29:14 scripts 26:16	54:17 121:1,6 separated 90:16
111:14 147:2 responsibility 33:9	123:13 risk 104:8	104:7,13 108:2,21 111:20 112:2,10	sea 35:5 36:14 search 3:6 14:15	separates 83:16 series 45:2 48:3
33:12 107:2 127:6 responsible 123:20	road 81:18 165:5 roadmap 48:6 49:9	112:13 120:12 152:13	48:22 52:2,10 second 15:21 23:22	serious 78:6 seriously 124:14
rest 9:3 162:13 restricted 109:15	161:18 Roberson 1:22 6:7	rule-change 128:16 run 13:14 33:20	69:3 73:1,12 82:2 89:4 93:18 128:17	service 5:15 69:2 session 10:10
109:19 110:5 restrictions 113:2	11:14 50:15 144:20	38:3 51:3 103:14 166:6	138:5 142:8 secondary 50:2,5	set 10:13 13:19,22 17:4 42:5 48:2
117:10,16 119:10 restrictive 114:20	ROBERTSON 11:14 157:12	running 42:6,19 50:22 150:18	75:8,9 80:6,7 81:17,19 108:8	51:8 63:17 92:22 110:3 121:19
115:1 result 97:22	robust 115:10 role 60:1 69:16	Rush 1:23 6:8,20 6:20 97:7,7	secondly 57:8 seconds 175:15	126:14 131:12 141:14,16 153:15
resulting 119:22 return 12:7	96:11 112:16 127:19 131:21	<hr/> S <hr/>	Secretary 2:17 see 10:17 11:3	155:3 163:18 sets 53:13 90:19
revalidate 39:14 reverse 148:3	132:2 133:13,13 roll 11:13	safeguard 19:10 safety 9:21	14:20 18:3 20:22 34:7 37:11 39:8	96:13 setting 15:22 21:4
review 3:3 10:5 12:3 28:15 30:14	room 1:9 80:19 81:15 86:16,17	sample 156:12 samples 41:11	44:18 47:1 60:18 61:4 64:13 66:20	26:13 94:21 99:1 174:2
32:14,20 56:18 61:11 62:1 150:2	88:17 96:8 137:9 Rosston 5:16,17	sampling 41:1 sat 158:5	70:1 86:3 87:1 98:8 112:10	settle 100:6 shackles 36:3
150:5,6 169:12 reviewed 33:1	6:1,11,13,19,21 7:16,20 8:12 9:7	save 175:16 saw 62:17 82:2	113:21 145:11 162:6 166:7	shaking 76:2 share 80:1,1 165:10
103:19 reviewing 30:5,9	25:20 44:3 50:17 50:20 51:11 53:14	140:16 saying 35:10 37:9	167:19 172:11 seeking 115:14	shared 22:2 28:10 69:7,8 86:6
rich 9:12 Richard 1:22	53:18 55:12 62:7 63:3,10 65:11	41:3 45:15 59:2 98:10 102:22	seen 73:18 142:14 sees 21:16	106:12 108:9 118:17 151:3
Rick 78:9 79:17 89:13 130:7	67:6,17 82:19 93:10 102:3,18	122:21 126:3 127:9,11,22	segment 99:22 selection 83:12	155:2 shared-spectrum 106:1
131:19 147:6	103:3 110:17	156:21 172:12	138:10	

shareholders 79:9	166:4	somebody's 81:17	57:17 62:11,11,22	spread 65:14
sharing 3:8 14:7	simply 115:16	160:17	63:16 72:16 84:11	Squared 164:9
15:6 17:3,19 23:7	175:21	someone's 71:12	88:12,21 98:5,6	squarely 107:3
23:8,11,19 36:16	single 105:2	someplace 36:11	99:6,11,13,16,18	130:19
36:22 47:10,12	single-frequency	somewhat 24:18	99:19,22 106:9	stab 143:7
48:12 55:9 56:5	109:12	66:20 122:8 143:6	111:1 113:19	Staff 2:11,21
56:14 63:6,7	sister 10:20	sophisticated 70:21	136:14 142:15	stage 93:18
64:10,17 65:4,18	sit 96:5 123:19	71:2	159:12 161:14	staging 19:8,11,19
66:9,11,19,22	148:19	sorry 7:3 17:13	specifically 56:16	stalemate 86:9
67:1,18 68:1,12	site 37:16	43:17 63:2 77:2,6	56:20 75:16 91:3	Stancil 1:23 4:15
68:14,17 69:1,5	sites 30:19	78:12 87:18 94:3	138:21 168:16	4:15 153:8,8,11
70:21 71:4,5,14	sitting 95:20 98:9	96:18 102:20	177:14	stand 37:14 51:4
72:16,22 75:2,2	158:14	118:9 129:14	specificity 48:9	180:18
75:21 77:9,21	situation 19:16	145:18 153:10	93:9	standard 39:4
78:7 79:20 80:8,9	22:2,20 59:10	157:4	specifics 72:21	92:21 93:1 98:2
80:10 82:15 83:18	74:4 82:8 104:15	sort 12:15 16:2	99:17	159:3
88:8,19 99:8,14	111:7 123:11	17:3,5 26:21 29:7	specific-location	standards 17:5
99:18,21 114:15	six 10:4 59:22	29:16 32:11 35:5	58:3	18:10 39:18 91:18
119:3,6 122:1,16	sizable 77:15	41:8 52:5 76:11	specified 59:4	91:18 94:8 159:4
134:15 155:6	size 70:3	77:16 80:8 92:3	spectrum 1:2 2:14	standards-develo...
Sharky 11:19,19	size-fits-all 71:9	101:8 115:4	2:22 3:8,11,13	97:9,18
87:11,13,18 88:2	slide 69:12 98:17	116:15,17 117:5	9:13 21:14 22:21	standing 9:20
shelf 112:8	slow 10:19	117:15 118:15	23:13 24:1 34:12	stands 48:1 50:13
shop 131:12	small 27:7 38:4	121:18 132:6	35:8 36:2 39:14	Stanford 1:7,10
short 103:1 167:16	155:10 163:8	133:18 142:12	44:16 47:4,18	5:17 7:2
shortly 10:19	smart 36:19	144:16,21 147:11	48:6,14 49:8 50:3	staring 36:5
shortterm 168:15	smoothly 31:13	147:13 150:7	64:10,10 67:18	start 4:8 7:12 14:15
169:14	Snider 170:1,4,5,8	152:19 153:18,20	68:12 73:7 74:10	52:9 59:16 155:20
shot 161:9	170:9,11 172:8,15	154:9,13 155:7,10	83:5 84:8,10,16	158:2 169:13
show 74:5	172:18 173:13,22	162:9 166:22	85:16,17 102:4	started 8:11 72:15
shows 92:2 150:17	174:12 176:15	167:5 173:9	103:5 105:8	93:3
side 18:9 79:15,15	177:10 178:12,16	sound 116:22	109:16 119:15	starting 85:20
91:4,21 92:6,10	178:21 179:6,9	120:15 140:21	128:2 137:10	92:15 97:6 142:21
130:20 135:6	snowfall 22:11	176:5	138:1,8,19,20,20	starts 137:2
151:1 157:2	software 26:16	soundly 129:5	139:4,11,16 144:1	state 4:16 56:12
sides 79:14 80:12	104:8	sounds 134:3	145:1,13 149:21	153:9
signed 10:11	sole 79:3	source 166:22	156:1 162:11	stated 99:7
significant 75:1,5	solution 83:14 85:4	so-called 109:11	164:19 177:14	statement 54:17
76:1,1,15 78:21	solutions 105:19	118:14	spectrum's 91:9	178:17 179:3
125:12 126:4	107:5,7	space 81:7 91:15	spectrum-manag...	statements 177:17
146:20	solve 127:21	spaces 37:4	10:1	178:3
significantly 30:11	solves 114:4	speak 114:8 158:4	speed-reading	STATES 1:1
34:2	solving 61:12	177:21	52:16	statistical 153:2
similar 19:4 42:4	somebody 6:14	speaking 17:16	spend 71:12	status 50:6 97:13
88:5	37:15 43:2 120:3	85:13 101:13	spending 116:2	108:8 173:1
simple 70:16	140:20 150:10	specific 9:22 12:21	splitting 69:9	staying 21:1
simplify 151:15	176:2,6	20:16 29:4 34:10	spooky 92:20	steering 45:21

46:21 48:15	20:14 39:6 60:4,7	super 18:14 115:11	T	tall 149:8
step 55:3 72:21	68:14 88:6 102:5	supplies 150:4	T 11:19	task 20:19 60:5
76:12,15	103:9,12 108:14	supply 91:14	tab 28:21	166:10,10
stepping 139:1	110:15 114:9	support 27:14 50:9	table 4:4 13:10	tasking 9:22
steps 98:17 105:10	124:19 125:2	138:7 139:3	57:1,1 94:18	tasks 11:5 152:4
Steps/Open 3:15	134:16 151:19	141:11,22 142:9	95:21 123:22	165:3 168:18
157:21,22	171:8,9,11,17,18	supported 27:18	124:18 129:19	team 38:17 66:19
Steve 11:19 87:11	171:21 172:3,10	47:5	tables 26:13	67:4
87:14,16 88:4	172:13 174:7	supporting 89:10	tailor 74:3	technical 10:4 50:9
stop 15:10	subcommittees 3:4	144:17	take 32:22 34:9	61:11,22 69:10,12
Story 145:20	51:17 160:16	supports 60:15	37:12 41:10 42:11	71:16,20 74:12
stovepipe 167:13	171:22 172:5	127:18	43:9 46:15,16	85:3 86:7,14,16
stovepiped 161:5	173:3,6 174:2	supposed 39:13	55:3 59:20 60:5	86:18 89:11 96:20
straight 106:7	Subcommittee's	166:14	66:15 84:11 88:15	178:1
stream 59:15	52:10 68:12 103:5	sure 9:7 13:15 39:2	90:22 98:12,13	technique 30:2
Street 1:9	137:11 138:2	39:18 48:7 54:19	99:13 101:14	technologies 99:17
strengthen 108:5	172:17	60:4 62:4 63:18	105:10 111:16	105:22
Strickling 2:17 4:9	subgroup 67:13	66:16,19 67:4	124:14 126:11	technology 48:6
4:9 7:13 8:15 9:8	subject 157:14	75:12 81:8 88:1	132:1 135:13,18	49:8 50:14 99:20
10:22 38:14,21	submitted 144:20	92:7 123:17 130:8	143:7 163:2 165:1	106:3 107:5,7
39:17 50:19 52:8	subsequent 52:19	133:22 134:19	167:18 175:15	109:4,6
59:14 60:21	141:21	136:19 143:14	176:18 179:2,5	technology-based
163:14,20 180:16	subsequently	149:11 151:21	taken 40:15 41:20	105:18
Strickling's 162:7	140:10 175:7	152:11,22 164:22	45:5 46:12 47:20	Telecommunicat...
strict 130:13	subset 155:10	166:17 169:8	77:11 137:4	2:10
strong 102:9 103:1	substantive 55:8	171:20	takes 27:16 84:12	telemetry 58:4
stronger 109:3	subtasks 45:3	surety 122:21	148:1 175:13	tell 57:17 90:13
132:1	sub-footnotes	survey 99:20	talk 9:14 21:10	96:3 112:1 151:21
strongly 18:15	81:16,16	Susan 6:4	93:15 107:20	166:19 173:2
structure 60:14	successful 62:9	susceptible 82:14	116:18 123:16	telling 175:18
126:18,20 127:13	128:15	swamped 167:2	127:4,16 139:17	ten 10:11 27:17
study 37:17 44:15	such-and-such	sympathize 31:3	142:1 157:13	52:4 66:10 81:18
45:15,16 56:14	125:16	system 24:20 30:15	174:16	128:10 135:14
109:10,22 110:12	suggest 18:16	34:2,3 36:20	talked 26:14 44:4	137:1,2
166:9	49:19 94:10	40:16 42:4,22	51:16 73:19 85:9	tend 41:18 79:5
studying 45:3	suggested 49:16	57:13,19 95:7	139:20 141:10	tendency 130:14
166:8	130:12 133:15	143:12 146:9	146:5 147:8 162:5	tends 117:3 130:19
stuff 17:7 58:10	141:17 142:5,18	systems 18:1 19:14	163:12 164:7	tenure 131:12
60:17 72:3 76:10	suggesting 160:19	20:3 21:22 22:8	talking 10:17 15:15	ten-minute 135:12
92:12 117:11	suggestion 26:11	22:14 23:2 32:4	16:16 28:7 35:16	135:13
119:16 132:12	26:15 143:10	35:17 38:1,8	63:15 64:9 65:3	term 49:2 69:5
133:6 147:14	145:8	41:17 42:4,9	76:19 77:14 78:2	159:5 167:16,17
148:18 149:1	suggestions 37:13	47:13 58:2,3,5	78:5 92:18 117:3	167:17 168:16
stuff's 91:10	summer 176:21	68:22 79:1,13	117:7 118:3	169:14
style 153:21 154:10	177:11 178:1	95:8 96:14 104:11	121:20 129:10	terminated 149:2
sub 144:8	summers 13:21	104:22	143:20 146:9	terminology 50:7
subcommittee	sunny 7:3		153:15	135:7,9

terms 11:22 21:18 22:22 50:4,11 61:19 65:1 71:4 72:19 99:7,8 100:15 101:5 114:18 115:18 116:16 117:11 122:13 147:19 159:8 162:16 163:5 167:16 168:14,14 169:14 174:4	things 10:8 12:4 19:6 21:11 22:7 22:12 33:16 35:11 39:2 40:12 44:4 45:13 55:6,18 62:8 71:14 72:14 78:2 80:5 82:6,7 83:13 85:4 86:12 88:14 89:11 94:16 95:15 117:6,20 118:7,12,19 122:9 122:14 130:20 131:5,22 144:15 146:6 147:18,19 148:9,14 149:7 151:5,13 154:21 155:8 158:7 160:6 162:9,14,17 163:3 163:8,22 165:13 165:15 166:2,7 167:21 169:4 173:8	65:1,12 66:15 67:7,13,20 70:22 71:9 72:17 75:5 76:14 78:4,11,12 79:6,11 80:4,11 80:18 81:6 82:15 82:17 85:7,19 87:20 89:21 90:4 90:8 93:17,21 94:6 95:11,15 96:3,7,17,18 97:8 98:10 99:12 100:2 100:7,11,12,18 101:5,13 104:16 107:13 111:13,16 114:4,11,22 115:2 115:13 117:4,14 118:7,18 119:1,17 123:9,10,11,22 124:12,16 125:2,4 125:8,18,20 126:3 126:6,12,18,19 127:2,14,15 128:10 129:9,12 131:2,22 132:3 133:6,12,17 134:18 135:5,8 136:1,7,10,11,15 136:16 138:15 139:14 140:5 141:1,18 146:4,12 146:14,19,20 149:17 150:8 151:8 152:3 154:19 156:9 157:4 158:2,19 159:15 160:5 161:2,3,8,10,17 163:4,15 164:4 165:11 166:3,14 167:3,11 168:2,5 168:6,11,22 169:9 174:4,8,19,20 178:15	121:22 144:15 153:11 154:18,21 169:13 third 39:20 73:22 74:15 93:20 thought 65:20 74:14,21 83:12 93:6 105:20 107:9 108:17 116:16 133:15 134:6,7 147:12 180:4,17 thoughts 13:7 21:9 54:7 74:21 114:6 136:9 154:13 165:10 171:15 thousand 170:19 threads 69:10 three 7:14 27:16 44:21 57:13 62:21 74:12 165:2 throw 100:3 130:17 160:1 Thursday 1:6 Ti 142:3 144:15 TIA 8:4 tie 140:4 ties 29:11 till 84:21 171:1 time 9:13 14:4 19:10 21:12 22:5 23:1,6 32:19 34:8 34:9,15 42:19 43:20 44:9 51:6,7 51:19 52:4 54:16 57:7,10 67:10 68:15 69:19 71:7 79:3 83:5,9 84:3,4 84:8,9,14 85:9 92:2 94:7 109:21 110:4,11 113:22 131:6 142:18 149:1 152:11 154:12 156:5 169:3,17 170:21 171:4 177:22 180:11,13 times 12:16 47:19	116:11 timing 86:21 titles 172:18 today 5:7 9:14 10:18 26:3 34:10 36:3 98:10 104:21 111:3,7 117:17 157:5 160:9 180:13 today's 10:15 11:8 118:4 told 53:2 59:3 72:10 132:4 133:5 175:1,7,11 tolerance 36:18 tomorrow 77:17 ton 119:15 topic 99:3 100:3 topics 10:7 14:8 98:17,19 99:12 166:13 toss 163:11 totally 116:3 167:1 touched 100:11 track 145:2,10 trade-off 120:22 traditional 114:21 traffic 41:21 95:9 Tramont 1:24 6:11 6:12 137:20 145:17,18 tranche 156:1 transaction 115:3 TRANSCRIPT 1:5 transition 10:5 15:7 22:22 23:9 23:17 33:22 39:11 56:17 57:9,11,15 58:1,6,20 59:10 60:19 63:8,16 64:8,16 65:1 66:7 66:21 67:1,8,18 110:1 transitions 23:5 transmitter 142:16 transmitter-wise 116:13
terrible 140:22 terrific 12:20 53:21 test 99:2 100:15 101:3,5,10 120:4 testament 164:4 tethered 117:15 122:6,12 text 24:2 46:22 76:9 88:13 90:16 thank 8:15,16 9:5 11:9 50:12 63:12 66:3 68:16 79:16 102:2 130:4 137:6 141:4 147:5 149:13 154:14 160:20 170:6 174:10 176:8 179:15,18 180:12 180:16,19 thanks 15:19 41:13 51:11 88:2 theme 82:2 themes 81:12 theory 48:2 thing 11:2 12:15 15:22 29:16 32:16 40:3 58:7 60:22 79:19 80:7 83:15 83:18 86:17 101:9 116:20 126:10 132:7 143:9 144:16 150:7 153:19 160:17 162:5 167:4,7 168:5	think 4:5 7:8 9:2,15 10:7 11:7,21 12:20 13:2 15:1 15:16 16:6,22 17:19 19:19 20:1 20:20 21:15,20 23:13,14 24:4,10 25:2,4,16 27:3,19 28:1,2,7,8,12,16 28:22 29:2 30:6 30:21 31:2 32:11 33:6,15,22 34:1,6 35:2 36:7,13 37:8 37:10,12,17 38:9 39:14,20 40:17 41:3,10,20,22 42:9,17 44:8,17 44:21 45:7 46:19 47:6 48:4,9,18 49:3,5,10 50:6 51:8 53:19 57:6,6 57:21 58:18 59:7 59:7,18,21 60:6,9 60:11,21 61:10,18 62:2 63:5,15 65:1	127:2,14,15 128:10 129:9,12 131:2,22 132:3 133:6,12,17 134:18 135:5,8 136:1,7,10,11,15 136:16 138:15 139:14 140:5 141:1,18 146:4,12 146:14,19,20 149:17 150:8 151:8 152:3 154:19 156:9 157:4 158:2,19 159:15 160:5 161:2,3,8,10,17 163:4,15 164:4 165:11 166:3,14 167:3,11 168:2,5 168:6,11,22 169:9 174:4,8,19,20 178:15 thinking 26:8 56:15 65:2,5,6,13 69:6 92:5 93:2		

transom 161:9	two-way 78:13	University 5:4	139:16 141:7	125:19
transparency 174:5	type 15:6 37:17 41:17 55:9 56:8	unlicensed 3:11 47:9,13 48:3 49:1	143:21 144:12	views 12:9 101:10
treated 173:15	68:4 71:7 83:8	49:2,3,15 50:1	152:15 153:1	violation 173:22
treatment 109:10	138:22 142:16	77:22 78:1 100:1	useful 32:11 57:3	virtually 103:18
tremendous 164:16	143:19 159:19	102:4 103:5,9	57:21 60:2 92:13	virtue 123:14
Triage 38:11	167:17 178:5	104:4,6,19 106:11	94:1,17 95:15	visibility 26:4
tried 52:21	types 18:1 22:6	106:13 107:10,12	user 21:17 42:22	voice 102:9 103:1
tries 89:17	42:14 70:7 95:8	107:18 108:8,19	43:8 75:19 95:20	vote 133:16,19
true 22:22 81:22	99:12 104:19	110:15 112:3,14	123:6,9 129:3	134:2 161:6
122:15 156:20	138:7 142:21,22	113:1 114:10,21	151:11,11	voted 54:15
167:20	typical 91:13	117:1,2 118:14,17	users 21:14 94:11	VTAC's 93:12
truly 167:19	typically 97:10	119:3 121:17	94:20 104:5,6	VTAC-type 93:7
try 15:5 31:14 53:8	104:22 105:2	123:12,14 124:20	115:2,14 123:17	
53:22 58:7 91:7		125:7 128:21	124:16 125:16	W
130:22 133:7	U	125:7 128:21	126:5,16 151:12	wacky 36:10
135:3 147:2	UHF 133:3	135:6 136:6	151:17	wait 44:11 62:16
150:19 155:18	ultimately 45:22	138:22 140:13	uses 17:20 25:10	134:8 171:1
156:4 159:16	59:6 63:7,8 82:4	143:10,17 146:16	46:1 49:2 114:22	waiting 10:16 52:6
167:14 173:7	90:10 126:12	150:9 152:10,20	utility 99:22	129:15
180:11	127:5,15 168:2,22	152:20 153:1	utilizing 77:16	walk 69:13 71:22
trying 17:22 24:9	umbrella 71:14	unlimited 72:13	U.S 92:10 97:5	72:4 87:17
32:3 36:12 43:5	Um-hum 160:11	unmute 102:21	126:16	want 4:8 9:10 10:8
68:1,6 79:21,22	unable 20:17	untethered 104:21		18:14 25:21,22
163:17 168:19	unconnected 105:1	109:12 113:9	V	32:1 35:22 38:15
169:10 176:13	109:14 110:4	unused 115:19	vacant 114:19	40:12 44:12 51:13
178:8	underestimate 36:4	unworkable 74:7	vacating 16:12	54:19 58:13,13,16
tune 15:6	underlying 35:6	update 69:13	57:20 64:10	59:9,15 60:10,13
turn 9:3 11:8 52:6	36:13	106:18 147:21	vague 62:15	62:22 66:1 67:12
54:1 68:7,11	understand 19:9	154:6 155:3,8	validate 33:5	70:21 71:1 72:4
73:17 87:10 102:4	32:2 37:8 48:8	updated 140:11,18	validation 34:1	72:10,12,13 73:19
119:12,13 179:20	55:4 59:20 63:14	154:5	valuable 28:2,3,13	74:18 76:4 81:8
turned 132:18	92:17 104:7 107:6	updates 105:9	101:6	82:10,12 84:19
turns 70:18	178:13	107:16	value 19:9 21:18	85:13,15 87:16
TV 105:7 114:17	understanding	updating 147:20	30:8 77:9 96:2	88:3 89:18 94:5
114:19	16:11	153:13	161:10 168:17,17	108:15 110:20
twice 102:15	understood 23:14	upfront 57:7 67:1	169:7,15	114:8 115:21
178:18	undertake 98:2	125:20	various 21:2 55:22	116:21 118:21
two 22:6 27:16	undertaken 97:17	use 14:21 21:15	vast 38:2,2	123:3 126:10
40:10 49:16 53:12	undertaking	30:1 33:19 50:4,7	vendors 97:22	130:6 131:11,20
62:17 64:13 68:5	125:12 146:11	55:21 61:21 65:15	verified 32:6 154:7	140:9 146:15
68:15,21 69:10	unemployment	67:2 69:21 73:7	verify 29:5	148:8 151:11
78:12 81:12 98:22	32:22	77:21 83:5,6	Verizon 4:18	155:3 163:11
104:18 118:1	unfortunately 9:13	84:15 85:18	versus 63:8 168:15	165:10 176:17
119:20 128:5	103:9 111:6	100:15 111:21	168:16,21	178:3 180:10,12
154:13 175:2	unit 132:15 171:13	115:18 117:2	vested 161:14	wanted 13:5 57:18
176:16	UNITED 1:1	118:17 124:20	view 21:3 28:10	57:19 75:9 80:15
		125:7 135:10	viewed 76:13	86:13 115:22

133:10 134:5,5 147:7 170:12 177:12,15 wanting 61:21 64:18 wants 39:6 55:13 76:6 77:19 82:13 130:22 137:18 warning 164:11 Warren 1:25 4:21 4:21 43:20 44:1 44:11 54:19 63:11 63:12 64:1,4 65:9 65:12 78:10,10 94:3,4 96:17 128:4,4 129:14 130:1,4 160:22 161:1 Washington 2:20 13:15 172:3 179:13,22 wasn't 131:14 132:19 waveform 139:2 141:6 142:1 144:7 144:17,19 waveforms 122:14 way 15:9 19:1 25:1 30:7 31:5 32:5,13 33:5 34:18 36:19 38:22 61:5 62:3 63:1 65:7 67:9,14 70:9 75:18 82:19 90:9 92:8 94:9 98:14 112:10 125:16 126:19 131:8 148:4,15,17 155:4 161:8 163:8 163:17 173:10 179:11,11 ways 70:2,11 92:16 122:13 165:6 wear 5:4 weather 7:4 9:2,3 webcast 170:12,16 170:18,22 175:8 webcasting 175:3,6	website 15:18 135:20 171:9,17 172:2,5,9 weeds 18:20 weeks 9:17 46:18 116:2 163:21 welcome 3:2 7:1 8:14 9:10 63:21 64:2 114:16 115:16 179:22 well-behaved 119:16 went 67:10 101:2 110:14 125:4 178:16 weren't 175:5 we'll 4:4 10:3,8,17 11:7 16:16 19:20 20:5 21:9 29:16 37:12 44:9 46:19 47:12 63:1 66:15 67:3 78:9 87:10 92:1 98:11 101:13 103:7 130:7 133:22 134:19,22 135:3 139:21 146:18,22 155:15 156:5 163:15 we're 7:9,12 8:10 10:2 13:1 18:2 19:3 21:21 23:10 24:3,11 26:2,8 29:10,22 34:6 35:10,11,15,20 43:4 46:2,4 48:19 49:20 51:9 54:3 60:12,13 61:8 62:2 64:9 65:3 66:12,16 67:5 68:14 70:16 72:10 78:6 81:13 83:15 83:21 90:12 92:3 92:18 93:3 100:7 100:17 102:4 103:15 111:10 113:21 117:7 121:20,22,22	134:10,11 139:6 144:14 149:9,21 150:13,18,20 151:2 152:2 155:21 157:18,19 158:9,12,20,22 159:2 163:18 166:8,13,17 168:2 168:18,19 we've 20:17,21 21:8 28:19 33:2 34:12 37:4 41:14 45:5,17 49:16 50:6 56:16 73:18 73:19 78:2 93:15 98:21 103:19 104:1 111:18,19 113:11 126:19 129:2,11,15 133:17 142:14,17 146:5 160:8 161:5 166:9,13 168:11 whatnot 173:10 175:19 whatsoever 8:22 wheel 93:5 108:16 white 37:4 48:12 whitespace 105:7 114:18 123:12 143:13 145:6 152:9 wholesale 66:1 wide 65:14 widely 104:14 wifi 56:9 114:21 115:11 118:5 Wikipedia 153:21 154:2,10 willing 55:2,11 85:11 119:12 125:2 127:4 152:6 willingness 67:22 84:12 WiNCom 144:20 wind 33:18 81:17 wired 124:2 wireless 4:18 48:13	66:6 95:6 104:19 131:10 152:20 wish 161:21 wonder 93:5 173:1 wonderful 9:9 92:22 131:10 word 75:8 167:20 wording 90:16,20 words 106:5 109:11 115:18 146:18 work 7:6,7,8 9:19 12:6 17:2,22 20:5 21:19 23:11 24:22 26:9 28:14 33:18 38:7 39:8 40:8,12 40:18 45:16 56:9 59:15 62:18 63:1 65:7 67:4,12,22 69:9 82:1 84:19 87:15,16 88:5 97:17,21 98:13 99:21 107:19 113:14 115:17 116:18 126:20 127:13 132:5,20 137:11 141:8 143:6,14 145:5 146:18 148:16 151:14 156:16 158:12 159:7 161:13 162:16,20 165:19 166:14 167:5,12 169:9 171:7 176:12 180:8 workable 69:5 worked 46:7 59:7 69:16 167:1 172:13 working 6:14 14:6 16:15 17:18 21:10 27:11 28:20 54:12 66:18 68:4,20 166:1,10 171:12 workplan 138:13 166:7 works 20:11	workshops 96:12 work's 91:16 world 35:4,15 36:15 75:2,4 76:3 82:5 92:11 93:22 97:2 98:5 131:11 139:2 worried 36:14 92:1 worry 157:1,2 worse 156:19 worth 119:17 136:11 166:3 wouldn't 28:7 167:8 Wow 141:1 wrap 98:16 wrapped 104:1 WRC 129:18 writ 65:19 write 175:17 written 75:6,16 90:1,9 92:21 175:9,10 wrong 31:22 35:3 38:16 73:16 74:6 116:13 135:9 wrote 31:10
				Y
				Yay 6:13 yeah 102:22 114:7 119:10 120:7,7 121:1,6,8,11,14 122:15 123:3 130:8 131:20 134:10,14 135:18 145:12 146:3 149:17 156:8 161:12,22 165:11 170:4,11 172:6,15 172:15,22 178:22 year 24:10 27:16 33:3 59:1 66:11 133:11 148:1,4,21 years 27:16,16,17 27:17 34:13 39:11 44:21 57:14 58:21

75:8 81:18 100:22 128:11 129:13 149:3 162:18,19 162:19 year's 110:15 yell 53:22 York 58:21,22 Yup 137:14	56:20 61:1,14 62:3,16 1755-1850 16:5 19:21 22:7 23:3 25:7 52:14 54:8 179 3:20 180 3:22	6 28:19 141:5 60,000 140:13 67 3:8		
<hr/> Z <hr/>	<hr/> 2 <hr/>	<hr/> 9 <hr/>		
zero 73:7 77:19 zones 71:3 74:7	2 28:22 29:2,6 30:10 37:14 43:10 69:12 106:8 147:9 2.4 109:17 114:20 115:11 118:14,19 20 129:13 162:11 2000s 44:21 2010 108:14 2012 1:6 25th 180:2,4 250,000 24:8 29:5 30:10,19 33:1 154:19	9:00 4:2 900 110:7 94305 1:10		
<hr/> \$ <hr/>	<hr/> 3 <hr/>			
\$4 28:22 30:10 37:14 43:10 147:9 \$40 40:16 \$6,000 175:5 \$7 9:21	3 107:22 3BP 96:5 3GPP 91:6 97:10 97:21 366 1:9			
<hr/> 1 <hr/>	<hr/> 4 <hr/>			
1 1:6 10 3:3 10:20 84:22 102 3:11 11 136:5 11:02 135:16 11:03 136:22 137:4 11:16 137:4 11:53 180:21 12 164:9 137 3:13 15 14:11 104:22 111:20 129:1 150 139:15 157 3:15 160,000 140:13,16 162 38:7 169 3:17 1710 22:7 61:2,13 61:21 1710-1755 16:11 57:5 1710-1850 22:15 174 38:7 1750-18 19:21 1755 10:17 20:15 22:8,21 55:5	4 3:2 29:3,7 108:18 139:8 144:6 48 3:6			
	<hr/> 5 <hr/>			
	5 49:21 56:9 94:17 95:13 109:9 118:15 122:16 144:21 146:17 50 175:7 500 3:6 14:16 48:22 52:2,10 60:6,7 63:14 64:5 66:5 67:22 69:7 88:6 155:21			
	<hr/> 6 <hr/>			

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Commerce Spectrum Management
Advisory Committee

Before: US DOC

Date: 03-01-12

Place: Stanford, CA

was duly recorded and accurately transcribed under
my direction; further, that said transcript is a
true and accurate record of the proceedings.

Neal R Gross

Court Reporter

NEAL R. GROSS

COURT REPORTERS AND TRANSCRIBERS

1323 RHODE ISLAND AVE., N.W.

WASHINGTON, D.C. 20005-3701