

UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL TELECOMMUNICATIONS AND INFORMATION
ADMINISTRATION

COMMERCE SPECTRUM MANAGEMENT ADVISORY COMMITTEE
(CSMAC) MEETING

Zoom Conference

Thursday, January 14, 2021

1 PARTICIPANTS:

2 CLAUDE AIKEN
3 President and CEO, Wireless Internet Service
4 Providers Association

4 AUDREY ALLISON
5 Vice President, Global Spectrum Management,
6 Boeing

6 MARY BROWN
7 Senior Director, Spectrum and Technology
8 Policy, Cisco

8 MICHAEL CALABRESE
9 Director, The New American Foundation,
10 Wireless Future Program

10 MARK E. CROSBY
11 President and CEO, Enterprise Wireless
12 Alliance

12 H. MARK GIBSON
13 Senior Director, Business Development,
14 CommScope

14 DALE N. HATFIELD
15 Senior Fellow, Silicon Flatirons Center for
16 Law Technology, and Entrepreneurship

16 CAROLYN KAHN
17 Principal Economics and Business Analyst/Group
18 Leader
19 The MITRE Corporation - Center for
20 Acquisition and Management

19 MARK LEWELLEN
20 Manager of Spectrum Advocacy, John Deere
21 Intelligent Solutions Group

21 JENNIFER MANNER
22 Senior VP, Regulatory Affairs, Echostar

1 PARTICIPANTS (CONT'D):

2 MARK A. MCHENRY
3 Founder and President, Shared Spectrum Company

4 DONNA MURPHY
5 Senior VP, Global Regulatory, INMARSAT

6 WAYNE PHOEL
7 Independent Consultant, Previous MIT/LL and
8 DARPA

9 CARL POVELITES
10 Assistant Vice President of Public Policy,
11 AT&T

12 RUTH PRITCHARD-KELLY
13 Vice President Regulatory Affairs, OneWeb

14 MARK RACEK
15 Senior Director of Spectrum Policy, Ericsson

16 CHARLA RATH
17 Independent Consultant (Co-Chair)

18 DENNIS A. ROBERSON
19 Research Professor of Computer Science,
20 Illinois Institute of Technology

21 ANDREW ROY
22 Director of Engineering Services, Aviation
Spectrum Resources

STEVE SHARKEY
Vice President, Government Affairs, Technology
and Engineering Policy, T-Mobile US, Inc.

MARIAM SOROND
Vice President, Technology Development, Dish
Network LLC

BRYAN N. TRAMONT
Managing Partner, Wilkinson Barker Knauer, LLP

1 PARTICIPANTS (CONT'D):

2 JENNIFER WARREN
3 Vice President, Technology Policy &
4 Regulations
5 Lockheed Martin Corporation (Co-Chair)

6 CHRISTOPHER WEASLER
7 Global Head of Spectrum Policy and
8 Connectivity Planning, Facebook, Inc.

9 ROBERT WELLER
10 VP for Spectrum Policy, National Association
11 of Broadcasters

12 MARK MCHENRY

13 * * * * *

14
15
16
17
18
19
20
21
22

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

C O N T E N T S

AGENDA ITEM:	PAGE
WELCOME/OPENING REMARKS	
OPENING REMARKS AND INTRODUCTION BY CO-CHAIRS	
SPECTRUM POLICY UPDATE	
SUBCOMMITTEE REPORTS AND DISCUSSION	
Subcommittee 1 Spectrum Strategy Governance	
Subcommittee 4 UAS	
OPPORTUNITY FOR PUBLIC COMMENT	
CO-CHAIR CLOSING REMARKS	
ADJOURN	

* * * * *

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

2 (1:03 p.m.)

3 MS. WARREN: So, welcome, everyone, to
4 our first meeting of 2021 and progressing on the
5 agenda that NTIA set for us. We have, as you
6 know, two more working groups that will be
7 presenting today, and one with a final report and
8 one with a draft report.

9 Before we get to all of that, you know,
10 I want to thank -- Charla and I want to thank NTIA
11 for their continued leadership and commitment to
12 the CSMAC and with, you know, entrusting us with a
13 lot of responsibilities to develop recommendations
14 that are meaningful for today and tomorrow and
15 into the future.

16 So, with that, I would like to turn it
17 over to Carolyn Roddy and Charles Cooper.
18 Carolyn, welcome.

19 MS. RODDY: Thank you, Jennifer. Good
20 afternoon, everyone, and welcome to this meeting
21 of the CSMAC. I'm pleased to meet with you and
22 want to thank you for your participation and

1 continued hard work as members of this
2 tremendously important advisory committee.

3 As the U.S. continues to advance its
4 global leadership in wireless technologies,
5 including 5G, satellite communications, and UAS
6 systems, it is vital for us to have your policy
7 expertise and technical advice as well as the
8 passion and energy you bring from the private and
9 non-profit sectors.

10 We live in a time of rapid technological
11 change, and we need you to remind us that
12 disruptive is not a bad thing when it refers to
13 bold innovation that leads to economic growth and
14 improved lives. Rural broadband, in all of its
15 forms, is one of my passions, and I am
16 particularly interested -- and I particularly
17 appreciate the work you are doing to eliminate the
18 digital divide.

19 Through the years, we have seen our
20 country's high-tech industries partner with our
21 outstanding research universities and institutions
22 and government agencies, including NTIA and the

1 FCC who set the pace for technological change.
2 CSMAC has played a key role in this legacy,
3 whether it's through past efforts on technical
4 aspects of spectrum sharing arrangements or
5 current work to discern how we can improve our
6 spectrum governance practices.

7 This committee has exemplified the best
8 traditions of hard work, technical rigor, and
9 commitment to the spectrum community and good
10 public policy. 2020 was an eventful year in which
11 we made real progress in responding to the need to
12 provide greater access to spectrum resources for
13 5G, particularly in the mid-band ranges.

14 Charles Cooper will give the full NTIA
15 spectrum update a bit later, but we can point to a
16 successful auction of CBRS licenses last summer.
17 The agreement to open up the 3450 to 3550
18 megahertz band (interruption). There is more work
19 to do to follow up and implement these
20 developments. And, NTIA, through both the Office
21 of Spectrum Management and the Institute for
22 Telecommunication Sciences in Boulder, Colorado,

1 will continue to fully support these ongoing
2 transitions as they proceed.

3 As 2121 opens, though, I definitely
4 think we can look forward a bit. As a group,
5 CSMAC is rounding third on its current slate of
6 study questions, and I'll look forward to hearing
7 the subcommittee updates today. It's not too
8 soon, though, to be thinking about what NTIA can
9 do on its own or in partnership with the FCC and
10 other federal agencies to further push the
11 envelope on Spectrum Management innovation.

12 There are possibilities for more
13 automated Spectrum Management tools and
14 techniques, such as the Incumbent Informing
15 Capability (ICC), that NTIA is working to develop
16 for time-based spectrum sharing with federal
17 incumbents. NTIA has an IT modernization plan to
18 address many of our core processes, some of which
19 have remained unchanged since the 1980s, including
20 improving automation security and reliability and
21 increasing spectrum efficiency.

22 We also need to ask questions. What

1 knowledge gaps can we identify? What tools do we
2 need to develop? What are our research
3 priorities? I know the CSMAC, once it is
4 reconstituted, will work with Charles and his
5 staff at OSM to prepare new study questions over
6 the coming year. I want to encourage you as CSMAC
7 members, and really all of us inside and outside
8 of government, not to overlook the power of
9 collaboration and communication to address
10 challenges and resolve problems.

11 This committee represents both a history
12 of doing that and a promise for more to come.
13 Whether we work in government, business, or the
14 non-profit sector, we all have a part to play in
15 harnessing the best this country has to offer,
16 which, after all, has always been the best the
17 world has ever seen. So, in that spirit, let me
18 thank you for allowing me to be here. Best wishes
19 and good luck in continuing your important work
20 today and in the months to come. And, thank you,
21 again, for your leadership and participation in
22 this effort.

1 MS. WARREN: Charles, were you going to
2 say something? Sorry, I just wanted to say thank
3 you very much for those words and the trust that
4 you're showing in us, and I appreciate your
5 facilitating our having this meeting in early
6 January so we could have an opportunity,
7 particularly on the important topic of UAS, to do
8 the draft report and still have time for our final
9 meeting to vote on it and have a final ready,
10 consistent with our normal processes. So, thank
11 you very much on that.

12 And, I think you touched on something
13 that Charla and I both see in all of the members,
14 which is the passion. There's a lot of passion.
15 You'll see that from -- when you see the reports
16 from the subcommittees on the level of membership
17 engagement. So, with that, I think Charla -- I'm
18 turning it over to you for the fun part of this.

19 MS. RATH: Yes. Thank you. But, before
20 I move to roll call, I did want to say one more
21 thing, which -- now, David Reid is retired, and
22 Antonio Richardson had stepped in the breach here

1 as Designated Federal Officer. But, you know, I
2 know David's not here to see it. He had the nerve
3 to retire in between meetings. But, we really do
4 appreciate everything he's done in the last few
5 years, and he was terrific in that role.

6 And, Antonio, thanks so much for
7 stepping in and, as Jennifer said, making it
8 happen in early January, which was a specific
9 request of ours, so that the UAS subcommittee
10 would have time to actually, you know, complete
11 their report, so. And, I couldn't agree more with
12 Jennifer on, you know, the enthusiasm of both the
13 CSMAC members as well as the government employees
14 who've been assigned to work with each one of the
15 -- each one of the subcommittees.

16 So, with that, I think this time I will
17 have a fairly easy roll call. Let's hope. So,
18 just, I'll say your name and just, you know, like
19 we can see each other, but if you would just say
20 I'm here, if you are. Claude Aiken.

21 MR. AIKEN: Here.

22 MS. RATH: Audrey Allison.

1 MS. ALLISON: I'm here.

2 MS. RATH: Donna Murphy.

3 MS. MURPHY: Oh, I'm here.

4 MS. RATH: Yeah, because I saw you
5 earlier.

6 MS. MURPHY: Yes, I'm here.

7 MS. RATH: Mary Brown.

8 MS. BROWN: Here.

9 MS. RATH: Michael Calabrese.

10 MR. CALABRESE: I'm here.

11 MS. RATH: Jeff Cohen. I don't think he
12 was going to be here. But, are you here, Jeff?

13 (No audible response.) Mark Crosby?

14 MR. CROSBY:: Here.

15 MS. RATH: Tom Dombrowsky? Mark Gibson?

16 MR. GIBSON: Here.

17 MS. RATH: Dale Hatfield? (No audible
18 response.) I know I saw Dale here a minute ago.

19 MR. CROSBY:: He's on. He said here. I
20 don't think he has his audio on.

21 MS. RATH: Oh, okay. Thanks. I
22 appreciate it, Mark. Carolyn Kahn?

1 MS. KAHN: Here.

2 MS. RATH: Paul Kolodzy? (No audible
3 response.) I don't know whether you heard that.
4 Paul Kolodzy? (No audible response.) Mark
5 Lewellen?

6 MR. LEWELLEN: Here.

7 MS. RATH: Jennifer Manner?

8 MS. MANNER: Here.

9 MS. RATH: Mark McHenry? (No audible
10 response.) I thought I saw Mark. Yeah, he was
11 here a minute ago. Mark McHenry? (No audible
12 response.) I'll give him another chance. Wayne
13 Phoel?

14 MR. PHOEL: Here.

15 MS. RATH: Carl Povelites?

16 MR. POVELITES: Here.

17 MS. RATH: Ruth Pritchard-Kelly?

18 MS. PRITCHARD-KELLY: Here.

19 MS. RATH: Mark Racek?

20 MR. RACEK: Hello. Here.

21 MS. RATH: Charla Rath. Dennis
22 Roberson?

1 MR. ROBERSON: Pleasure to be with you.

2 MS. RATH: Andy Roy?

3 MR. ROY: Here.

4 MS. RATH: Kurt Schaubach? I think he
5 called and said he wasn't going to be able to make
6 it. Steve Sharkey?

7 MR. SHARKEY: Here.

8 MS. RATH: Mariam Sorond?

9 MS. SOROND: Hi. I'm here.

10 MS. RATH: Bryan Tramont?

11 MR. TRAMONT: Enthusiastically present.

12 MS. RATH: Excellent. Jennifer Warren?

13 MS. WARREN: Here.

14 MS. RATH: Chris Weasler?

15 MR. WEASLER: Hi, Charla. I'm here.

16 MS. RATH: And, Bob Weller.

17 MR. WELLER: Hi, Charla. I'm here.

18 Good afternoon.

19 MS. RATH: Good afternoon. Great.

20 We've got a pretty full group here. Thank you

21 very much. And, that was way easier than the

22 first time we did it. So, on that note, Jennifer,

1 let's you have something else to say. I was going
2 to turn it over to Charles for his spectrum policy
3 update.

4 MS. WARREN: Charla, did you want us to
5 go over some of the logistics about how to
6 proceed?

7 MS. RATH: Oh. Yeah, thank you. Yeah,
8 thanks for the reminder. Just a reminder to
9 everyone, that Jennifer and I can't see the
10 hand-raising function. So, once we, you know,
11 start with the various reports, and if you want to
12 speak, the equivalent of raising your hand is to
13 just put it in the chat. Say I'd like to speak.
14 No need to put the question in there. Don't
15 bother taking the time to write it out. Just put
16 yourself in there, and Jennifer and I will keep an
17 eye on it. And, that'll be your way to sort of
18 track through.

19 Otherwise, Jennifer, is there anything
20 else I'm missing?

21 MS. WARREN: No, other than just
22 requesting that everybody stay on mute until the

1 time that you have questions and we call on you.
2 Thank you.

3 MS. RATH: Great. Thanks. Thanks for
4 the reminder. All right. Over to you Charles.

5 MR. COOPER: Well, great. Thanks,
6 Charla, and special thanks to Carolyn Roddy for
7 joining us here today and providing the opening
8 remarks. My role here this afternoon is to
9 present the first spectrum update for 2021 as a
10 way of setting the stage for following working
11 group discussions. Because the new year is, you
12 know, kind of only a couple of weeks young, this
13 will be partly a review of 2020 and partly a way
14 to look forward to the opportunities we have in
15 the coming year.

16 All in all, we had a pretty good,
17 productive year in the spectrum community in 2020,
18 despite the ongoing challenges with working
19 remotely, which many of us continue to do so. We
20 saw several milestones in efforts to make
21 additional spectrum available for 5G wireless
22 services, particularly in the 3 GHz midband. Here

1 at NTIA, we made some key decisions with regard to
2 developing our tools for more automated spectrum
3 management, such as the Incumbent Informing
4 Capability. We also saw legislative developments
5 just in the past few weeks that could help advance
6 our IT modernization plans.

7 Let's begin with the headlines. As we
8 speak, the FCC C-band auction of licenses in the
9 3.7-3.9 GHz band has set new records for spectrum
10 auction, with bids exceeding 80 billion thus far.
11 Kudos to the commission for this outstanding
12 result and to everyone in government and the
13 private sector whose spade work has enabled this
14 auction to go forward.

15 The current auction comes on the heels
16 of last summer's auction of the priority access
17 licenses, the PALs, and the 3550 to 3650 subpart
18 of the Citizens Broadband Radio Service. That
19 auction netted just over 4.5 billion through the
20 awarding of more than 20,000 licenses to some 228
21 winning bidders. The PAL licensing followed the
22 opening of that band of license by rural users at

1 the beginning of last year.

2 NTIA continues to work with the
3 commission and industry groups to assist in the
4 introduction of the CBRS operations in the dynamic
5 protection areas where they are sharing that band
6 with federal government radars. Meanwhile, work
7 to follow up on the AMBIT agreement to repurpose
8 3450 to 3550 MHz is progressing.

9 Given the accelerated work on the
10 Department of Defense, the FCC, and the NTIA,
11 Congress was able to set a deadline of this year
12 in the recently enacted \$1.4 trillion FY21
13 Appropriations Bill to auction that band.

14 We continue to work with DoD and the
15 commission on defining the coordination mechanisms
16 for sharing this band, and we will also need to
17 complete, and the technical panel approved,
18 transition plans under the Commercial Spectrum
19 Enhancement Act. I will also note in passing that
20 the FCC is making preparations for an auction of
21 the spectrum at 2.5 GHz band, and it is addressing
22 proposals in the 12 GHz band as well.

1 Also, we are continuing to work toward
2 finalizing a framework for federal -- non-federal
3 sharing in the 37 GHz band. Discussions with,
4 again, DoD, FCC, and NTIA have been proceeding on
5 two tracks, one technical, led by OSM Spectrum
6 Engineering & Analysis Division, and the other
7 policy-focused. Looking forward, we certainly
8 have our work cut out for us in helping bring
9 about these repurposing efforts to their
10 conclusions to the transition planning and
11 implementation, which you know is a detailed and
12 very time-consuming process.

13 We will also continue to oversee current
14 steady efforts, such as the 1300 to 1350 Sitzer
15 (phonetic) program as well as further work in
16 other spectrum bands. Meanwhile, the second
17 annual report on the status of repurposing
18 initiatives has been completed and is now publicly
19 available at our NTIA website. Report indicates
20 that within the midrange, 1130.5 MHz of spectrum
21 has been made available to support 5G.

22 In the report, we are also taking this

1 opportunity to help define low-band, mid, and high
2 bands. So, we're defining low-band spectrum as
3 frequencies up to 1 GHz, mid-band spectrum between
4 1 to 10 GHz, and high-band spectrum in the bands
5 above 10 GHz. Some 7513 MHz of spectrum has been
6 made available for wireless services across all
7 the bands.

8 And, I think it's appropriate as well to
9 hover just a second over the track record and to
10 note that it could not have been achieved without
11 the cooperation and collaboration between the
12 co-regulators, NTIA and FCC, along with the
13 federal agencies and industry groups. This model
14 may take some work out at times, but we are
15 confident that it leads to the best outcomes.

16 We're continuing to develop the
17 Incumbent Informing Capability (IIC), which we
18 will think will be important when advancing the
19 dynamic framework in the CBRS and eventually other
20 bands. The IIC rolled out the time and
21 location-based sharing, a new and innovative way
22 to collaboratively and dynamically increase

1 opportunistic spectrum access to allocations
2 principally used by the federal government.

3 The IIC is a mechanism for more reliably
4 informing new operations while incumbent systems
5 are operating in close proximity (inaudible)
6 spectrum bands and need to be avoided at any
7 particular time and place. The IIC might first be
8 implemented in selected geographic locations in
9 the 3 GHz range and expanded to other shared bands
10 to enable more dynamic sharing. I'm pleased to
11 report as well that NTIA will be presenting a
12 paper on this at the upcoming TPRC48 conference to
13 be held in February.

14 We also continue to advance our IT
15 modernization program and that effort to obtain
16 congressional appropriations to fund this effort.
17 The program is extremely critical, whereas Carolyn
18 noted some of the systems have not been touched
19 since the '80s. And, that's important not only to
20 NTIA but overall our collective ability to manage
21 spectrum effectively and efficiently. It is
22 linked to efforts to roll out dynamic spectrum

1 access as well as sharing solutions that we can
2 implement with more confidence and less delay.

3 Congress, in a recently acted National
4 Defense Authorization Act, the NDAA, has helped
5 out, directing NTIA to help develop a plan to
6 modernize our spectrum management information
7 technology systems. The bills include a
8 time-based automation mechanism to share federal
9 spectrum between covered agencies to
10 collaboratively and dynamically increase access to
11 federal spectrum.

12 So, this bill does have some pretty
13 tight deadlines on NTIA. By the end of March, the
14 NTIA, working through its Policy and Plans
15 Steering Group, the PPSG, will identify a process
16 to establish goals from modernizing the
17 infrastructure related to federal spectrum
18 management.

19 And, then by August, later on this year,
20 NTIA will have to submit to Congress our plan to
21 modernize an automated infrastructure related to
22 managing federal spectrum use. The report will

1 include an assessment of the current
2 infrastructure, an acquisition strategy, timeline,
3 plans for security, reliability, automation, and
4 workflows. So, before turning it over to the
5 co-chairs, I would like to address some
6 bookkeeping housekeeping matters. As you know, we
7 will hear today from the working groups on
8 questions 1 and 4 which will address spectrum
9 management governance and unmanned aviation
10 systems. I believe Subcommittee 1 will submit a
11 final report and recommendations this afternoon,
12 and there will be a bit more work for Subcommittee
13 4 to finalize the report. Subcommittees 2 and 3
14 have also -- have actually completed their work
15 and submitted their reports. I would like to
16 thank them for doing that. So, in particular,
17 Subcommittee 2's final report on future spectrum
18 requirements of non-federal users along with its
19 recommendations was submitted last July and it's
20 available on the CSMAC webpage. Similarly, the
21 Subcommittee 3 final report on unique identifiers
22 for interference, prevention, detection, and

1 mitigation was also presented this last July and
2 it's available on the same website.

3 This means we're nearing the conclusion
4 of the current term of CSMAC. I'd like to
5 congratulate everyone for tackling these questions
6 in a creative and thorough manner. Your
7 recommendations will be extremely valuable to us,
8 and I look forward to hearing the Subcommittee 1
9 and 4 reports as the meeting progresses.

10 Looking forward, as we begin to process
11 the reconstituting CSMAC for its next term, I'm
12 sure many of you will be joining us again along
13 with some new members, and we will look forward to
14 developing another set of questions for your
15 guidance and advice. For those of you who may be
16 stepping down after the session, we want to thank
17 you for your service and contributions to CSMAC
18 and NTIA, which have been tremendously valuable.

19 Please look for information and guidance
20 from Antonio Richardson who's on our OSM staff
21 regarding the timing and procedures for seeking
22 renewed membership on CSMAC. We also welcome

1 Antonio as the new IRAC Designated Federal
2 Officer, since Dave Reed has retired. So now,
3 without further ado, back to our co-chairs.

4 MS. WARREN: Thank you, Charles.

5 MS. RATH: Thanks, Charles.

6 MS. WARREN: Would you entertain any
7 questions, or should we proceed to the report?

8 MR. COOPER: Happy to take any
9 questions.

10 MS. WARREN: Okay. Let me just see if
11 -- and this is just from the CSMAC members, just
12 to be clear. Are there any questions from the
13 CSMAC members before we move to the report? I see
14 Mark Gibson.

15 MR. GIBSON: Thanks, Jennifer, and
16 thanks everybody. Thanks, Charles, for that
17 report. You probably can get my questions around
18 the IIC. And, it's more just a question around --
19 just please keep in mind as you're working on
20 that, whatever industry can do to help and support
21 that, please just keep in mind, if you need help
22 gathering use cases or interacting with us or

1 whatever -- and actually I'm not going to speak
2 for all of industry or for that matter even for
3 CSMAC.

4 But, though it's a heavy lift on your
5 part and, you know, we've talked about it and, you
6 know, there's a lot of work to be done, so -- but
7 we think that at least, you know, within my
8 sphere, that it's probably the key to a lot --
9 opening up a lot of spectrum instead of using, you
10 know, the sensor approach. So, you know, if
11 there's anything that we can do as industry to
12 help with that, just, you know, please keep us in
13 mind and put us to work. Thank you.

14 MR. COOPER: Yes. Thank you so much for
15 your comment on those, Mark. And, furthermore, in
16 the FCC proceeding actually on 3450 to 3550, there
17 were actually a lot of commenters in support of
18 our IIC. So, that was encouraging. So, we'll
19 certainly keep industry advised and as close as
20 possible in the effort.

21 MS. WARREN: Anybody else? If not, we
22 will move to -- I see nothing in the chat, and I

1 don't see hands waving. So, why don't we then
2 thank you, again, Charles, for -- unless, Charla,
3 you had a question. I saw you were maybe going to
4 say something.

5 MS. RATH: No, I just was going to say
6 the same thing. Thanks.

7 MS. WARREN: So, with that, I'd like to
8 turn to Working Group 1 who -- actually, this is
9 their second task. They completed their first
10 report, and then, always ready for more work,
11 Jennifer Manner and Mary Brown agreed to take on
12 this second task of looking at the question of an
13 MOU. And, with that, I am going to turn it over
14 to Mary who, I believe, will kick us off. But,
15 Mary, Jennifer, the floor's yours. Thank you.

16 MS. BROWN: Yes. Thank you very much.
17 I'm Mary Brown, and I hope you all can see my
18 screen which should show our high-level summary of
19 our report. But, before I get into an
20 introduction of this and then turn it over to
21 Jennifer, I just want to take a 15-second pause to
22 say thank you to my co-chair Jennifer Manner, to

1 the committee members, and especially to the NTIA
2 staff, Antonio Richardson, Chris Mattingly, and
3 even though he's in retirement, Dave Reed. These
4 guys really helped when we had questions about
5 NTIA process, and we so much appreciated your
6 ability to get to answers quickly and keep us on
7 track. So, thank you.

8 And, to my fellow committee members,
9 thank you also for your hard work, your attendance
10 and engagement in all of our meetings, and for
11 bringing your very deep understanding of spectrum
12 governance issues to this table. You are an
13 impressive group and I learned a lot from you in
14 the past 2 years.

15 So, with that, let me introduce the
16 topic. This is Working Group 1, and we were
17 looking at questions around spectrum's governance
18 of decision-making. How do we make decisions on
19 spectrum utilization and is the process serving us
20 well? And, of course, no surprise, never before
21 has spectrum been so important to every user
22 community, and it's no surprise that among the

1 user communities, there are often differences of
2 opinion on any number of topics.

3 So, in this phase of our work, we were
4 focused on a 15-year-old memorandum of
5 understanding between NTIA and the FCC, where they
6 would meet periodically to discuss the spectrum
7 agenda and whether or not that memorandum of
8 understanding could or should be revised and how.

9 And, what I think we concluded -- and
10 this is sort of my interpretation at a high level
11 -- Jennifer will take you through the specifics --
12 is, while the existing memorandum of understanding
13 promotes coordination between the agencies, and
14 while that goal is laudable, we were searching for
15 ways to revise the memorandum in such a way that
16 it promotes collaboration, greater collaboration,
17 and includes mutual understanding between the
18 agencies, because that's an even better outcome
19 than just coordination.

20 And, I think you will see that in the
21 recommendations that the working group is bringing
22 forward. So, we have presented a marked-up

1 version of the memorandum of understanding that we
2 are recommending for consideration, and what we
3 are reviewing here is just a summary report at a
4 high level. So, Jennifer, let me turn it over to
5 you to take us through what the group recommended.

6 MS. MANNER: Thank you, Mary, and
7 thanks, everyone. So, just walking through the
8 reforms, just building on what Mary said was, part
9 of what we also wanted to do was modernize the
10 MOU, just because spectrum management's even
11 changed dramatically over the time.

12 So, one of our first areas we focused on
13 was to expand the overall areas that are being
14 looked at, to include economic national security,
15 safety, and otherwise, because there's a number of
16 areas that spectrum has managed, and I think
17 either things that were, you know, kind of
18 included but more generalized, we thought having
19 specific references were (inaudible).

20 The other areas that we felt were
21 important -- one was spectrum planning, which, of
22 course, has always been important, but also

1 specifically bringing out sharing. Spectrum
2 sharing, as everyone here knows, is something
3 that's so important today and have that explicit
4 in the MOU -- we thought was critically and
5 important as well as international issues,
6 especially those regarding the (inaudible). And,
7 with the increasing role of standards, we also
8 felt that standards issues as they relate to
9 spectrum should also be encompassed within the
10 coordination between NTIA and then the FCC. So,
11 that was an important area.

12 The other issue was, we were trying to
13 think of ways to improve, and one of the ways we
14 thought was actually establishing the heads of the
15 (inaudible) and NTIA spectrum management group to
16 meet in advance of every principal's meeting.
17 And, so that would force them to determine what
18 the agenda was and really increases and clarifies
19 a timeframe for review of routine and not routine
20 items.

21 We also thought something else that
22 would really help -- and this goes to Mary's

1 discussion notes, increasing coordination and
2 understanding -- was to create a standing working
3 group on spectrum planning and initiatives, and
4 this would include things such as the development
5 of a common set of metrics and best practices.
6 And, that would better assist them with projects
7 -- the potential for interference.

8 One area we were -- everyone had
9 discussed previously, we were not allowed to make
10 legislative recommendations or the recommendations
11 that would require legislative changes. But, one
12 area we spent some time on is what happens if the
13 FCC and NTIA can't do something? So, we did note
14 in the document that FCC and NTIA should consider
15 creating a joint path for escalation of issues
16 that could be taken, really, on a timely basis.

17 And, then finally, we included a 3-year
18 review period for the MOU. There was no review
19 period beforehand in the MOU, so it's probably
20 part of the reason it hasn't been updated. We
21 didn't want something too frequent, but we thought
22 it was important that if we looked at every -- you

1 know, every 3 years or so and just get a review
2 and make sure it's up to date.

3 I just want to join in thanking our
4 committee members and me personally thanking
5 mainly my co-chair, the staff from NTIA who
6 supported us, and, really, the entire CSMAC. We
7 had, as you'll see below, maybe you can move the
8 committee list to see who is in our group -- but
9 we really did have a wide variety of experts.

10 And, we had really great discussions on
11 a regular basis. You know, I think we met pretty
12 much every 2 weeks, if not more, to address these.
13 And, folks in our group did a tremendous amount of
14 work on both on the call and between calls. So,
15 I'd like to join with Mary in thanking everyone.
16 And, we're happy to take any questions. Thank you
17 so much.

18 MS. WARREN: Thank you, Jennifer. So,
19 the list that you showed of all the participants
20 means there's a good deal of familiarity with this
21 report, and so there should not be a lot of
22 surprises, but there still may be areas that folks

1 would like to discuss or ask questions about. Let
2 me just throw it open in case that is the
3 situation.

4 I see no chat and I see no waving of
5 hands. And, I think that's a testament to the
6 kind of inclusive, deliberative process that you
7 and Mary ran, which really did allow for everyone
8 to engage and debate and we could see the product,
9 and the fact that people are comfortable with it
10 as- is with things. So, that is great.

11 I think we would then process-wise move
12 to a vote to approve this report as submitted.
13 And, let me ask if there -- see if we can do this
14 by acclimation, and just ask if there are -- if
15 there is any opposition. Otherwise, we can have
16 it by acclimation. (No audible response.) Okay.
17 Just making sure nobody's got a mute problem.
18 Great. So, Jennifer, Mary, thank you. This has
19 been approved by acclimation and it will now go
20 forward as formal recommendations and report to
21 NTIA. Thank you very much.

22 And, I want to echo the support of the

1 NTIA liaison, Chris Mattingly. I cannot tell you
2 how many times we asked for -- could you check on
3 this? Could you check on that? Without batting
4 an eye, she came back very quickly with answers.
5 So, I think that also has really helped smooth the
6 process. I also just want to make sure you're
7 aware of how your team supported this. Yeah.
8 Charla?

9 MS. RATH: Okay. Great. Thanks so
10 much. And, I also want to echo everything said
11 here. You know, this subcommittee, this is your
12 last report. You've been one of the more
13 controversial subcommittees. We seem to get a lot
14 of questions on what you recommend, but it is an
15 important subject, and I appreciate all the work
16 that you and your team, NTIA, and everybody has
17 put into this. So, again, thanks.

18 Moving on to our last subcommittee on
19 unmanned aircraft, I want to turn it over first to
20 Carolyn Kahn, and then Andy Roy will also talk
21 about it. I do want to say here, too, that this
22 committee has really done an incredible amount of

1 work, and I think, you know, it certainly shows in
2 the draft report.

3 We won't be taking a vote on it today,
4 but it is -- you know, it is a very good, clear
5 assessment of the work of the committee. And, you
6 know, I think both subcommittees served a great
7 job of, you know, keeping people on track and
8 really, you know, managing what is a fairly
9 complicated topic. So, thank you for that. And,
10 over to you, Carolyn.

11 MS. KAHN: Okay. Great, Charla. So,
12 the committees presenting our draft report at this
13 meeting, and Andy and I will be summarizing our
14 findings and recommendations in going through that
15 update with you, so. Here, this is our
16 subcommittee numbers, and, like we've said before,
17 I thank everyone, and Andy.

18 I thank my co-co-chair (phonetic), and
19 we both thank all of the subcommittee members as
20 well as our NTIA liaisons for supporting this
21 effort and offering the different perspectives
22 from the subcommittee members across the different

1 sectors of the telecom industry. And, NKA, I
2 appreciate your help, both Dave Reed, before his
3 retirement, Rich Orslak and also Antonio
4 Richardson who helped with the whole transition.
5 So, thank you all.

6 So, this is our -- the questions that we
7 have from our subcommittee, and, essentially,
8 they're asking what our appropriate model for
9 spectrum access for UAS, what our important
10 governance characteristics, are there liability
11 issues to consider, which is all encompassed in
12 Part B.

13 Part A provides some background. And,
14 then, Part C gets at is there a need for creative
15 entities to collaborate across the different
16 federal advisory committees on UAS, and how could
17 such an entity be structured.

18 So, we focused on control operations,
19 where CMTC control and non-cabled communications
20 on that link, looking at spectrum access options,
21 looking for UAS, and, again, with the intention of
22 providing value add to other work that's going on

1 in the UAS.

2 So, our approach, we had initiated a
3 two-tiered approach, which is first to look at the
4 different spectrum access for UAS, so we
5 identified different potential models and
6 solutions for that, looking across into different
7 bands, so up some bands, and then looking at
8 potential solutions that could meet some or all of
9 these different requirements.

10 We look at the spectrum access models in
11 terms of different technology options. Some
12 examples of the models, possible UAS types that
13 they could be better suited for or more tailored
14 to potential evolutions as well as advantages and
15 disadvantages, other observations, and then looked
16 across the state of the UAS environment and the
17 different federal advisory and also other
18 committees that are doing work in the UAS area,
19 so, looking at kind of those activities, the
20 current and recent activities, and we conducted
21 outreach, including interviews and some other
22 types of exchanges with organizations to obtain

1 additional supplementary information.

2 So, our schedule, again, the CSMAC as a
3 whole had a good start, so our subcommittee kicked
4 off in January, so, gosh, almost a year ago. So,
5 we focused on doing kind of the landscape view,
6 conducting interviews, then analyzing the
7 information to develop our draft report and
8 iterating on it -- so, how we conduct it, how we
9 kind of worked as we met on -- about every 2
10 weeks, so on a regular basis, a lot of dialogue
11 interactions, and some dialogue outside of the
12 meetings, and, of course, the outreach as well, so
13 then also had provided some updates at the
14 previous fall CSMAC meetings.

15 So, some background. So, UAS is unique.
16 The second requirements differ from other types of
17 wireless and spectrum types of applications.

18 (inaudible) of really complex
19 environment, safety of flight,
20 safety of (inaudible). These are
21 really critical issues that need to
22 be navigated in a safe manner.

1 There are so many different types of
2 UAS, from small UAS, under 55 pounds, larger UAS.
3 So, looking at all of these different types of
4 systems as well as (inaudible), the sheer scale in
5 differences from, you know, is another complexity
6 in the UAS area, different altitudes, so a lot of
7 complexities. So, that was the reason to focus on
8 the UAS.

9 And, then, in particular, regulatory
10 structures and infrastructure is needed to support
11 the safe growth of UAS. It is an economic
12 opportunity, but also really needs to be done in a
13 safe manner. Safety is critical, and how it's
14 integrated into the NAS is critical. And, so,
15 looking at this policy and technical challenges
16 was important. So, that just provides some
17 background. I will pass it over to Andy to
18 continue.

19 MR. ROY: Great. Thank you, Carolyn.
20 And, just to add to your comments earlier about
21 the support from the subcommittee, we really do
22 appreciate the input and the breadth of experience

1 that was put into this report and the work that
2 we've got to at this stage.

3 So, I want to discuss the spectrum
4 access models, but I would like to reiterate from
5 Carolyn's comment there about the complexity of
6 the UAS environments. It is really -- to say
7 varies is an understatement. Manned aviation at
8 the moment goes from small private aircraft and
9 small helicopters all the way up to -- you have
10 fixed commercial, flights that we -- well, at
11 least we used to fly regularly and hopefully we'll
12 return to soon -- but UAS extended that even
13 further.

14 We go down to sort of hobbies level and
15 other smaller UAS and drones, package delivery,
16 and then all the way through that stack up to
17 commercial, fixed-wing aircraft and even beyond
18 that as well, talk about several vehicles and
19 other aspects.

20 So, really, the significantly complex
21 environment with a very complex safety layer added
22 to the top of it as well, which certainly brings

1 all of challenges both in trying to comprehend and
2 then apply different models that would work to it.
3 So, if you could come onto the spectrum access
4 models, if you could.

5 So, what I'm going to discuss is fixed
6 models that were reviewed. I would say that we --
7 in describing this, this is more sort of
8 conceptual, I would say, on the spectrum access
9 models than knocked down to the extent of fully
10 defining exactly what it does, because there could
11 be multiple different options within each of these
12 different concepts as well. So, we've kept it at
13 a fairly high level.

14 There was a lot of discussion in the
15 group for the inputs and how these would be
16 defined and so forth. But, we've reached this
17 sort of endpoint here to make sure we weren't
18 going to start going down too many rabbit holes
19 and then be asking NTIA for an extra 5 years to
20 basically start developing stuff a little bit
21 further.

22 So, I'll cover off -- third-party

1 coordinator model, terrestrial commercial
2 wireless, commercial SATCOM, unlicensed, and then
3 spectrum access and band partitioning are slightly
4 different -- they're still access models, but they
5 look at some aspects of the other models as well
6 and how we may use them. So, the next slide,
7 please.

8 So, firstly, third-party coordinator.
9 So, what the group considered here was basically
10 an aviation spectrum expert would be a third-party
11 coordinator to act on behalf of the agency, FCC
12 and NTIA, to basically issue the necessary
13 authorization for those UAS command non-payload
14 communication links, we call them, sort of the C2
15 function, not sending back what you deemed to be
16 maybe video for a photography session or something
17 for the active links that are controlling what's
18 going on.

19 Each year (inaudible) self is obviously
20 a sign one or more frequencies are paying them the
21 necessary requirements for resilience and backup.
22 And, they've been using -- the process would use a

1 combination of automation and/or human in the
2 loops to develop and assign these frequencies as
3 required on behalf of FCC or NTIA. There are
4 similar models already in effect. The VHF plan at
5 the moment has third-party coordinator, and other
6 non-aviation bands also have third-party
7 coordinators, some of them multiple at the same
8 time. And, this report really doesn't address
9 that.

10 And, I should say, of course, I forgot
11 at the start is that the group does not express
12 any preference in the reports about which spectrum
13 access model would be suitable. All we point to
14 is certain UAS models that may be more appropriate
15 for each access model. But, we don't express a
16 preference as we go through.

17 So, in terms of the technology options
18 out there, there are certified UAS CNPC systems
19 already being developed that have received some FA
20 (phonetic) certification for those. And, as I
21 mentioned before, there are examples, but
22 currently, but also in those standards being

1 developed, there is also notes about what
2 frequency management organizations may be used as
3 a third-party coordinator.

4 Thirdly, this type of technology is more
5 aimed at the larger UAS types, for the higher
6 altitudes and obviously the necessary safety that
7 goes with that -- great thing into the
8 FA-controlled airspace.

9 And, then the group started thinking
10 about what could be looked as potentially
11 evolutions to these sort of systems as well and,
12 really, a significant level of automation could be
13 applied to this in combination with
14 pre-coordination of assignment criteria, which
15 would really allow for a very quick turnaround
16 potentially of the required spectrum authorization
17 going forward. Next slide, please.

18 So, there are several advantages and
19 disadvantages, and you'll see these for all the
20 models we're about to cover. I won't go through
21 every single one of these in depth, because we
22 will be here for a very long time, otherwise.

1 But, I'll give some highlights for each of the
2 sections as we go through.

3 So, certainly, for the third-party
4 coordinator, there is advantages through the model
5 used at the moment. And, in the process, it does
6 allow for a known and planned RF environment.
7 There's a lot of -- and analyzing the worst case
8 -- it is done to provide slack in the system in
9 case the aviation environment changes, which
10 obviously does, given whether other issues as well
11 affecting flights.

12 However, on the other side of that as
13 well, applied to that worst case, is actually a
14 lot of unused spectrum, I would say, that goes in
15 there if you don't need to use that worst case if
16 the flight goes as planned or if there's not an
17 issue you need to account for, then there is some
18 element to that spectrum's less coverage that is
19 going unused even if it is there for a reason.
20 So, there's that sort of area.

21 And, obviously aviation certification
22 requirements that are looked at for these systems,

1 then creation of a whole new ground infrastructure
2 are certainly going to increase the cost of access
3 as well for this system to go forward. Next
4 slide, please.

5 Another option we were considering as
6 well was terrestrial commercial wireless networks.
7 You can probably imagine that 4G and 5G would be a
8 good example of this, using their existing study
9 on that works to provide the connectivity needed
10 within the wide-band channels they already have or
11 additional wide-band channels as well.

12 Obviously, the service is traditionally
13 exclusively licensed or shared in others depending
14 on the deployed network infrastructure. And,
15 obviously the spectrum access mechanism itself is
16 coordinated internally by the operators with the
17 network's time frequency access, automatically
18 controlled by the various systems they have as
19 well. There is obviously the national terrestrial
20 carrier networks, and at this point in time we
21 need its best optimized system or UAS, though
22 obviously that could expand as things start to

1 evolve, and there is obviously concurrent work on
2 activities at the moment for UAS development.

3 Essentially, evolution for that, I've
4 already touched on with the development of
5 UAS-specific protocols, but also the coverage as
6 well could be expanded, especially for U.S.
7 Altitude as well, to provide a more encompassing
8 system for UAS operations. Next slide, please.

9 On the advantages -- a real big
10 advantage -- the networks are primarily already
11 established and in operation, and that is a big
12 positive for the rollout that, in combination of
13 using global standards and existing roaming
14 agreements, it does allow an easier implementation
15 for the system to move forward and redundancy with
16 the multiple frequency bands that mobile systems
17 could use.

18 Or, the disadvantages, obviously the
19 systems are primarily aimed at coverage for users
20 on the ground and generally not moving that
21 quickly in relative terms. So, they may need to
22 be looking at, depending on current assessments,

1 about what could be used for expanding that
2 coverage to altitude and obviously faster-moving
3 assets such as aircraft.

4 And, obviously then, look at the
5 protocol. Traffic could be analyzed for sharing,
6 for prioritization and pre-emption for the
7 necessary transmission of UAS to control functions
8 and ensuring that access is guaranteed with
9 irrelevant quality of service. Next slide,
10 please.

11 On the commercial SATCOM side, we were
12 looking at one or more commercial SATCOM
13 providers, using their existing or future SATCOM
14 connectivity, and, really, their control
15 structure, again, similar to terrestrial wireless
16 that's obviously within our internal system, how
17 they allocate depending on the frequency bands and
18 the resources they have.

19 Obviously, those services can overlap,
20 giving very large coverage areas, especially for
21 some terrestrial services to achieve that,
22 especially for remote or oceanic regions which are

1 a key component obviously for aeronautical travel.
2 Obviously, at the moment, really, the nationwide
3 and global GS stationary satellites,
4 non-stationary, and a lot of different frequency
5 ranges to consider as well.

6 From those currently out there, there
7 are L-band services for air traffic control
8 already set aside with the aviation safety
9 allocations to SATCOM and the (inaudible), too.
10 And, then as we move up in the frequency, we have
11 the Ku and Ka SATCOM use of passenger services on
12 aircraft, but also they are used by military for
13 current UAS command and control usage as well.

14 Really, as you imagine with these sort
15 of types of systems, they are primarily in the
16 larger platforms, flying at altitudes above the
17 tree line and set in the oceanic and remote areas
18 and FAA-integrated airspace. Evolution of this is
19 fairly encompassing but development of smaller
20 antennas could support smaller UAS that allow a
21 greater option range for the distant UAS mission
22 types going forward. Next slide, please.

1 So, commercial SATCOM, as we've
2 discussed, a real advantage there is going to be
3 the coverage they provide. It really does allow,
4 especially for a wide-ranging UAS mission type a
5 little easier access to the relevant CMP ceilings
6 going forward, and also UAS using SATCOM systems
7 at the moment as well to operate fairly
8 successfully. And, there is obviously discussions
9 at the ITU now for the fixed satellite service for
10 UAS to want to control.

11 On the disadvantages, it is less robust
12 in urban areas. For example, open canyons that
13 could be a consideration. And, as with other
14 technologies, although SATCOM does have a lot of
15 Ku/Ka SATCOM, there is a susceptibility to rain
16 fade as well, which is a consideration in UAS
17 mission finding (phonetic). Next slide, please.

18 On your license side, really you would
19 expect all devices are operating equally, with no
20 regulatory guarantee of access, and they're using
21 their individual capabilities to overcome
22 interference as best they can do. Obviously,

1 license rules will vary depending on the band and
2 the purpose, and you're not really certifying the
3 individual in the sense of the device operation.
4 It's all done through a device before it's given
5 to the individual to operate, and there's a
6 license bands (phonetic).

7 Technology options, the main ones, Wi-Fi
8 and Bluetooth, but there are some technologies
9 that are obviously available as well. And, the
10 existing examples, UAS and the model aircraft used
11 for recreational uses -- some of you may have got
12 a drone for Christmas, as they're quite prevalent
13 now. And, if you did get one with my aviation hat
14 on, please do follow all FAA rules to make sure
15 you're safely flying those throughout the year.

16 On the possible UAS types, these are
17 very much, as you'd imagine, small UAS flying
18 locally, low population density and for non-safety
19 critical data as well, given the relevant
20 limitations on a license. On the evolution side,
21 one of the options we considered in the group was
22 maybe expanding the policy and logic to more of a

1 centralized database system to adjust system
2 behaviors, performance, and enforcement measures
3 as needed to try and support and develop the
4 system further for greater usage potentially.

5 Next slide, please.

6 I know the advantage is -- the main
7 thing for a license, obviously low cost of access
8 and a technical barrier to entry is very low as
9 well. So, it does allow a very much mass
10 adoption. They are comparatively very efficient.
11 They've got to try and squeeze as much use out of
12 those than they can do. And, by their nature,
13 they're quite robust. They're going to be looking
14 to try and overcome assignments and interference,
15 because that's their very nature.

16 At the same time, at a big disadvantage
17 for a license, there's no regulatory guarantee of
18 access. It must be done purely by system design
19 and planning. And, given their ability in the
20 bands, that does have a consideration to
21 safety-critical data, and other points are
22 unlicensed devices to UAS. Next slide, please.

1 And, then moving onto the last two.
2 Dynamic spectrum access. So, that's sort of an
3 element that combines some of the other spectrum
4 access models the report talks to, where the
5 radios themselves looking for available spectrum,
6 each add more (inaudible), trying to independently
7 decide what's going on based on what it's seeing
8 from the RF usage. (inaudible) license or a
9 license, depending on what's needed, and it could
10 be combined where the assignment's through a
11 third-party coordinator or other matters and also
12 secondary usage and availability with this model
13 as well, acting as an overlay to existing
14 communications technology.

15 CBRS, and if I could get CFS to give
16 examples of what this could be or what it could
17 apply to, and certainly the UAS tried to give it
18 its more dynamic nature, emergency operations, use
19 and undeveloped regions, and potentially there's a
20 large amount of congestion, this can support that
21 as well.

22 And, again, the group looked at what

1 evolutions this can include, including additional
2 core policy and logic from just behaviors,
3 securing and enforcement as needed as well, and,
4 if possible, augmenting through sensing, about to
5 be collected as well by the central system to
6 provide a better RF picture for UASs that are
7 traversing through the airspace. Next slide,
8 please.

9 On the advantage, obviously it's trying
10 to seek its most efficient means in the radio as
11 possible to use the RF usage could have a
12 significant benefit there. But, it does obviously
13 increase radio complexity, especially with the
14 same functions we talked about as well. So, that
15 could be a barrier to adoption.

16 And, last access model, please. Next
17 slide. Band partitioning. Excuse me. So,
18 really, this is looking at how we could probably
19 share different access models in the same
20 spectrum. It could even achieve great frequency
21 or even physical separation, depending on what the
22 requirements are, and that could also be a dynamic

1 role as well.

2 There was an example, which the group is
3 looking at, in Europe. They can look at the
4 C-band and potentially splitting that to SATCOM
5 and terrestrial usage at the same time. And, we
6 understand that proposal is now being potentially
7 withdrawn. We're waiting for more details. And,
8 if we do have some for (inaudible), we would
9 obviously bring that up as well.

10 But, definitely, multi-role mission UAS
11 types would probably benefit from this, if
12 available. And, as I mentioned before, dynamic
13 partitioning could even provide greater efficiency
14 through the spectrum, but, given the information
15 the group has, we definitely, certainly feel
16 additional studies would be warranted, especially
17 for this spectrum access model if it went forward.
18 Next slide, please.

19 And, so, on the advantages, obviously
20 partitioning allows a bit more dynamic use with
21 the different system requirements could be more
22 robust to how it wants to operate. However, the

1 additional filters add to the complexitivity
2 (phonetic), but as well could have significant
3 inefficiencies, which, again, would be a barrier
4 to the adoption going forward. Next slide,
5 please.

6 So, it's under the findings for spectrum
7 access models. As you can see, there are multiple
8 access models, depending on what the UAS mission
9 requirement are, and they are significantly
10 varied. Some of the group's very much strong
11 feeling was that, for a mature UAS ecosystem going
12 forward, we're going to be seeing multiple
13 overlapping approaches to spectrum access models
14 as it goes forward.

15 With different bands and different
16 technologies all being considered, obviously the
17 safety component is the key driver to a lot of how
18 these spectrum access models would operate. And,
19 so, both the requirements from the FAA on a
20 regulatory level but also whether safety spectrum
21 is needed or not would very much depend on that
22 mandate by the FAA on how they want certain

1 systems to operate depending on their mission
2 profile.

3 There is relative significant important
4 governance characteristics as well for the
5 spectrum access models. As we talked and hinted
6 several times already, safety assurance is key how
7 the spectrum access is prioritized. Enforcement,
8 not just for how the systems operate themselves
9 but also for external forces affecting those
10 control links to active aircraft.

11 Coordination, again, internally for
12 assignments but also externally where other users
13 in the spectrum that may need assistance
14 maintaining that link availability, and obviously
15 continuity during hand-offs as well.

16 Again, between different frequencies on
17 the same system but also if you are moving between
18 different spectrum access models, ensuring that
19 hand-off process is achievable all the way
20 through. And, lastly, contingency planning.
21 Nothing stays the same, especially at aviation,
22 and making sure these models handle that going

1 forward is certainly a key requirement.

2 One of the other aspects we also wanted
3 to bring up, given that the range is (inaudible)
4 the spectrum access requirements will evolve as
5 time will go on. And, the spectrum access model
6 should be flexible enough to accommodate those
7 different needs as UAS industry continues to
8 emerge and develop and mature as it goes forward.

9 Lastly, the third-part coordinator role
10 for this particular section. We think the
11 discussion in the report about there may be a
12 broadening of that role that could be considered,
13 less specific, more to assignments, but also,
14 given the multiple spectrum access models, there
15 is some discussion about whether that could help
16 with the transition between different spectrum
17 access models between the UAS transitions through
18 those different areas.

19 As mentioned at the start, there's also
20 a question of liability, and the report that's
21 talked to this, sort of at a fairly high level,
22 but, really, the main focus is going to be what

1 the FAA and FCC regulations are for liability.
2 That's going to be a key concern to ensure
3 compliance and therefore the liability for their
4 different operators, managers, and users of those
5 (inaudible) for the CNPC links to UAS. So, the
6 operators themselves, any service providers as
7 well providing that link, and obviously any
8 third-party coordinators are all going to meet to
9 ensure they're meeting those extra requirements to
10 avoid the liability concerns that are being
11 raised.

12 In discussing all these various issues
13 and the access models and the considerations and
14 so forth, there is a lot of parameters, as I'm
15 sure you could imagine, that FCC and NTIA are
16 going to need to incorporate into the UAS spectrum
17 models. And, really, there is an urgency the
18 group viewed on moving forward with this.

19 I mean, in the time we started since
20 start of last year, the FAA has been issuing out
21 new reports and orders for how to do things such
22 as remote ID and other aspects, and there's very

1 much a dynamic sector. Obviously, no sector sits
2 still in how it develops, but UAS is a very active
3 technology area and needs to be moved forward
4 quickly, and we think, to avoid holding this back,
5 there is an urgency that needs to be looked at to
6 make sure that we keep up with that from a
7 spectrum approach going forward.

8 And, with that, I think that's the end
9 of the spectrum access models. Yes.

10 MS. KAHN: Okay. So, now we're going to
11 talk about Federal Advisory and other committees
12 for UAS. Again, this is the second -- this is
13 dropped as the second part of the question from
14 NTIA on what is the potential need to create an
15 entity that supports collaboration across the
16 Federal Advisory Committee to UAS.

17 So, we looked at these different
18 committees. They include Federal Advisory as well
19 as other committees to UAS that PP TAC (phonetic),
20 FAA, DAC, UAS ExCom, NASA, UPP, and the PNT
21 Advisory Board. So, they all have had found
22 recent or ongoing and current activities related

1 to UAS.

2 So, for instance, the FCC TAC, which
3 provides technical advice to the FCC, had a scope
4 within their questions that were studying -- they
5 were studying spectrum issues to UAS and
6 identifying areas that might require special
7 attention by the FCC and spectrum management
8 functions. Their work in this area for UAS was
9 completed in 2018. There isn't any current
10 ongoing work on drones in the TAC, but we did
11 leverage the work that they did, and that was very
12 helpful in the exchange that we had with them,
13 then also the FAA Advisory Committee. So, that
14 provides independent advice, recommendations to
15 DoT and FAA, responding to questions and tasking
16 resources.

17 From the FAA, so, their advice and
18 independent recommendations are focused on
19 improving efficiency and safety with regard to
20 integrating UAS into the National Airspace System,
21 the NAS. And, then UAS ExCom, which is an
22 executive committee, so, this includes senior

1 executives from across many of the different
2 federal agencies, including FAA, DoD, DHS,
3 Commerce, Department of Energy, Department of
4 Interior, Justice, NASA. And, they provide a
5 forum for federal agencies to share information on
6 UAS research and development and also policy and
7 procedures, focused on safely integrating UAS into
8 the NAS.

9 They have subcommittees and they're
10 supported by the UAS Science and Research Panel,
11 the SARP. This provides updates. They interact
12 with research efforts and more broadly in academia
13 and the science community on -- it provides
14 updates to the ExCom. Then, also the NASA UPP,
15 the UAS Traffic Management Pilot Program -- so,
16 they were set up to define industry and FAA
17 capabilities required before UAS Traffic
18 Management, particularly that flight level below
19 400 feet.

20 The NASA UPP transfers research to the
21 FAA who helps to develop this area. But, looking
22 at their summaries and reports, they're not so

1 good on spectrum bands, and then the PNT Advisory
2 Board, which is focused on GPS and provides
3 advice, focused in that area.

4 So, what our findings show is that there
5 are different federal advisory committees that
6 have had recent or ongoing work in the UAS area.
7 But, it would be more impactful if there was
8 closer alignment, kind of a North Star, a point of
9 focus, to bring together the different
10 stakeholders and provide a common direction and
11 focus in the national interest, also to provide
12 kind of signposts on where to do for different
13 pieces of information. That came out both in our
14 interviews as well as just our work in getting the
15 lay of the land of what's going on with UAS.

16 So, while there are many different --
17 federal advisory and other committees, there is no
18 national committee that's assuming leadership
19 specifically as a national focal point on UAS
20 spectrum. And, NTIA and FCC need to be informed
21 of UAS spectrum requirements. They need to
22 coordinate across the different stakeholders,

1 federal and non-federal, in sharing of spectrum
2 for UAS. And U.S. leadership is needed by
3 direction coordination and integration.

4 And, so, we concluded that we do think
5 that there is a need to create an entity to
6 support the collaboration and facility on all of
7 this great work that's going on across the
8 different federal advisory and other committees
9 through UAS.

10 So, we were also asked to identify and
11 develop alternate mechanisms in governance
12 structures for such an entity. So, we came up
13 with some different options. So, one would be
14 designate a central point of contact. So, this
15 would be a person who is designated that could
16 help provide the signpost where to go, help to
17 coordinate and encourage collaboration across the
18 different federal advisory, community federal
19 agencies, industry, academia, other nonprofit
20 organizations.

21 And, there's an option for that central
22 POC structure to mature over time into the next

1 option, which is establishing an office within a
2 federal agency. So, this could be where an actual
3 office is established to be a focal point to help
4 collaborate and facilitate collaboration,
5 information sharing across all of the different
6 activities that are going on to support a whole
7 nation approach.

8 And, while remaining like Hutchin
9 (phonetic), in permissive it would work towards
10 achieving national goals that are agreed and
11 rationalized in advance. An analogy to this is
12 the Department of Commerce's Office of Space
13 Commerce, and we did talk to them about their
14 experiences, and so that's part of the input to
15 this.

16 Another option is to create a new
17 executive steering committee. So, this new
18 committee could be charged with helping to reform
19 how the different FACA groups might collaborate
20 around UAS spectrum, would include representatives
21 from the different federal agencies and work
22 across the different FACA groups on UAS-related

1 issues.

2 If the executive community believes
3 there's a need for a new organization, then --
4 beyond itself to coordinate the work, then it
5 could also charter a new entity. And, NTIA could
6 initiate this type of structure with establishing
7 a new executive committee. So, next.

8 Governance structure expanding the
9 charter of an existing federal advisory committee.
10 So, one of the existing federal advisory
11 committees could be -- their charter could be
12 expanded to facilitate collaboration across the
13 different FACA groups.

14 And, there is -- FACAs are each doing
15 work that's assigned by the government agency that
16 is sponsoring that FACA, and so, again, there is
17 this need for the cross federal agency type of
18 coordination.

19 Another option is expanding UAS ExCom.
20 So, UAS ExCom, it's charter could be expanded in
21 terms of its responsibilities to include
22 coordination across the different federal advisory

1 committees and other committees through UAS.

2 And, then, the last option, it would
3 appear, establishing a new federal advisory
4 committee which could be charged with coordinating
5 across the different federal advisory committees
6 for UAS. Of course, this would add another FACA
7 group to the mix.

8 So here are our draft recommendations
9 and they're on the slide, you know, as included in
10 our JOF (phonetic) report that, just to highlight
11 our conditions here. We recommend NTIA play a
12 leadership role to coordinate across federal
13 government to provide direction and resources to
14 facilitate spectrum access toward UAS, so bringing
15 together the different federal stakeholders to
16 identify spectrum requirements, ensuring that
17 spectrum access models in multiple bands can be
18 leveraged to meet those needs.

19 NTIA should coordinate across the
20 federal agency uses the spectrum through UAS,
21 inform the FCC, a federal agency UAS spectrum
22 requirement, and work with FCC and FAA to make

1 sure that spectrum access models maximize
2 industry's ability to offer UAS solutions better
3 consistent with FAA safety requirements and FCC
4 and NTIA regulatory requirement. So, that
5 addresses the spectrum access model.

6 The second draft recommendation is
7 aligned to the governance structures. So, CSMAC
8 recommends that NTIA initiate and champion
9 designation of a central point of contact within
10 the executive branch for UAS coordination,
11 including spectrum.

12 So, this would be bringing together
13 federal agencies, industry, academia, and other
14 nonprofit organizations to bring together these
15 multiple endeavor perspectives, serve as an
16 industry advocate within the executive branch to
17 support a whole-nation approach for UAS, and then
18 after 1 year, assessing this option and seeing if
19 it makes sense to mature it over time into an
20 office within a federal agency, again, while
21 remaining like -- they're working toward achieving
22 U.S. goals and would serve as a standing

1 coordinating committee to advance UAS.

2 Then, our last slide here. Our
3 remaining staff is to incorporate feedback,
4 finalize our report and recommendations, and then
5 deliver our final report and recommendations to
6 NTIA in March of this year. So, that concludes
7 our presentation, and we open it up for questions
8 or I can turn it over to Jennifer and Charla.

9 MS. RATH: Actually, just waiting to see
10 whether any of the CSMAC members have questions.
11 Again, as a reminder, hand-waving works only if
12 you have your video on. Otherwise, I would
13 recommend just putting something in the chat to
14 everyone. But, I don't see anything, any
15 questions.

16 Again, this is a group that a lot of the
17 CSMAC members participated in. I'm not sure how
18 many questions you will get. I'm going to give it
19 another -- just a little bit longer. Remember,
20 you just have to put your name in the chat and
21 say, have a question, have a comment.

22 I think we're good, Carolyn and Andy.

1 So, one thing I did want to say -- I sort of
2 mentioned this at the beginning, but I'll say it
3 again -- this is a very complicated topic that you
4 have. As you know, from the makeup of the CSMAC,
5 a lot of differing views and just experiences.

6 And, you know, I know we've got --
7 you've have one more, the final report, after
8 people have had a chance to read this through and
9 just reminding people that what they should be
10 doing is read it through, give any comments to
11 Andy and Roy. But, I have to say, you know,
12 having sort of watched it and, knowing how
13 complicated this is, I'm very impressed with how
14 the subcommittee has worked and how you were able
15 to kind of walk through, you know, differences of
16 opinion and come to what is still a draft but is
17 clearly, you know, a very well put together draft.

18 Jennifer, I don't know whether you've
19 got anything to add at this point before we move
20 on to public comment.

21 MS. WARREN: Yeah, I would just like to
22 echo what you've said but also -- this is an area

1 that I think is such an important area for our
2 future, for future economic growth, and whether
3 it's from small to large UAS, and as Andy and
4 Carolyn noted, we're talking about a whole economy
5 here, an autonomy economy, from, you know, pizza
6 delivery to cargo delivery autonomously. And,
7 it's tremendous the work that's being done by them
8 to kind of help move the U.S. forward and all of
9 the committee members. So, I think it's great
10 work. Thank you.

11 MS. RATH: Great. At this point, we're
12 putting it up for public comment, Antonio. So, I
13 know you're in charge of making sure that happens.
14 And, I would also urge the members of the public
15 to -- Antonio, tell me if I'm correct. They also
16 have access to the chat, because that may be the
17 easiest way to identify people who (inaudible).

18 MR. RICHARDSON: Well, they may have
19 access for the chat if they log in.

20 MS. RATH: Oh, okay.

21 MR. RICHARDSON: But, they have all been
22 unmated now, so if anyone from the public would

1 like to speak, go for it.

2 MS. RATH: Never sure how long to let it
3 go, so. (Laughs) But, this feels like I don't
4 think we're going to get any comments from the
5 public. If I defer somewhat to Charles and our
6 designated federal officer to make sure we do the
7 right thing. But, I'm thinking we're moving on.

8 MR. RICHARDSON: Yeah, I just wanted to
9 give them at least a minute or two here or to
10 maybe say something. But, if we don't hear
11 nothing within a minute, Charles, if you agree, I
12 think that'd be it.

13 MR. COOPER: Yeah. I'd say let's just
14 give it a moment here to have fine folks to find
15 their new key that they're looking for. And,
16 again, I just want say thank you --

17 MS. RATH: (Laughs)

18 MR. COOPER: On question 1 and question
19 4, you know, my mind is swimming with all the
20 different options, of course.

21 MS. RATH: (Laughs)

22 MR. COOPER: Yeah, it's going to take a

1 while for us to absorb it, because there's a lot
2 of excellent contact there. So, thank you for
3 that immense work.

4 MS. RATH: Okay, Antonio. What do you
5 think?

6 MR. RICHARDSON: I think that's it.

7 (Laughs)

8 MS. RATH: (Laughs) All right. So,
9 just quickly and then I'll turn it over to
10 Jennifer. Again, I want to thank, you know,
11 obviously all the subcommittees. We do have one
12 more meeting, though, after this one. So, in
13 particular, today I want to thank the two
14 subcommittees who reported, you know, both of
15 which were fairly complicated subjects and, you
16 know, in particular, subcommittee 1 who sort of
17 just said, okay, we'll do something else, why not.

18 And, it looks like we will have one more
19 meeting before our terms are up for this session.
20 And, unless NTIA comes up with something more they
21 want one of the subcommittees to do -- Charles,
22 I'm looking at you -- I think we will -- the last

1 thing we'll have is the UAS report, no longer a
2 draft but in final, and we'll vote on that.

3 So, it's been a full few years, but
4 we're not finished yet, so. And, I did also want
5 to specifically thank Andy for his public service
6 announcement on making sure that people use their
7 drones correctly. So, we are an all-purpose
8 committee here, so thank you.

9 Anyway, Jennifer, turning it over to you
10 for the final remarks.

11 MS. WARREN: I don't think I can add
12 much to what you just said. Again, our thanks and
13 our appreciation has been noted. Everybody's
14 bringing such direct experience and background to
15 the work here and, given the importance of
16 spectrum across so many domains, it's really
17 important in order for the NTIA to get the best
18 advice that can be brought. So, thank you to
19 everyone for participating as fully as you have.
20 I know there have been a lot of challenges, not
21 with respect to the CSMAC, but just in the world,
22 that have that bit of effect of the amount of time

1 and effort put in, but we didn't see any let-up.
2 So, that's great. We have one more meeting, as
3 Charla said. So, let's just keep going. And, we
4 look forward to delivering that final product to
5 you, Charles. Thank you. And, thanks, everyone.

6 MS. RATH: Thanks, everybody.

7 SPEAKER: Take care.

8 MS. RATH: Yes, we are adjourned.

9 Right. Exactly. Bye-bye.

10 (Whereupon, at 2:22 p.m., the
11 PROCEEDINGS were adjourned.)

12 * * * * *

13

14

15

16

17

18

19

20

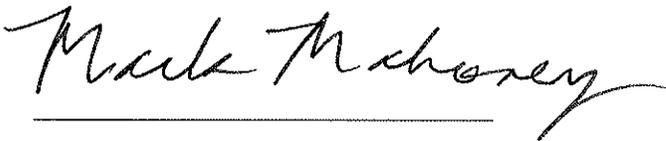
21

22

CERTIFICATE OF NOTARY PUBLIC

COMMONWEALTH OF VIRGINIA

I, Mark Mahoney, notary public in and for the Commonwealth of Virginia, do hereby certify that the forgoing PROCEEDING was duly recorded and thereafter reduced to print under my direction; that the witnesses were sworn to tell the truth under penalty of perjury; that said transcript is a true record of the testimony given by witnesses; that I am neither counsel for, related to, nor employed by any of the parties to the action in which this proceeding was called; and, furthermore, that I am not a relative or employee of any attorney or counsel employed by the parties hereto, nor financially or otherwise interested in the outcome of this action.



Notary Public, in and for the Commonwealth of Virginia

My Commission Expires: August 31, 2021

Notary Public Number 122985

