S. HRG. 114–264

# REMOVING BARRIERS TO WIRELESS BROADBAND DEPLOYMENT

## HEARING

BEFORE THE

## COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

OCTOBER 7, 2015

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED FOURTEENTH CONGRESS

FIRST SESSION

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# REMOVING BARRIERS TO WIRELESS BROADBAND DEPLOYMENT

**WEDNESDAY, OCTOBER 7, 2015**

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
*Washington, DC.*

The Committee met, pursuant to notice, at 10:01 a.m., in room SR–253, Russell Senate Office Building, Hon. John Thune, Chairman of the Committee, presiding.

Present: Senators Thune [presiding], Wicker, Ayotte, Fischer, Moran, Sullivan, Johnson, Heller, Gardner, Daines, Nelson, Cantwell, Klobuchar, Blumenthal, Schatz, Markey, Udall, Manchin, and Peters.

## OPENING STATEMENT OF HON. JOHN THUNE, U.S. SENATOR FROM SOUTH DAKOTA

The CHAIRMAN. This hearing will come to order. I want to welcome our panel and thank you all for being here this morning. Our committee meets to examine policies related to spectrum and wireless broadband.

As I mentioned at our July hearing on Wireless Broadband and the Future of Spectrum Policy, we have an opportunity to develop meaningful legislation to further promote economic development and the many benefits fueled by increased mobile connectivity. Similar to the feedback from our last hearing, I look forward to hearing from my many colleagues and our witnesses about ideas that they may have for such legislation.

I also invite stakeholders not here today to share their ideas with the Committee in the coming days and weeks. Opening more spectrum for commercial use can bring in revenue to pay down our national debt and fund other priorities. But, the more lasting economic benefits spurred by spectrum availability—new jobs, technological innovation, and increased consumer welfare—depend on spectrum actually being used by individuals across the country. That requires the design, construction, deployment, and maintenance of physical facilities, including towers, antennas, fiber optic cables, and servers.

The benefits of increased wireless deployment go well beyond the value of improving mobile connectivity for individuals where they live. There's also tremendous potential in bringing connectivity to unserved areas where people may not reside, but where they do work and play, like farmland and parklands. Facilitating personal mobile devices and machine-to-machine communications in these areas holds great promise to improve public health and safety, in-

crease agricultural productivity, and better manage natural resources.

Telecommunication and broadband connectivity in rural America not only opens doors for individuals and families, but also enables new opportunities for farmers and ranchers when it comes to the millions of acres of land that they actively manage. Machine-to-machine and machine-to-farm communication is already delivering new productivity gains and promises much more benefit for American farmers, environmental stewardship, and the economic future of rural communities. I look forward to hearing testimony today about some of these innovative solutions and how public policy can facilitate their ongoing development.

Improving broadband infrastructure deployment has received increasing legislative, administrative, and regulatory attention in recent years. Most recently, the Broadband Opportunity Council concluded a months-long review among 25 Federal agencies led by the Departments of Commerce and Agriculture to produce recommendations to increase broadband deployment through existing agency programs, missions, and budgets. We are pleased to have NTIA before us today to explain the recent report and discuss its role as a facilitator of interagency activities related to broadband.

Universal broadband connectivity is a national objective, but its pursuit ultimately involves thousands of decisions made at the local level. These decisions are made by private enterprises determining where to deploy facilities and where to risk capital. They also are made by local and Federal Government authorities who are charged with protecting their constituents' interests, authorities like city planning officials, military base personnel, and forestry managers. Today, we're going to hear more detail about what goes into these decision processes, how they operate in practice, and how Congress can help to improve their efficiency.

I'm encouraged by the broad engagement of members on this committee in efforts to promote wireless broadband deployment. Members on both sides of the aisle are working on a bipartisan basis to develop pragmatic concepts and actionable legislation as well as trying to identify new and bright ideas.

I invite all of our members to continue working with one another to understand these issues, to create a fulsome record, and to craft broadband deployment legislation for action in this Congress. I'm committed to these efforts and believe it is among the most important work that can be done by this committee.

Thank you. And I want to recognize now our Ranking Member, Senator Nelson.

**STATEMENT OF HON. BILL NELSON,**
**U.S. SENATOR FROM FLORIDA**

Senator NELSON. Thank you, Mr. Chairman.

And what you said about having to rely on State and local governments is one of the reasons that I requested that we have one of my mayors, the Mayor of Wilton Manors, Mayor Resnick, be part of the panel.

And just to back up what you said, Mr. Chairman, we're all here because of the demand for and the reliance on wireless broadband. And the additional need for spectrum always seems to gather most

of the attention, but we also, as we adopt a forward-looking wireless policy, we've got to look at the infrastructure side of the wireless situation.

As we continue to hear concerns about delay and the processes required for getting additional wireless infrastructure deployed, this is a part of the discussion that we're going to have to tackle. And that's because building these networks implicates a number of very important issues, from historic preservation and environmental concerns to State and local land-use policies to tribal sovereignty and to national security. And so, our hope is that all the stakeholders in this can work together to help us find ways to balance these competing demands and, therefore, to meet, ultimately, what the public must have.

And I also look forward to hearing from our NTIA witness about the steps the administration is already taking to increase opportunities for deployment of wireless infrastructure on Federal lands and buildings.

The recent Broadband Opportunity Council report includes a number of recommendations on ways to speed this deployment on Federal lands. Just last week, GSA, under the guidance of Congress, took significant steps to improve processes for seeking access to Federal lands. And as we said in a previous hearing, we stand ready to work with Chairman Thune and all the stakeholders to find areas of bipartisan consensus so that we can address the future of U.S. wireless policy.

Thank you.

The CHAIRMAN. Thank you, Senator Nelson.

And we are, as I said, joined by a great panel today. And, starting on your right and my left, we have Mr. Douglas Kinkoph, who is the Associate Administrator of the Office of Telecommunications Information Applications for the National Telecommunications and Information Administration—put that on a business card——

[Laughter.]

The CHAIRMAN.—Mr. Jonathan Adelstein, who is currently the President and CEO of PCIA, the Wireless Infrastructure Association, and also formerly the Administrator of the Rural Utilities Service, and a Commissioner at the Federal Communications Commission, and, I might add, a native South Dakotan—so, Jonathan, welcome, good to have you here; Mayor Gary Resnick is the Mayor, as Senator Nelson noted, Wilton Manors, Florida; and Mr. Core Reed is the Senior Vice President of Intelligent Solutions for Deere & Company, which will have, I think, some interesting thoughts on applications in agriculture, which is of great interest to many of us on this panel; and Mr. Bruce Morrison, and he's the Vice President of Operations and Network Build for Ericsson, in North America.

So, welcome, to all of you. It's great to have you with us. Please feel free to begin with your remarks. And, if you could confine them as closely to 5 minutes as possible, and then we'll get into our questions.

And we'll start on my left with Mr. Kinkoph.

## STATEMENT OF DOUGLAS KINKOPH, ASSOCIATE ADMINISTRATOR, OFFICE OF TELECOMMUNICATIONS AND INFORMATION APPLICATIONS, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Mr. KINKOPH. Thank you, Chairman Thune, Ranking Member Nelson, and Committee members. I welcome other opportunity to testify before you today on behalf of the National Telecommunications and Information Administration.

My name is Doug Kinkoph, and I'm Associate Administrator at NTIA and lead the agency's efforts related to broadband, including leading NTIA's new Broadband USA Initiative.

As President Obama has declared, access to high-speed broadband is no longer a luxury, it is a necessity for American families, businesses, consumers, and critical to U.S. economic growth and competitiveness. At NTIA, we have been working hard over the past 6 years to advance broadband availability nationwide through our $4 billion Broadband Grant Program.

We oversaw roughly 230 projects across the country that have built critical network infrastructure, opened or upgraded public computer centers, established broadband adoption and digital inclusion programs. NTIA's State Broadband Initiative invested another $300 million to help states collect broadband data for the National Broadband Map and expand their statewide broadband capacity.

Six years ago, when Congress funded this program, we made a promise to communities across the country that they would benefit from this funding. The Obama administration's investment in broadband would create jobs, stimulate economic development, spur investment, and open up new opportunities in employment, education, and healthcare. Today, I'm proud to say we've delivered on those pledges. Our broadband grantees deployed more than 114,000 miles of new or upgraded network miles, connected nearly 26,000 community anchor institutions, such as schools and hospitals, connected—and installed or upgraded more than 47,000 personal computers and public access centers. And our grantees enrolled hundreds of thousands of people as subscribers to broadband services for the first time.

As we move beyond these projects, we recognize that more work needs to be done to ensure that no one is left behind. Nearly 51 million Americans still do not have access at home to a wired broadband connection in their homes today, and we expect the need for speed to continue to increase.

Even though the Recovery Act Grant Program is coming to an end, President Obama has continued to emphasize the importance of broadband. Over the past several months, he has outlined a series of initiatives aimed at closing the digital divide and fostering investment in our Nation's broadband infrastructure. Last March, the President created the Broadband Opportunity Council, made up of over 20 Federal agencies, and directed it to determine what actions the Federal Government could take to eliminate regulatory barriers to broadband deployment and to encourage investment in broadband network and services. NTIA Administrator Larry

Strickling served as the Co-Chair of the Council at the designation by Senate—Secretary Pritzker.

On September 21, the White House released the Council's report, which described concrete steps that 25 Federal agencies would take over the next 18 months to eliminate barriers and promote broadband investment and adoption. Four key themes framed the recommendations and action items:

One, modernize Federal programs to expand program support for broadband investment;

Two, empower communities with tools and resources to attract broadband investment and promote meaningful use;

Three, promote increased broadband deployment and competition through expanded access to Federal assets;

And finally, improve data collection and analysis and research on broadband.

Once implemented, we believe that the recommendations will make meaningful difference to communities seeking to expand and enhance their broadband capacity. For example, more funds will be available to support broadband projects, and local governments will have new tools and resources at their fingertips to bring broadband to their communities.

The recommendations of the Broadband Opportunity Council represent an important next step in the administration's ongoing campaign to expand broadband access and adoption. But, what matters is—now is that the agencies implement the recommendations and continue to identify additional steps that can be taken and barriers that can be tackled.

At NTIA, we play an ongoing role in ensuring that the Council's important work is carried out. NTIA's Broadband USA Initiative will continue to work closely with communities seeking to expand their broadband capacity. NTIA has learned a lot over the past 6 years overseeing this broadband portfolio of broadband infrastructure and adoption grants. NTIA has learned that there is no one-size-fits-all approach. Through our Broadband USA Initiative, we are now leveraging that knowledge and expertise to help communities in their broadband expansion efforts. We are offering them technical assistance and support they need to overcome their unique challenges through publication of products, workshops, and direct technical assistance.

And I thank you again for the opportunity to participate in today's hearing. And I will be happy to answer any questions.

[The prepared statement of Mr. Kinkoph follows:]

PREPARED STATEMENT OF DOUGLAS KINKOPH, ASSOCIATE ADMINISTRATOR, OFFICE OF TELECOMMUNICATIONS AND INFORMATION APPLICATIONS, NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Chairman Thune, Ranking Member Nelson, members of the Committee, thank you for this opportunity to testify on behalf of the National Telecommunications and Information Administration (NTIA) regarding removing barriers to wireless broadband deployment. As President Obama has declared, access to high-speed broadband is no longer a luxury; it is a necessity for American families, businesses, and consumers and critical to U.S. economic growth and competitiveness. NTIA contributed to advancing broadband availability throughout the Nation by financing roughly 230 projects across the country that have built critical network infrastructure, opened or upgraded public computer centers and established broadband adop-

tion and digital inclusion programs from $4 billion from the 2009 Recovery Act. NTIA's State Broadband Initiative Program invested another $300 million to help states collect broadband data for the National Broadband Map and expand their statewide broadband capacity.

Six years ago, when Congress funded this program, we made a promise to communities across the country that would benefit from this funding: the Obama Administration's investment in broadband would create jobs, stimulate economic development, spur private-sector investment, and open up new opportunities in employment, education and healthcare. Most important, it would improve lives. Today, I am proud to say we delivered on those pledges. Our broadband grantees deployed more than 114,000 miles of new or upgraded network miles, connected nearly 26,000 community anchor institutions such as schools and hospitals and installed or upgraded more than 47,000 personal computers in public access centers. And our grantees enrolled hundreds of thousands of people as subscribers to broadband services.

These projects have already had a significant impact on economic development. We commissioned an independent study from ASR Analytics looking at the social and economic impact of our broadband grant program and released that report earlier this year. The report showed that on average, in only two years, communities that received our broadband grant funds experienced an estimated 2 percent greater growth in broadband availability than non-grant communities. The report also concluded that the additional broadband infrastructure built by our grantees could be expected to create more than 22,000 long-term jobs and generate more than $1 billion in additional household income each year. The report also showed that community anchor institutions, like schools and libraries, served by our broadband infrastructure grantees experienced significantly increased speeds and lower costs. As an example, the median price paid by libraries in the sample was $233 per megabit per month before the grant program, at a median speed of 3 mbps. As a result of the grant program, the median price dropped to $15 per megabit per month and median speed increased to 20 mbps.

With our infrastructure projects, one of our major goals was to prime the pump for private-sector investment by supplying critical middle-mile infrastructure that local providers can use to deliver affordable broadband to more homes and businesses. That is why all networks built with Recovery Act dollars are subject to open-access rules that let all other carriers interconnect with these networks on fair and non-discriminatory terms. Open access middle-mile fiber can also be used for wireless tower backhaul. We also encouraged our grantees to connect directly to the key anchor institutions in these communities due to the higher bandwidth needs of schools, libraries and other institutions.

In Massachusetts, there is a great example of a public-private partnership that laid the foundation for broadband expansion throughout the state. The $45.4 million grant to the Massachusetts Technology Park (MassTech) delivered affordable, high-speed Internet to 123 communities in rural western Massachusetts. The project was completed in January, 2014 and built 949 miles of new fiber and connected 1,233 community anchor institutions. For this project and the Open Cape project, the state of Massachusetts provided the project matching funds. In building on the success of the Recovery Act projects, the state is making funding available to 45 communities to support their community broadband projects.

Another Recovery Act success story is South Dakota Network, LLC (SDN), a partnership of 27 independent telecom companies covering most of South Dakota. SDN used its $20.6 million grant to add 397 miles of new middle-mile spurs that connected 512 community anchor institutions, including schools, hospitals, libraries, clinics, public safety agencies, courthouses, government buildings, and National Guard facilities, to high-speed broadband. The new and improved broadband access helped these institutions provide services that were previously unavailable due to lack of access or slow connections speeds. Healthcare providers can now offer telemedicine services and public schools and libraries now provide distance learning opportunities.

To foster wireless broadband deployment, NTIA awarded a $9.5 million Recovery Act grant to Pine Telephone Company to deliver affordable wireless broadband service to the underserved tribal lands of the Choctaw Nation and its ten counties in rural southeastern Oklahoma. Through its grant, Pine Telephone leveraged the power of broadband to create economic growth and jobs and to enhance education and public safety. Upon completion in June 2013, Pine Telephone had constructed a new high-speed 344-mile network that used 3G universal mobile telecommunications systems (UMTS) technology. In addition, Pine Telephone constructed a last-mile wireless network that included 42 new wireless links, 37 new towers, and 6 new/upgraded interconnection points. Pine Telephone connected 22 community an-

chor institutions (CAIs), including six K–12 schools and 16 public safety entities, and provided last-mile broadband services to 497 residential subscribers and 33 businesses. It also donated space on the new towers for placement of emergency responder radio systems, which will help to improve critical public safety communications during emergencies.

NTIA also awarded $32.2 million to the Navajo Tribal Utility Authority (NTUA) to build out telecommunications infrastructure throughout the Navajo Nation in northern Arizona, northwestern New Mexico, and southeastern Utah. Completed in 2013, NTUA constructed over 1,345 miles, including 570 miles of aerial fiber and 775 wireless miles. It also built 32 new towers to expand its existing microwave network and provide broadband access over 15,120 square miles of the Navajo Nation's 27,000 square mile area. It directly connected 50 chapter houses, which are the heart of each community and serve as municipal buildings and central community meeting places. In addition, NTUA's subrecipient, NTUA Wireless (dba Choice Wireless), provides last-mile services via a 4G Long Term Evolution (LTE) network. Through this LTE network, NTUA provides high speed broadband access to both fixed and mobile customers to include 30,000 households (approximately 135,000 people) and 1,000 businesses in 15 of the largest communities on the Navajo Nation, including Window Rock, Shiprock, Kayenta, Chinle, and Tuba City.

In addition to the goal of economic development, NTIA also focused on inclusion issues—how to make broadband available to all Americans. We cannot lose sight of the importance of adoption. Once the facilities are built, we need for people to subscribe to use the service. Today, only 74 percent of Americans overall subscribe to broadband service. Through our adoption programs, we have learned important lessons about what works and what does not. An important takeaway is that digital literacy is fundamental to sustainable broadband adoption. Our grantees around the country have demonstrated that successful digital literacy training must be tailored to the specific needs of the community and the individual. Based on our grants, we now have developed a portfolio of innovative approaches to offering this training. Sustainable broadband adoption projects are reaching people who may never have even turned on a computer—a group that includes a disproportionate number of lower income Americans, senior citizens, and members of minority groups—and teaching them how to navigate the Internet, set up an e-mail account, write a resume, and even apply for jobs over the Internet.

Through the Recovery Act, NTIA funded $250 million of sustainable broadband adoption grants. A program called TechGoesHome provides an illustration of one of these grants. The City of Boston's Department of Information Technology partnered with a nonprofit called Open Air Boston to provide digital literacy training, subsidized netbooks or mobile devices and low-cost Internet access to low-income middle and high school students and their families. TechGoesHome served 62 middle and high schools and 35 community sites, and it equipped Boston teenagers with valuable digital literacy skills that will help them compete in a job market that takes these skills for granted.

As we move beyond these projects, we recognize that more work needs to be done to ensure that no one is left behind in this digital revolution. When we started the Recovery Act grants program in 2009, the Federal Communications Commission (FCC) still defined broadband at a speed less than 1 Mbps. Today the FCC recommends download speeds of 25 Mbps. At that rate, nearly 51 million Americans still do not have access to a wired broadband connection. And we can expect the need for speed to continue to increase.

Even though the Recovery Act grant program is substantially complete, President Obama has continued to emphasize the importance of broadband. Over the past several months, he has outlined a series of initiatives aimed at closing the digital divide and fostering investment in our Nation's broadband infrastructure.

In 2013, the President launched ConnectEd, a public private partnership to connect 99 percent of America's students to the Internet through high-speed broadband within 5 years. Since the President's announcement, the public and private sectors have committed more than $10 billion of total funding and in-kind commitments as part of this five-year effort.

Earlier this year, the President announced ConnectHome, a new initiative with communities, the private sector, and Federal Government to expand high speed broadband to more families across the country. The pilot program is launching in 27 cities and one tribal nation and will initially reach over 275,000 low-income households. Through the program, Internet service providers, non-profits and the private sector will offer broadband access, technical training, digital literacy programs, and devices for residents in assisted housing units.

Last March, the President created the Broadband Opportunity Council, made up of over twenty Federal agencies, and directed it to determine what actions the Fed-

eral Government could take to eliminate regulatory barriers to broadband deployment and to encourage investment in broadband networks and services. On September 21, the White House released the Council's report, which describes concrete steps that 25 Federal agencies will take over the next 18 months to eliminate barriers and promote broadband investment and adoption.

Many of the agencies involved had never considered broadband to be part of their core mission. So an initial part of the task was for each agency to look internally at policies and programs to explore whether there was flexibility to do more.

The Council also solicited stakeholder input on ways that the Federal Government can incentivize broadband investment, drive competition and remove regulatory and policy barriers at the community level. We heard from more than 200 parties, including community groups, trade associations, broadband experts, state and local governments, private entities and individuals. Their feedback was important to shaping the report.

Four key themes framed the recommendations and action items.

1—Modernize Federal programs to expand program support for broadband investments.

2—Empower communities with tools and resources to attract broadband investment and promote meaningful use.

3—Promote increased broadband deployment and competition through expanded access to Federal assets.

4—Improve data collection, analysis and research on broadband.

Once implemented, we believe that the recommendations will make a meaningful difference to communities seeking to expand and enhance their broadband capacity. For example, more funds will be available to support broadband projects, and local governments will have new tools and resources at their fingertips to bring broadband to their communities.

The first set of recommendations targets modernizing Federal programs to expand program support for broadband investments.

Not all Federal programs fully reflect the changing conditions that reflect the need for broadband. In some cases, programs that can support broadband deployment and adoption lack specific guidelines to promote its use. We asked agencies to clarify whether their programs supported broadband investment. As a result, agencies have committed to 13 actions which clarify or open up additional options for Federal funding for broadband in programs totaling $10 billion. Examples include the Department of Housing and Urban Development's Community Development Block Grant and the Department of Commerce's Economic Development Assistance Programs.

The second set of recommendations relates to empowering communities with tools and resources to attract broadband investment and promote meaningful use. While Federal leadership is essential, many decisions about broadband investment are local. They are made by local governments in partnership with industry and guided by state law. To address the gaps, the Council recognized the need for Federal agencies to provide communities with targeted, easily accessible resources that share best practices from their peers around the country.

NTIA's BroadbandUSA effort has been working with communities across the country and we have heard time and again the challenges facing these communities to identify sources of funding for broadband, and to know where to turn to within the Federal Government for answers to their questions. One key action, which NTIA will spearhead, will be to create a portal for information on Federal broadband funding and loan programs to help communities easily identify resources as they seek to expand access to broadband. This will help communities find broadband-related policy guidance, key agency points-of-contact and best practices. Last week, NTIA announced the release of our Broadband Funding Guide, which provides a roadmap on how to access Federal funding to support broadband planning, public access, digital literacy, adoption, and deployment.

The third set of Council recommendations relates to expanding access to Federal assets. Specific actions here include a commitment from the Department of Transportation to issue policy guidance to leverage highway rights of way for broadband. The White House's Office of Science and Technology Policy and National Economic Council will also lead the creation of an online open data inventory of Federal assets that can help support faster and more economical broadband deployments, both wireline and wireless to remote areas of the country. Additionally, NTIA will assist the Department of the Interior (DOI) in developing an initiative to leverage over 4,000 towers and other assets on DOI-managed property to support wireless broadband deployments. This effort could reduce barriers to entry, increase competi-

tion, and improve service over 500 million square acres of land in unserved and underserved communities.

The fourth set of recommendations revolves around improving data collection, analysis, and research on broadband. Research on broadband deployment, competition and adoption has not kept pace with the massive digital changes that permeate our economy and society. To address this issue, the Council, led by the National Science Foundation and NTIA, will develop a comprehensive broadband research and data collection agenda. This will allow Federal and private funders to coordinate and prioritize future research plans to support American competitiveness.

The recommendations of the Broadband Opportunity Council represent an important next step in the Administration's ongoing campaign to expand broadband access and adoption, but what matters now is that agencies implement the recommendations and continue to identify additional steps that can be taken and barriers that can be tackled. We welcome continued dialogue with all stakeholders in this effort.

At NTIA, we will play an ongoing role in ensuring that the Council's important work is carried out. NTIA's BroadbandUSA initiative will continue to work closely with communities seeking to expand their broadband capacity. NTIA has learned a lot over the past six years overseeing this broad portfolio of broadband infrastructure and adoption grants. NTIA has learned that there's no one-size-fits-all approach that works. Every community has unique needs and challenges. Through our BroadbandUSA initiative, we are now leveraging that knowledge and expertise to help communities in their broadband expansion efforts. We are offering them the technical assistance and support they need to overcome their unique challenges through publication of products, workshops, and technical assistance.

Thank you again for the opportunity to participate in today's hearing.

The CHAIRMAN. Thank you, Mr. Kinkoph.

Mr. Adelstein.

**STATEMENT OF HON. JONATHAN S. ADELSTEIN, PRESIDENT AND CEO, PCIA—THE WIRELESS INFRASTRUCTURE ASSOCIATION**

Mr. ADELSTEIN. Well, thank you, Mr. Chairman, Ranking Member Nelson, and members of the Committee. I really appreciate the opportunity to testify today, and I appreciate the focus on infrastructure. Your opening statements really hit the nail on the head. Without it, we can't have wireless broadband.

As you indicated, Mr. Chairman, I'm CEO of PCIA—The Wireless Infrastructure Association. We represent the companies that build, design, own, and manage wireless telecom facilities. Our members include the infrastructure providers, wireless carriers, equipment manufacturers, and professional service firms that build that network and maintain it. Our mission is to expand wireless broadband everywhere. I think that's a mission consistent with what this committee has talked about and what you've talked about this morning. We help our members provide the facilities to meet consumers' growing demand for mobile data. Put simply, wireless infrastructure enables the delivery of innovative applications, like telemedicine, like distance learning. It's a catalyst for economic growth and job creation. A PCIA study found that the industry's investments—we invest roughly $35 billion a year, but they have outsized impact on the economy because of all the direct and indirect effects. We're expected to generate $1.2 trillion in chairman growth over 5 years and 1.3 million new jobs out of those investments. But, those investments have to flow, and that's what this committee's task that you sent to us today is, to figure out how to help that happen.

This committee has shown great leadership in eliminating a number of barriers to infrastructure deployment. Most notably,

Section 6409 of the Spectrum Act, which you enacted in 2012, has had a real and direct impact on speeding the deployment of 4G infrastructure by eliminating local regulatory barriers to upgrading existing wireless infrastructure. And the FCC has done an outstanding job of implementing it with a clear framework of rules. Our members report real progress on the ground. This committee's work has improved the speed, cost, and ease of deploying 4G networks. We're grateful for your visionary leadership.

We're also grateful for the cooperative spirit of representatives of local governments, like Mayor Resnick here, and all the associations that he serves on. We've worked together to implement on the ground those provisions that you enacted. And I think it has been very effective in helping get the word out and getting it done smoothly.

Still, we face a lot of challenges. Wireless data demand is projected to explode by 700 percent over the next 5 years. And the question is, How are we going to meet that demand? One way is more spectrum, as you indicated this morning. There's a lot that we need, in terms of spectrum. We need as much as we can get, as fast as we can get it. This committee's done great work on that front, as well. Spectrum, of course, is expensive, scarce, and takes a lot of time to get into use for consumers.

Another avenue is through technological efficiencies, which also improve data throughput, squeezing more out of existing spectrum. But, again, this takes time to develop.

A third way to address the wireless data crunch is through the rapid deployment of infrastructure. Wireless infrastructure provides additional capacity as soon as it's deployed. Solutions range from tall towers that provide wide coverage and capacity to small cells and distributed antenna systems that fill the gaps in high traffic areas.

Despite the assistance this committee has provided, roadblocks do remain. For example, some municipalities require proof of need before authorizing infrastructure builds. These requirements are both unnecessary and costly. Local governments shouldn't be in the CTO business of deciding what level of service is appropriate, or forecasting demand. Our members invest their limited capital where it's needed to serve consumers. Localities aren't in a good position to second-guess these technical questions.

Another way Congress could promote broadband is by streamlining the process of siting wireless infrastructure on Federal lands. GSA finally took a step last week to implement Congress's 2012 directive to provide standard forms and applications for wireless siting. Despite this law, an Executive Order by the President, many challenges remain in siting infrastructure on Federal property. Further legislation is needed to facilitate access on Federal lands, especially because they benefit rural areas so significantly.

PCIA supports S. 1618, the Wireless Innovation Act, which is being considered by this committee, as well as other efforts that are being made by this committee to address that.

Mr. Chairman, you and this committee are rightly focused on finding ways to focus on accelerating broadband deployment in rural America. PCIA completed a white paper in conjunction with our member, John Deere, who's testifying today, on steps to en-

hance private investment. One critical mechanism is the Rural Utility Service, provides loans for broadband buildout. And these loans need a predictable level of support that enables borrowers to plan and invest in infrastructure. The Connect America Fund and its wireless component, the Mobility Fund, can help rural areas build infrastructure.

Wireless broadband helps drive America's innovation economy and fuels the Nation's economic future. Continuing to upgrade America's wireless infrastructure is necessary to connect more Americans with broadband. Policymakers from Congress to local governments need to eliminate regulatory barriers so our industry can invest their capital where it's needed most. We can't afford costly burdens and delays that will slow the rollout of wireless broadband.

Our member companies are grateful for the bipartisan recognition of the centrality of wireless infrastructure by this committee, by Congress, by the administration, by the FCC. We look forward to making continued progress together.

And I thank you for the opportunity to testify.

[The prepared statement of Mr. Adelstein follows:]

PREPARED STATEMENT OF HON. JONATHAN S. ADELSTEIN, PRESIDENT AND CEO, PCIA—THE WIRELESS INFRASTRUCTURE ASSOCIATION

Chairman Thune, Ranking Member Nelson, and members of the Committee, thank you for holding this important hearing and for the opportunity to testify on the urgent topic of removing barriers to wireless broadband deployment. I am the President and CEO of PCIA—The Wireless Infrastructure Association (PCIA), the principal organization representing the companies that build, design, own, and manage telecommunications facilities in the U.S. and throughout the world. Our over 230 members include infrastructure providers, wireless carriers, equipment manufacturers, and professional services firms. PCIA focuses on ensuring that the infrastructure is in place to make mobile devices work. As mobile devices and applications continue to evolve, they share a common requirement of a wireless connection to a wired network—often provided through a tower. Our mission is to expand wireless broadband everywhere, helping our members provide wireless facilities that enable consumers to meet their growing mobile data needs anytime, anyplace.

The wireless broadband infrastructure industry is honored to work with this Committee and Congress on sound policies to encourage deployment of broadband for all Americans, regardless of location or economic status. The premise of this hearing demonstrates the importance of broadband deployment.

**Wireless Infrastructure Enables Broadband that Creates Jobs and Economic Growth**

When it comes to meeting the growing wireless data demands of Americans and consumers throughout the world, the wireless infrastructure industry plays an indispensable role. Put simply, our industry enables wireless communication and applications. Similar to roads and bridges, which carry physical traffic, wireless infrastructure is the essential platform for digital traffic that carries innovative applications like Uber, Instagram, Twitter, and YouTube, as well as life-altering broadband services like telemedicine, distance learning, improved public safety response, mobile banking, and a host of industrial and manufacturing functions. Efficient wireless infrastructure buildout will promote innovation and solidify America's historical competitiveness in the technology sector, and virtually every other sector of the economy.

Wireless infrastructure enables the economic growth and technological innovation that accompanies wireless broadband, including the Internet of Things, the app economy, and many future efficiencies and commercial opportunities that wireless broadband enables. A PCIA study found that private investments in wireless infrastructure between 2013 and 2017 are expected to generate as much as $1.2 trillion in economic growth and create 1.3 million net new jobs—including those directly attributable to wireless infrastructure and those created by it in other American busi-

ness enterprises.[1] Sustaining such investments will strengthen America's competitiveness and allow the U.S. to remain the leader in wireless innovation and thus in the global economy.

This Committee has shown great leadership for its work to eliminate a number of barriers to infrastructure deployment. Most critically, this Committee's work on Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012 has made an enormous difference in speeding the deployment of wireless infrastructure. Specifically, Section 6409(a) established a new Federal law governing state and local review of requests for modification of existing wireless towers or base stations, including collocations for additional providers of wireless services. The Federal Communications Commission's (FCC) outstanding and aggressive implementation of this law grounded Congress' work with a clear regulatory framework that we are confident the courts will find legally sound. Our members report real progress on the speed, cost, and ease of their efforts to deploy 4G networks as a direct result of this Committee's work, so we are grateful for your visionary leadership.

Regarding implementation of Section 6409(a), PCIA, along with CTIA—The Wireless Association, has worked in good faith with national organizations representing state and local governments to implement the law at the suggestion of FCC Commissioner Mignon Clyburn. Over the last several months, we have met with the National Association of Counties, the National League of Cities, and the National Association of Telecommunications Officers and Advisors. We formed a working group together that has released several educational resources and participated on panels across the country. Together, we have produced resource materials for local governments, including (1) a checklist to streamline review processes; (2) best practices used by jurisdictions able to review and approve applications in less than 60 days; (3) webinars and contacts for education and assistance regarding application process; and (4) a model ordinance and application. Members of the working group posted these on their respective websites. It is precisely this kind of cooperation that has enabled significant progress toward fulfilling the promise of the legislation Congress enacted. I commend these organizations, and my fellow witness Mayor Gary Resnick, for their commitment to work together to expedite broadband deployment for the citizens of their communities.

**Mobile Broadband is the Future of Broadband**

As a variety of reports demonstrate, Americans are quickly moving towards mobile broadband as their primary way to access the Internet. For example, according to Cisco, last year's mobile data traffic was nearly 30 times the size of the entire global Internet in 2000. And this trend is expected to continue.[2] Cisco also reports that U.S. mobile data traffic will grow two times faster than U.S. fixed IP traffic over the next four years and traffic from wireless and mobile devices will exceed traffic from wired devices by 2019.[3] These statistics underscore the need for government policies that reflect the growing demand for mobile data and address the challenges of meeting it by efficiently deploying wireless infrastructure.

America is facing an economic and technological challenge, which I have termed the wireless data crunch. The wireless data crunch refers to the need to meet the nearly insatiable and increasing demand for wireless mobile data with the network's capacity to deliver it. The demand for wireless data will increase 700 percent over the next five years. That's on top of the explosive growth we have already witnessed in the last five years. This tremendous growth is both encouraging and sobering at the same time. The challenge for the wireless infrastructure industry, the telecommunications sector at large, and for this Committee is: how are we going to meet this demand? The projections should serve as a wake-up call that industry and government need to continue to work together to maintain the U.S.'s position as the global leader in wireless innovation, as this Committee has long recognized.

To ensure capacity meets consumer demand, we need to build and deploy all manner of wireless infrastructure including more traditional towers, small cells, distributed antenna systems, and 1Wi-Fi offload. This integrated infrastructure ecosystem results in greater spectral efficiency. Using spectrum, a finite and limited resource, as efficiently as possible, allows more data to flow over existing frequencies.

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[1] WIRELESS BROADBAND INFRASTRUCTURE: A CATALYST FOR GDP AND JOB GROWTH 2013–2017 (2013), available at *http://www.pcia.com/images/IAE__Infrastructure__and__Economy__Fall__2013.PDF*

[2] CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2014–2019 1 (2015), available at *http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/white__paper__c11-520862.pdf*

[3] CISCO VISUAL NETWORKING INDEX: FORECAST AND METHODOLOGY, 2014–2019 2 (2015), available at *http://www.cisco.com/c/en/us/solutions/collateral/service-provider/ip-ngn-ip-next-generation-network/white__paper__c11-481360.pdf*

Network engineers recognize three basic ways to deliver more wireless data: (1) additional spectrum, (2) increased technological efficiency, and (3) expanded wireless infrastructure. I will briefly discuss spectrum and technological efficiency. As PCIA's focus is providing the infrastructure that makes mobile devices work, I will highlight on this aspect of the delivery of wireless data.

**Additional Spectrum**

Clearly, more spectrum must be made available—as much as we can get as fast as we can get it. And of course, spectrum is of great value. Thanks to the excellent work by members of this Committee, the FCC was able to auction 65 MHz of AWS–3 spectrum for over $45 billion. Let me put that in context. There were already 550 MHz of spectrum in commercial cellular use. Thus, we've just increased the amount by around 12 percent. The usefulness of this spectrum is affected by the lag time between when the spectrum is auctioned and when it is ready for use. This includes the need for the spectrum to actually be allocated and cleared, antennas and other infrastructure to be upgraded, and a whole generation of handsets to be swapped out. Significant amounts of time are needed before these bands begin to offload traffic from existing frequencies, and it is not likely to be fully phased in for up to five years.

This Committee and the industry are carefully monitoring the next auction—the incentive auction for broadcast spectrum. This auction is not slated to begin until next year, and will likely take over five years to yield any significant spectral relief. Beyond that, significant additional spectrum is not yet in the pipeline. Critical efforts are underway to clear unused Federal Government spectrum for commercial use, including the commitment by the Obama Administration to clear 500 MHz by 2020. Notably, Senator Rubio reintroduced the Wireless Innovation Act (S. 1618), which seeks to identify and allocate Federal spectrum to commercial use. However, as this Committee is well aware, it is extremely complicated, and expensive, to move Federal agencies off their current frequencies. Clearing and auctioning Federal spectrum is necessary, but it will not help ease the wireless data crunch in the very near future. We certainly need more spectrum, and I urge you to pursue policies to make more available for commercial use.

**Technological Efficiencies**

Technological efficiencies also help ease the wireless data crunch. Each new network generation brings with it new technologies, more network capacity for data per user, and the potential for better voice quality, lower latency and greater data throughput. For example, 4G is much more efficient than 3G, allowing for more economic use of allocated spectrum, and 4G LTE Advanced is yet more efficient. But even as we build out 4G, traffic immediately diverted to these new and more efficient data channels—there's lag time here, too, with old 3G and even 2G handsets still in use. Carriers can incentivize customers to use more efficient handsets, but this also takes time. Industry plans to begin field testing 5G as early as next year, but the technology is not expected to be introduced in the U.S. until around 2020. Technological efficiencies are absolutely critical, and more is needed, both on the network layer and on the software and content layer. Again, however, technological innovation alone will not enable the wireless industry to meet growing consumer demand, even when combined with new spectrum projected to come online.

**Infrastructure**

As noted, additional spectrum and technological efficiencies are necessary tools in the effort to address the data crunch. The third critical resource is the rapid deployment of the physical network, the infrastructure that supports spectrum and any new technological upgrades. This is the primary focus of PCIA.

The physical wireless infrastructure now being deployed and upgraded offers a solution that is already carrying an immediate and heavy load to address the wireless data crunch. It consists of major investments of private capital that ushers this technology to market. With the appropriate regulatory guidance, today's wireless industry can better plan for the network of tomorrow. Too often, misunderstandings and misrepresentations about wireless infrastructure can stall the deployment of these life-changing technologies. Wireless infrastructure has the power to transform a city in economic decline into an innovation hub. It can breathe new life into aging commercial zones, and provide rural areas the ability to compete in the innovation economy.

Today, there are an abundance of choices available to network planners. The traditional tall towers effectively provide most of the coverage and capacity necessary. The industry is also deploying distributed antennas systems and small cells to fill the gaps or overlay capacity in high traffic markets. Further, the networks themselves are getting smarter. Self-optimizing networks and the combination of intel-

ligent software and hardware design allows a network to anticipate usage and provide greater resources to areas of need in real time, providing users with responsive service. Wi-Fi continues to play an important role in this system, offloading traffic to the wired network and providing greater headroom for cellular services.

The densification of wireless infrastructure plays a critical role in meeting wireless data demand. In fact, infrastructure appears poised to play the largest role of any of the available solutions in the next five years, and perhaps more, to address the wireless data crunch. Spectrum and network densification are fungible—roughly speaking, doubling the amount of spectrum in an area could provide a similar boost to network capacity as doubling the number of cell sites. The availability of network densification as an alternative to spectrum purchases puts a cap on the cost of spectrum—and carriers regularly weigh them against one another. The mobile carriers paid high prices for spectrum in the AWS–3 auction, which is understandable because this could be one of the only available opportunities for significant new spectrum in the near future other than the 600 MHz auction. Today's infrastructure will provide the foundation upon which the wireless industry will deliver the Internet of Things, 5G, and the applications, services, and jobs that will fuel the U.S. economy into the future.

**Broadband Opportunity Council**

Earlier this year, President Obama created the Broadband Opportunity Council to focus on increasing broadband investment and adoption. The Council is co-chaired by Department of Commerce Secretary Penny Pritzker, working with the National Telecommunications and Information Agency (NTIA), and Department of Agriculture Secretary Tom Vilsack, working with the Rural Utilities Service (RUS), where I was previously Administrator. It includes over twenty-five different government agencies, united around clear policy objectives, including identifying regulatory barriers impeding broadband deployment.

On September 21, the White House released a formal report that included recommendations to improve broadband across the country. The Council recommended that Federal agencies should further streamline access to Federal lands, structures and rights of way in order to help speed broadband deployment nationwide. The report also notes that there is significant room for improvement in local and state government practices. Local and state regulations, the report points out, cannot be addressed through executive action, but the Federal Government can encourage best practices. The Council has also sought to create an online inventory of data on Federal assets, and maintain the points of contact tasked with overseeing broadband buildout. Faster and more efficient broadband deployment is the goal. Nevertheless, as the report notes, many of the recommendations provided by commenters require congressional action. This report provides clear recognition of the crucial role Congress plays in taking broadband deployment forward.

**Congress' Role in Encou raging Br oadband Deployment**

Wireless infrastructure is the backbone of all wireless voice and data communications. The industry is constantly innovating with new wireless technologies. Without sound regulations and policy at the local, state, and Federal levels, the innovation and competitiveness of the wireless industry will suffer. Even with all the positive strides in broadband deployment over the past five years, there remain a number of barriers to broadband deployment for Congress to address.

We've seen how misinterpretations of congressional intent can cause delays in broadband deployment. Too often, local jurisdictions have denied siting applications without full reasoning and accountability as required by the Telecommunications Act of 1996 (Telecom Act). This left capital tied up and broadband projects languishing or abandoned. It took action by the Supreme Court in *T-Mobile* v. *Roswell* to help resolve one roadblock. In January, the Supreme Court agreed with our assessment that the Telecom Act requires localities to provide clear, written reasons when applications to build wireless facilities are denied. The Court sided with industry and found that wireless providers must be informed in a clear-cut and timely manner. We were pleased with this ruling, but we should not have to petition the highest court in the land to resolve these types of delays in the name of broadband buildout and all that it enables.

One suggestion for Congress to consider that would alleviate roadblocks to wireless siting at the local level would be removing requirements that a provider demonstrate "proof-of-need" or show a "gap-in-service" when siting a wireless facility. Proof-of-need is used as a barrier to building new facilities because it is simple to reject an application based on a local government's subjective evaluation that the applicant failed to sufficiently demonstrate that a facility serves a purpose. Moreover, varied judicial interpretations of Sections 332 and 253 of the Telecom Act

allow a jurisdiction to deny an application on the basis that "sufficient" wireless coverage already exists in the area. The test is extremely subjective in practice, makes it more difficult to site wireless facilities, and thereby slowing broadband deployment and preventing wireless facilities from alleviating data capacity constraints. As the need to meet consumer demand moves from coverage to capacity, communities are not well positioned to second-guess costly investment decisions that are guided by experienced radio frequency engineers to improve customer service. In many cases, such obstruction can undercut service to the very citizens local governments are elected to serve.

Another way Congress can encourage investment in broadband deployment is by maintaining an appropriate regime for the tax treatment of Real Estate Investment Trusts (REITs). Long-standing tax policies, established in the 1960s, and IRS guidance, have always held that communications towers have been considered real estate for REIT qualification purposes. Transmission tower companies lease vertical real estate—communications towers and the land beneath it—to multiple tenants. Tenants own the equipment and lease space on the towers generally over a long period of time. Transmission tower companies eliminate the need for each tenant to construct its own towers, which prevents overcrowding neighborhoods and communities with multiple towers. This model enhances competition in the wireless industry by lowering costs for mobile wireless service providers and other tenants to enter new markets. Transmission tower companies allow these competitors to operate without having to raise capital to build their own tower networks.

Today, the properties of tower companies play a critical role in broadband deployment. Continued buildout of towers is essential to meeting the demand for wireless data, and the current REIT structure promotes this necessary capital investment. As the National Association of Real Estate Investment Trust (NAREIT) stated in its April 2015 submission to the Senate Finance Committee, "Today, investment through and by tower REITs is one way the national demand for real estate specialized to meet the needs of mobile phone providers and users is met."

Congress can also encourage broadband deployment by enacting bipartisan legislation to promote an open Internet. Only congressional action can give the certainty for broadband providers looking to invest. As Congress looks to enact open Internet legislation, it should provide the FCC the necessary legal authority to map out clear rules of the road for broadband providers while encouraging investment in broadband networks.

Another barrier to broadband deployment is the byzantine process of siting wireless broadband infrastructure on Federal lands. This Committee on a bipartisan basis has expressed interest in this issue and we appreciate your leadership. The Federal Government owns or administers nearly thirty percent of all land in the U.S., as well as thousands of buildings. Broadband providers currently face significant challenges when working to secure access to Federal lands and buildings. Deploying wireless infrastructure on these properties is absolutely critical for public safety and economic development. Wireless facilities can be sited on Federal property in an environmentally responsible way that is sensitive to areas historic significance.

Predictability and consistency are vital to network planning and investment in any arena, but this need is amplified when deploying broadband on Federal property, which often requires burdensome interagency review and coordination. PCIA is actively working with agencies across the Federal Government, Congress, and the White House to find ways to expedite the siting process. In 2012, Congress, with the leadership of this Committee, put forward a framework to make it easier to site communications facilities on Federal lands and properties through standard applications and agreements. Also in 2012, President Obama issued Executive Order 13616 to promote infrastructure buildout on Federal lands and created a cross-agency working group charged with meeting the mandate of speeding deployment on Federal lands and properties.

Unfortunately, even with an Executive Order and direction from Congress, the process to site wireless infrastructure on Federal lands has not sufficiently improved. Further legislation will spur agencies to work with the industry to bring broadband service to difficult-to-reach Federal lands and Federal buildings. As such, PCIA supports the Wireless Innovation Act (S. 1618) to address this very issue. By facilitating access, the Federal Government can increase revenues through lease payments to the Treasury while at the same time improving broadband access for its citizens. Better access to Federal lands and property will also help increase broadband availability in rural areas. The importance of expanding rural broadband is clear. Many of the lands and properties that would benefit from streamlined siting are by definition rural. We look forward to continuing to work with both

chambers on legislation to streamline and expedite the process of siting broadband infrastructure on Federal property.

As our member John Deere has indicated in its testimony, along with work on Federal lands, it is important for the public and private sector to work together to ensure that buildout can accelerate in Rural America. One critical mechanism is the loans provided by the Rural Utilities Service for broadband buildout. These loans are repaid with a significant portion of funding from the Universal Service Fund (USF). For these funds to meet their intended purpose there must be a predictable level of support to the USF so that loan recipients can plan, borrow, and invest in infrastructure. Lastly, the Connect America Fund (CAF) is a sustainable cost-recovery mechanism for rural areas where subscriber densities are too low to motivate providers to build infrastructure and offer service. CAF's wireless component, the Mobility Fund, is targeted at the expansion of mobile broadband networks. We think these programs will go a long way to accelerate the deployment of wireless broadband in rural communities.

Similarly, more work is needed to provide connectivity to native nations so that these communities can take advantage of the benefits that broadband provides. PCIA has long worked with tribal leaders and communities to promote their access wireless broadband, including commenting in various dockets related to historic preservation and environmental protection. PCIA has also participated in the FCC's annual workshops on this topic, providing a platform for information exchange between industry and those representing native nations to better understand the cultural differences and shared experiences. In the spirit of collaboration, PCIA would urge a reexamination of certain tower siting processes at the FCC, whereby, for example, an application to site communications facilities in downtown Chicago triggers a full-day review and fees associated with a tribe many miles away. Our industry understands the critical nature of sovereignty and respects the value of protecting sensitive historic sites. Still, there must be a more efficient and rational approach that is more appropriately targeted so that we may all benefit from a stronger network.

Both state and Federal policies require pole attachment rules that promote the deployment of broadband access and the new technologies that enable it, while providing fair treatment for pole owners. Among other things, Congress added "provider[s] of telecommunications services[s]" to the category of attachers entitled to pole attachments at just and reasonable rates, terms and conditions under Section 224 of the Telecom Act. This Section has been modernized through action by the FCC, which has helped to provide greater access to poles for wireless attachers, shortened timelines for make-ready and other work, and established rates in greater harmony with other like attachments. However, many jurisdictions have been slow to adopt the FCC's standards. In these states, the telecommunications industry must re-legislate and re-litigate the efforts taken before the FCC. Greater national certainty and clarity with respect to the rights of wireless attachers in these jurisdictions would spur further broadband deployment.

Last, Members of this Committee have been working on legislation to require that broadband conduits be installed as a part of certain highway construction projects, also known as "dig once." This initiative would help facilitate broadband infrastructure deployment and reduce duplicative Federal reviews for work at the same location. PCIA looks forward to working with the Committee on this legislation.

**Conclusion**

The wireless infrastructure industry faces a number of legal and regulatory hurdles that slow investment and deployment. By providing certainty and lowering some of the barriers noted above, Congress can play a constructive role in ensuring broadband to all Americans. In closing, there are number of specific steps Congress can take to encourage broadband deployment. This Committee should look to remove requirements that a provider demonstrate "proof-of-need" or show a "gap-in-service" when siting a wireless facility. Next, Congress should look to expedite and streamline the process for citing wireless broadband infrastructure on Federal lands. In addition, ensuring that the current REIT structure that dates back to the 1960s is maintained is another way Congress can increase deployment. Further, harmonizing rates and providing greater national clarity on pole attachments would promote deployment as well. And finally, installing broadband conduits as a part of certain highway construction projects would reduce duplicative Federal reviews for broadband deployment.

Wireless broadband helps drive America's innovation economy and fuels the Nation's economic future. The U.S. has always been the global leader in wireless broadband innovation, and private investment in wireless infrastructure is a big the

reason why. Continuing to upgrade America's wireless infrastructure is a necessary component of connecting more Americans with broadband.

The mobile broadband revolution holds incredible promise for economic growth, job creation, public safety, education, healthcare and many other benefits. At the same time, there are warning signs on the road ahead. Our industry is determined to meet consumer demand, even as it rises swiftly. That is capital intensive, costly and operationally demanding. We need policies that allow that allow us to invest that capital efficiently, and to target areas that need additional coverage and capacity. To maximize the promise of wireless broadband for economic growth, job creation and technological innovation, infrastructure builders need the capital to invest—and we need regulators and Congress to help, as this Committee has long realized and as the purpose of this hearing recognizes. We are deeply grateful for the bipartisan recognition of the importance of infrastructure by this Committee, by Congress, by the FCC and the Administration. All have implemented policies to promote wireless broadband deployment, and all are working to build on recent successes.

Thank you again Chairman Thune and Ranking Member Nelson for holding this hearing and inviting me to testify. I look forward to continuing to work with you and the rest of the Committee to continue to make progress on these very important issues.

The CHAIRMAN. Thank you, Mr. Adelstein.

And we move now to distinguished mayor. Mayor Resnick, please proceed with your remarks.

**STATEMENT OF HON. GARY RESNICK, MAYOR, WILTON MANORS, FLORIDA**

Mr. RESNICK. Thank you. Good morning, Chairman Thune, Ranking Member Nelson, and members of the Committee.

I am Gary Resnick, Mayor of the City of Wilton Manors, Florida, and long-term member of the National League of Cities and the National Association of Telecommunications Officers and Advisors. The cities and towns in your states are very likely members of NLC and NATOA. I also have the privilege of serving as chair of the Intergovernmental Advisory Committee of the Federal Communications Commission. In addition, my background as an attorney with the Florida firm of Gray Robinson, representing businesses and local governments for over 20 years in connection with communications issues, and my role as mayor, has allowed me to work effectively with public and private entities and local citizens to improve wireless communications.

I want to thank the Committee for calling attention to the importance of wireless communications services by holding this hearing, and I appreciate the opportunity to provide the unique perspective of local governments in our role in ensuring our communities have access to wireless broadband services.

No one wants broadband deployment and competitive choice more than local governments. We are not only regulators of the deployment of this infrastructure, we are large consumers of these services, and often local governments are providers of broadband services. For years, communities across the country have taken innovative steps to increase the deployment of critical infrastructure, including towers, carefully balancing the health, safety, and welfare concerns of our residents and communities. The recent tragedy in Oregon and events in the Carolinas are just the latest examples demonstrating the importance for local governments and our first responders to have reliable access to vital wireless communications and broadband services.

While various stakeholders' approaches to increasing wireless broadband may differ, all of us have the same goal: to ensure that all Americans have affordable access to advanced broadband services. Our need for additional broadband deployments must be balanced with the critical need for local governments to maintain reasonable control and authority over the placement of these facilities in our communities. Federal policies must respect our ability as local officials to manage public rights-of-way as well as land uses on public and private properties. Disruption to neighborhoods, open spaces, streets, sidewalks, and business can have a negative impact on public safety and industry as well as on the sustainability of our communities.

The vast majority of projects in our communities are reviewed and deployed in a timely manner, respecting both the needs of providers and tower owners and also the desires of the communities they serve. In fact, many communities with industry input have taken steps to streamline their siting practices in an effort to provide certainty in the permitting and zoning processes. Any assertion that most local governments are barriers to wireless infrastructure deployment is simply wrong. As mayor, I know firsthand how vitally important communications services are to our first-responder, police, and fire personnel, the vast majority of whom are local government employees.

In 2009, the FCC adopted a declaratory ruling establishing time frames within which local governments must act on tower-siting applications. Prior to that FCC action, the Florida legislature adopted similar time frames for local government action. To date, these time frames have worked well in my state and throughout the country. In a related facility siting report and order adopted in 2014, the FCC declined to adopt an additional remedy in the event that time frames were not being met, in large part because of a finding that the existing rules were working well. In its 2014 wireless broadband facilities order, the FCC recognized the vital role that local governments play in bringing advanced communication services to all Americans. The FCC did so in a way to preserve local land-use authority, protect camouflage and concealment measures, and allow local communities to protect aesthetic and safety interests.

In conjunction with the 2014 order, NLC, NATOA, and the National Association of Counties worked cooperatively with CTIA and PCIA on educational initiatives and materials that provide communities with resources to encourage increased broadband deployment. Cooperation between local governments and industry is evident by the sheer number of sites deployed to date.

There may be instances where deployment does not occur as quickly as either industry or local governments would like. If there are delays to deployment, it should be understood that we, as local leaders, are managing a variety of infrastructure needs, just as the industry is managing a variety of issues. It would not be productive for the legislative process to portray each other as obstacles to wireless broadband deployment. Reaching consensus, which is the mainstay of the government process at the local level, would be most effective. We look forward to continuing our demonstrated effective working relationship with the wireless industry and our

Federal colleagues using a collaborative approach to promote broadband deployment in a manner that respects the legitimate interests of all interested parties.

Billions of dollars are being invested in broadband projects through various Federal programs. Local governments, the government closest to the people and most accountable to our joint constituents, want to see these investments succeed. We will continue to play an important role in helping to ensure that these initiatives are deployed in a timely and efficient manner while protecting the unique needs and interests of the communities they seek to serve.

Again, on behalf of NLC and NATOA and local governments, I would like to thank the Committee for inviting me to participate in this hearing today. I urge you to view local governments as strong partners in ensuring that affordable broadband services are available to all Americans.

Thank you again, and I look forward to any questions you may have.

And I want to just acknowledge the presence here today of many of my colleague city officials from Florida, and appreciate their support in coming to this hearing.

Thank you.

[The prepared statement of Mr. Resnick follows:]

PREPARED STATEMENT OF HON. GARY RESNICK, MAYOR, WILTON MANORS, FLORIDA

Good morning, Chairman Thune, Ranking Member Nelson and Members of the Committee. I am Gary Resnick, Mayor of Wilton Manors, Florida and long-term member of the National League of Cities (NLC) and the National Association of Telecommunications Officers and Advisors (NATOA). The National League of Cities is the Nation's largest and most representative membership and advocacy organization for city officials, comprised of more than 19,000 cities, towns, and villages representing more than 218 million Americans. The National Association of Telecommunications Officers and Advisors is the premier local government professional association that provides support to its members on the many local, state, and Federal communications laws, administrative rulings, judicial decisions, and technology issues impacting the interests of local governments. The cities and towns in your states are very likely members of NLC and NATOA.

I also serve as Chair of the Intergovernmental Advisory Committee (IAC) of the Federal Communications Commission (FCC). The IAC provides guidance to the FCC on a broad range of issues of importance to state, local and tribal governments including cable and local franchising, public rights-of-way, facilities siting, universal service, broadband access, barriers to competitive entry, and public safety communications. My background as an attorney with the Florida firm of GrayRobinson, representing businesses and local governments for over 20 years in connection with such communications issues, and my role as Mayor, has allowed me to work effectively with public and private entities, and local citizens, focused on improving wireless communications.

I want to thank the Committee for calling attention to the importance of wireless communications services by holding this hearing and appreciate the opportunity to provide the unique perspective of local governments and our role in ensuring our communities have access to wireless broadband services. No one wants broadband deployment and competitive choice more than local governments. We are not only regulators of the deployment of these services for the benefit of our residents, we are large consumers of these services and often local governments are providers of broadband services. For years, communities across the country have taken innovative steps to increase the deployment of critical infrastructure—including towers—carefully balancing the health, safety and welfare concerns of our residents and communities.

The recent tragedy in Oregon and the preparations for Hurricane Joaquin are just the latest examples demonstrating the importance of local governments and our first responders having reliable access to vital wireless communications and broadband services.

**Role of Local Governments in Increasing Wireless Broadband**

While various stakeholders' approaches to increasing wireless broadband may differ, it is safe to conclude that all of us have the same goals—to ensure that all Americans have universal, affordable access to advanced broadband services and that deployment occurs as efficiently as possible without compromising the public's health and safety. It is undeniable that the growing demand for wireless broadband services, coupled with the growing use of personal wireless devices, requires the deployment of additional infrastructure. Increased access and better wireless broadband services bring a wealth of benefits to America's municipalities and counties, including increased economic development and job creation, enhanced public safety, telemedicine, distance learning, and improved civic engagement.

Our need for additional broadband deployments must be balanced with the absolute need for local governments to maintain reasonable control and authority over the placement of these facilities in our communities. Because of our responsibility as local leaders to protect the health, safety, and welfare of our residents, Federal policies must respect our ability as local officials to manage public rights-of-way as well as land uses on private and public property. Disruption to neighborhoods, open spaces, streets, sidewalks, and businesses can have a negative impact on public safety and industry, as well as the sustainability of our communities. As such, local governments have, and must maintain, authority to regulate land use, zoning and access to public rights-of-way.

**Not a Barrier to Deployment**

Local governments believe that the vast majority of projects in our communities are reviewed and deployed in a timely manner, respecting both the needs of providers and tower owners, and also the desires of the communities they serve. In fact, many communities, with industry input, have taken steps to streamline their siting practices in an effort to provide certainty in the permitting and zoning processes. Many communities have enacted ordinances that express a preference for collocations and encourage such siting requests by limiting government review solely to a staff process. Any assertion that most local governments are barriers to wireless infrastructure deployment is simply wrong. As Mayor, I know firsthand how vitally important communications services are to our first responder police and fire personnel—the vast majority of whom are local government employees. Additionally, wireless broadband is critical for the economic and social welfare of our residents, educational institutions, libraries, and businesses and we strive to ensure they have affordable, reliable access to these services.

In 2009, the Federal Communications Commission adopted a declaratory ruling establishing time frames within which local communities must act on tower siting applications. Prior to that FCC action, the Florida Legislature adopted similar time frames for such local government action. To date, the time frames have worked well in my state and throughout the country. In a related facilities siting Report and Order adopted in 2014, the Commission declined to adopt an additional remedy in the event the time frames were not met, in large part because of a finding that the existing rules are working well.

Furthermore, in its 2014 wireless broadband facilities siting order, the FCC recognized the vital role that local governments play in bringing advanced communications services to all Americans. While taking steps to eliminate what it viewed as unnecessary review procedures with respect to small-sized wireless broadband facilities on existing structures, the FCC did so in a way to preserve local land use authority, protect camouflage and concealment measures, and allow local communities to protect aesthetic and safety interests.

In conjunction with the 2014 order, NLC, NATOA, and the National Association of Counties worked cooperatively with CTIA and PCIA on educational initiatives and materials that provide communities with resources to encourage increased broadband deployment and choice for our residents and businesses, consistent with the new Federal rules. We are eager to work with all stakeholders. Proof of cooperation between local governments and industry is evident by the sheer number of sites deployed to date.

There may be instances where deployment does not occur as quickly as industry or local governments would like. We understand that the wireless industry is undergoing many changes and has many pressures that may delay deployment of infrastructure. Similarly, wireless infrastructure is just one of the many responsibilities that fall on the shoulders of local governments. If there are delays to deployment, it should be understood that we, as local leaders, are managing a variety of infrastructure needs, just as the industry is managing a variety of issues. It would not be productive for the legislative process to portray each other as obstacles to wireless broadband deployment. Reaching consensus, which is the mainstay of the gov-

ernment process at the local level, would be most effective. We look forward to continuing our demonstrated effective working relationship with the wireless industry and our Federal colleagues using a collaborative approach to promote deployment in a manner that respects the legitimate interests of all interested parties.

**FirstNet**

Public and private stakeholders are working collaboratively to deploy a new nationwide, interoperable, wireless broadband network for public safety communications ("FirstNet") to serve both urban and rural America within the next several years. As a result, challenges to timely wireless deployment may increase. However, let there be no mistake—local governments actively encourage and want the deployment of this new network and will strive to ensure it is built in a timely manner.

Any assertion that local governments would act in any manner to delay the deployment of FirstNet ignores the long-established role that local governments play in providing public safety communications and protecting life and property.

**Conclusion**

Billions of dollars are being invested in broadband projects through various Federal programs, such as the Connect America Fund and E-Rate, with much of it in rural parts of our country. Local governments—the government closest to the people and most accountable to our joint constituents– want to see these investments succeed. We fully recognize that local governments will play an important role in helping to ensure that these initiatives are deployed in a timely and efficient manner, while protecting the unique needs and interests of the communities they seek to serve.

On behalf of NLC and NATOA, I want to thank the Committee for inviting me to participate in this hearing today. I offer the ongoing assistance of local governments as you examine ways to increase broadband deployment across our Nation. I urge you to view local governments as strong partners in ensuring that broadband services are available to all Americans.

Thank you again. I look forward to any questions you might have.

The CHAIRMAN. Thank you, Mayor. It's nice to have mayors and local officials here, because they're actually people who have power to get things done.

[Laughter.]

The CHAIRMAN. So, next up, Mr. Reed.

## STATEMENT OF CORY J. REED, SENIOR VICE PRESIDENT, INTELLIGENT SOLUTIONS, DEERE & COMPANY

Mr. REED. Chairman Thune, Ranking Member Nelson, and members of the Committee, good morning. My name is Cory Reed, and I'm the Senior Vice President for Intelligent Solutions at John Deere. That's the precision ag business at John Deere. Thank you for the opportunity to testify today.

John Deere is a global manufacturer and provider of agriculture, construction, turf, and forestry equipment and services. We serve customers around the world who cultivate, harvest, and build upon the land to meet the growing need for food, fuel, fiber, and infrastructure. Deere has been providing innovative equipment and services to serve these customers since 1837. Today, Deere is pioneering state-of-the-art data and information solutions designed to greatly enhance productivity and sustainability.

This topic is of central importance to the vitality of rural America, and, in particular, the U.S. agricultural sector. Despite the remarkable growth and innovation in broadband technologies nationwide, too many rural communities today lag behind in access to those technologies and the benefits that they bring. John Deere is acutely aware of this gap and the challenges it presents for agriculture.

The modern economics of farming have transformed production agriculture into a technology-driven sector increasingly dependent on access to broadband. The Internet of Things in rural America includes not only smart meters and appliances, but also smart tractors, combines, and production systems. In fact, the rapid adoption of data-driven technologies and services across the ag economy today is as transformational as was the introduction of mechanization to farming nearly 100 years ago.

With this in mind, I'd like to share five specific ideas that Deere believes can close the gaps between those that have access to broadband and those that do not:

First, rural broadband programs must make deployment in agricultural areas a priority to address the needs of U.S. farmers and rural communities. Farmers are compelled by long-term demand trends to achieve and sustain unprecedented high levels of productivity by increasing yields and managing input costs with finite amounts of land and water. And the stakes for the future of the U.S. ag sector are high. As you know, rural populations have declined over the last several years, and rural economic growth has lagged the country as a whole. These pressures in rural America are felt in the ag economy, as well. But, we also know that increased agricultural productivity arising from technology innovation and adoption can help revitalize these same rural communities.

Second, broadband deployment policies must include mobile as well as fixed services. Wherever possible, farmers are using precision agriculture technologies, including GPS-enabled technologies, that depend on high-speed wireless broadband to communicate with customers and vendors to obtain realtime information on field conditions, weather, and other environmental factors, to follow commodity markets, and to manage fleets. New technologies enable more prescriptive use of soils, water, fertilizer, herbicides, and fuel. They allow farming practices and applications to be tailored to the specific conditions of an individual field. With access to mobile broadband services, farmers can employ innovative machine-to-machine operations in the field and machine-to-farm communications from the field, and achieve significant improvements in productivity and cost management.

Mobile broadband services are essential to broadband deployment in rural areas where infrastructure, land acquisition, and right-of-way cost to serve large areas can be high, and the potential subscriber population can be small relative to urban and suburban areas. To enable realtime sharing of data and communications, including machine-to-machine and machine-to-field interactions, precision agriculture requires access to both reliable wireless and wireline broadband services. However, today's reality is that access to mobile and fixed broadband coverage in the fields where ag equipment operates falls short of what's needed and will be needed. For these reasons, Deere supports the retention and expansion of the FCC's Mobility Fund and other funding sources, as well as infrastructure policies and rules aimed at supporting expansion of rural mobile services.

Third, Federal policies and programs should assess broadband coverage goals based on geographic area and functional use, includ-

ing deployment in active croplands. Deere believes Federal agencies should review broadband availability through an expanded lens, one that incorporates a geographic and functional-use metric aimed at advancing deployment to commercial and economic activities where access has fallen behind. Historically, FCC, NTIA, and USDA funding programs supporting broadband deployment have focused on last-mile connections to residential consumers and anchor institutions. Cropland areas where farming is done have lagged behind in adequate mobile coverage. To address this gap, the metric of broadband access in active croplands and farm buildings should be considered in identifying areas of need. Cropland coverage can be assessed using USDA's GIS data for crop operations, the U.S. Geological Service's Land-Use Classification, or other data bases. Given their economic and commercial importance to rural communities, farming operations should receive priority in implementing rural broadband support, and should be considered anchor institutions for purposes of existing support programs.

Fourth, broadband deployment funding programs need to be updated and expanded. Deere endorses the expansion of the Universal Service Fund to include backhaul capacity and a variety of middle-mile projects. Effective rural broadband services require backhaul capacity to keep up with expanding broadband demand. Further, all providers should be eligible to receive support for middle-mile facilities that support wireline backhaul for mobile broadband, not just for middle-mile facilities that support wired last-mile connections.

Finally, infrastructure policies should be evaluated to promote rural and agricultural access to broadband. Deere supports efforts to promote the expansion of the infrastructure necessary for wireless broadband deployment in rural and agricultural areas. In particular, we would encourage actions to streamline procedures for siting wireless towers and infrastructure and installing conduit. We must ensure that all unnecessary barriers are removed.

In conclusion, let me reiterate that the future of our rural communities is closely linked to the strength of American agriculture. That future in an increasingly technology-dependent global environment will be determined by whether agricultural operations have full access to advanced wireless services, including high-speed wireless broadband.

Again, thank you for the opportunity to share Deere's perspective on this critically important topic, and I look forward to your questions.

[The prepared statement of Mr. Reed follows:]

PREPARED STATEMENT OF CORY J. REED, SENIOR VICE PRESIDENT, INTELLIGENT SOLUTIONS, DEERE & COMPANY

Chairman Thune, Ranking Member Nelson, and members of the Committee, thank you for holding this important hearing and for the opportunity to testify today on behalf of Deere & Company. John Deere is a global leader in the manufacture of agricultural, construction, turf and forestry equipment. Deere provides advanced agricultural and other equipment and services to customers that cultivate, harvest, transform, enrich and build upon the land to meet the world's dramatically increasing need for food, fuel, fiber and infrastructure. Deere has been providing innovative equipment and services to customers since 1837, and today, is pioneering state-of-the-art data and information solutions designed to greatly enhance productivity and sustainability.

This topic is of central importance to the economic vitality of the Nation's rural communities, generally, and to the agricultural sector, in particular. Today, access to mobile broadband services is an essential component of a healthy and growing national economy. Rapid developments in broadband technology have not only opened unprecedented opportunities for economic activity, but also for education, health care services and cultural development. Despite the remarkable nationwide growth and innovation in broadband and advanced technologies, however, too many rural communities in the United States lag significantly behind in access to those technologies and the extraordinary benefits that they can bring.

We at John Deere are acutely aware of this technology gap and the special difficulties it presents for the agricultural sector. The challenging economics of farming and the need to meet long-term demand have transformed agriculture in the U.S. and many other countries into a technology-driven sector increasingly dependent on access to broadband. The "Internet of Things" in rural America includes not only smart meters and smart appliances, but also smart tractors, combines, and production systems. In fact, the rapid adoption of information technologies and services across the agricultural economy today is no less significant than was the introduction of mechanization to farming almost 100 years ago.

Deere greatly appreciates this opportunity to discuss with the Committee the urgent need that we see for actions that will promote rapid deployment of broadband facilities and services in the agricultural sector. I am pleased to share several recommendations for steps that can be taken to bridge the gaps between those that have access to broadband and those that do not.

**Rural Broadband Programs Must Make Deployment in Agricultural Areas a Priority to Address the Expanding Needs of American Farmers and Rural Communities**

Megatrends in the today's global agricultural sector make accelerated deployment of expanded broadband systems and services critical. Farmers are compelled by long-term demand to sustain unprecedented high levels of productivity by carefully managing costs while increasing yields from a finite amount of land. World population is projected to climb from approximately 7 billion today to more than 9 billion by 2050. This means that every hour, there are an additional 9,000 new mouths to feed globally, which equates to roughly enough new people to fill Washington Nationals Park more than five times each and every day. As incomes around the world rise, animal protein becomes a larger component of average diets. This, in turn, generates greater demand for grains. In most of the world there is a rising trend in farm sizes, scale and specialization as economies develop. Environmental sustainability and compliance is a growing challenge, and the supply of skilled labor for agriculture is not enough to meet the demand.

The stakes for the future of the Ag sector are high. Agriculture and agriculture-related industries contributed $789 billion to the U.S. gross domestic product (GDP) in 2013, a 4.7-percent share.[1] The agricultural economy extends to a wide range of other sectors that contribute added value to the economy. In 2013, 16.9 million full- and part-time jobs were related to agriculture—about 9.2 percent of total U.S. employment. Direct on-farm employment provided over 2.6 million of these jobs. Employment in related industries supported another 14.2 million jobs.[2]

While the U.S. economy is now in its sixth year of recovery from recession, it remains fragile in some aspects, especially in rural areas. Urban employment now exceeds pre-recession levels but rural employment persists at levels well below its 2007 peak.[3] Rural populations have declined over the last several years, and 779 rural counties continued to lose jobs in 2014.[4] The population, economic and employment pressures in rural America continue to affect the agricultural sector. Between 2007 and 2012, the number of U.S. farms decreased by 4.3 percent.[5] One important bright spot in today's rural areas is increased productivity, arising from technology innovation and adoption that has fueled growth in U.S. agriculture.[6]

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[1] *See* USDA, Ag and Food Sectors and the Economy, available at: *http://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy.aspx.*

[2] *See id.*

[3] *See* USDA, Rural America at a Glance, 2014, at 1, available at: *http://www.ers.usda.gov/media/1697681/eb26.pdf.*

[4] *See id.* at 1.

[5] *See* USDA, Preliminary Report Highlights, U.S. Farms and Farmers (Feb. 2014), available at: *http://www.agcensus.usda.gov/Publications/2012/Preliminary_Report/Highlights.pdf.*

[6] *See* USDA, Agricultural Productivity, available at: *http://www.ers.usda.gov/topics/farm-economy/agricultural-productivity.aspx.*

## II. Broadband Deployment Policies Must Include Mobile, as Well as Fixed Services

The impacts of these megatrends are an everyday reality for American farmers who face constant pressure to improve efficiency, environmental stewardship, and output. For this purpose, farmers look to advanced smart farming technology solutions, including solutions that take advantage of mobile and fixed broadband access. Today, producers are able to farm to within a few centimeters of accuracy thanks to innovative GPS-enabled positioning systems that are now standard on virtually all modern farming equipment, as supplemented with data available from satellite signals. Using these high precision techniques, advanced agricultural equipment and services now include technology that provides real-time agronomic data that can be analyzed to optimize the precise amount of seed, fertilizer and pesticides needed, reduce costs for fuel, labor, water, and identify best practices for fields in a given location. (Deere's Precision Ag Technologies, for instance, gives farmers access to detailed agronomic information in the field essential for improved decision-making with respect to managing costs and recourses.)

Where possible, producers using these precision agriculture techniques communicate via high-speed wireless broadband with customers and vendors, follow commodity markets, obtain real-time information on field conditions, weather and other environmental factors, and manage fleets and regulatory compliance. With access to mobile broadband services, farmers can also employ innovative machine-to-machine ("M2M") operations in the field and machine-to-farm ("M2F") from the field that enable producers to make significant improvements in real-time productivity and cost management.

Today these technologies are making an enormous contribution to improved used of limited resources, regulatory compliance and Ag sustainability. Precision technologies are enabling more efficient, prescriptive use of soils, water, fertilizer, herbicides and fuel by allowing producers to tailor farming practices and applications to the specific conditions of an individual field.

For example, when the farmer leaves his field in the fall, he is able to share harvest yields directly and immediately with trusted agronomist advisors. This helps the advisor to prescribe the appropriate amount of nutrients to be added back to the soil, based only on what the farmer took off at harvest, and ensure those nutrients are added and incorporated before winter. The farmer can also make decisions on which seeds to buy for next year, taking advantage of early order price discounts. By reducing inputs, improving resource management, minimizing land impacts and lowering costs, these technologies are delivering the promise of sustainability on the farm.

The economic impact of these technologies is significant. According to recent reports, data-driven decisions about irrigation, fertilization and harvesting can increase corn farm profitability by $5 to $100 per acre, and a recent 6-month pilot study found precision agriculture improved overall crop productivity by 15 percent.[7]

We must take steps now to bridge the gap between rural broadband availability and urban and suburban broadband availability. Mobile services, not only wireline fixed services, are essential to broadband deployment in rural and remote areas where infrastructure, land acquisition, and right-of-way costs are higher on a per capita basis than that of urban and suburban areas. To enable real-time sharing of data and communications, including in the context of innovative M2M and M2F interactions, precision agriculture technology requires access to both reliable mobile and wireline broadband services.

However, the harsh reality in the rural U.S. is that there is a significant lack of access to adequate mobile and fixed broadband coverage in the fields where agricultural equipment operates. Today, many John Deere customers are challenged by this lack of adequate mobile coverage. Deere's JDLink™ data service, for example, currently relies on the cellular telephone network to transmit telemetric machine operation data. The lack of coverage needed for these solutions to transmit telemetric data from the machines, already a concern, will only become more problematic as data volumes increase. In rural areas where farm machines operate today, JDLink™ data transmissions have a 70 percent successful call completion rate. Without significant improvements in cell coverage in agricultural areas, Deere expects that this figure could drop to about 50 percent in two to three years as agricultural demand for wireless broadband services increases. For these reasons, Deere supports the retention and even expansion of the FCC's Mobility fund and other

[7] *See* Kurt Marko, Forbes, Precision Agriculture Eats Data, CPUC Cycles: It's a Perfect Fit for Cloud Services (Aug. 25, 2015), available at: *http://www.forbes.com/sites/kurtmarko/2015/08/25/precision-ag-cloud/*.

funding sources as well as infrastructure policies and rules aimed at supporting expansion of rural mobile services.

**III. Deployment Policies and Programs Should Assess Broadband Coverage Goals Based on Geographic Area and Functional Use; Croplands Require Coverage and Farms Should be Treated as Anchor Institutions**

Deere believes it is time for Federal agencies with broadband deployment mandates to view broadband availability through an expanded lens—one that incorporates a geographic and functional usage metric aimed at advancing broadband deployment to industries and economic activities where access to this key input has fallen behind. Broadband access in active croplands, in particular, should be included as a metric in identifying areas of need and farm operations should be treated as "anchor institutions" for the purposes of existing support programs. While fixed broadband has penetrated the residential and business areas of many rural communities, the cropland areas where farming is done lags far behind in adequate mobile broadband access. Yet agricultural operations are no less important to the economic vitality of these same communities than are those commercial entities served by fixed broadband. By supporting increased wireless broadband deployment in areas where most farming operations occur (*i.e.,* in the fields), rural communities and the U.S. economy will benefit through increased economic growth, improved environmental stewardship, and enhanced food security.

Historically, Federal funding programs at the FCC, NTIA and USDA aimed at spurring broadband deployment have focused on enabling last-mile connections to residential consumers and "anchor institutions," defined generally to include healthcare providers, schools, and libraries, as well as middle-mile facilities that enable last-mile connections to these ends. This assessment framework overlooks significant geographic and functional-use areas of broadband demand and coverage, and the benefits that deployment to such unserved and underserved areas can create. Large swaths of agricultural land in the United States—where people do not reside, but where they work and contribute to the rural and national economy—are wholly lacking broadband coverage.

To address this gap, broadband access in active croplands (and farm buildings) should be included as a metric for identifying areas of need. There are a number of ways that "cropland" coverage can be assessed including by using the USDA's GIS data for crop operations or the U.S. geological Survey's (USGS) Land Use classification.

It should be noted that farms represent a significant center of rural commercial activity. Owners, employees, buyers and vendors all conduct business in farm facilities and thus are important locations in rural communities. On that basis, as "anchor" institutions, farm operations should be given priority in implementing rural broadband support programs.[8]

Deere also recommends that government broadband support programs should count machine-to-machine mobile broadband transmissions, by agricultural equipment in the field and associated operators' mobile devices, when assessing the status of mobile broadband deployment. By counting the number of machines with modems working the 300+ million acres of cropland in the United States, program administrators will have better information to more accurately assess the availability and lack of availability of advanced broadband services in rural areas, and can then consider targeted ways to strengthen funding to those rural areas of the country that need it most. Counting only rural populations fails to account for the growth in modems imbedded in agricultural machinery or the economic impacts of the Ag sector.

**IV. Funding Programs Need to Be Updated and Expanded**

Deere endorses the expansion of the Universal Service Fund (USF) to include backhaul capacity and a variety of middle-mile projects. Effective rural broadband service requires backhaul capacity to keep up with expanding broadband demand. Further, all providers should be eligible to receive support for middle-mile facilities that support wireline backhaul for mobile broadband, not just for middle mile facilities that support wired last mile connections.

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[8] Although the USDA reports that sixty-seven percent (67 percent) of U.S. farms had Internet service (DSL, wireless, cable, and satellite) in 2013, compared with sixty two percent (62 percent) in 2011 these figures do not reflect connectivity acreage under active crop production and whether the access that is being detected to the farmhouse is in fact sufficient to support today's smart farming operations. *See* USDA, NASS, *Farm Computer Usage and Ownership* (Aug. 2013), available at: *http://www.nass.usda.gov/Publications/Methodology__and__Data__Quality/Computer__Usage/08__2013/fmpc0813.pdf.*

We should also allow USF support for standalone broadband services not tied to traditional telephone services. The widespread availability of standalone broadband service will give consumers greater choice in service and providers and will avoid rules that effectively force consumers to purchase services they do not want.

**V. Infrastructure Policies Should be Evaluated to Promote Rural and Agricultural Access to Broadband**

Finally, Deere supports efforts to promote expansion of the infrastructure necessary to expand wireless broadband deployment in rural and agricultural areas. In particular, we would encourage actions that streamline procedures for siting wireless tower infrastructure and installing conduit. We must ensure that all unnecessary barriers are removed, including delays and expense associated with permitting, federal, state and local siting approvals, and approvals to access highway and other rights of way. "Dig once" policies that avoid repeated excavations and the attendant costs delays, and disruptions, should be encouraged.

**Conclusion**

The future of our rural communities is closely linked to the strength of American agriculture. Today, the outlook for both is challenging but bright given the resourcefulness of American farmers, the advent of precision agriculture and other innovative farming technologies and the Nation's extensive agricultural resources. Whether our rural communities are able to thrive in an increasingly technology-dependent world will be determined by whether we are successful in ensuring that agricultural operations have full access to advanced wireless services and technologies including high-speed broadband.

I appreciate the opportunity to provide the Committee some perspective on this critically important topic. Thank you all for your work and engagement in exploring solutions. I look forward to answering your questions and being an ongoing resource to the Committee. Thank you.

The CHAIRMAN. Thank you, Mr. Reed.

Mr. Morrison.

**STATEMENT OF BRUCE MORRISON, VICE PRESIDENT, OPERATIONS AND NETWORK BUILD, ERICSSON INC.**

Mr. MORRISON. Thank you, Mr. Chairman, Ranking Member Mr. Nelson, and good morning to all the members of the Committee.

My name is Bruce Morrison, and I lead the team that builds, deploys, and manages networks for Ericsson here in North America. That includes real estate acquisition and permitting tower erection, leads base-station radio installation, and everything in between. Ericsson has thousands of employees and subcontractors handling the deployment of broadband networks in the United States, including the integration of tens of thousands of communications sites in the last year alone. In my 15 years of infrastructure deployment, I have seen tremendous change in progress, and I look forward to sharing some of that experience with you here today.

At Ericsson, we believe in a networked society, where individuals and industries are empowered to reach their full potential. Our infrastructure services and software enable and improve the efficiency of networks around the globe. Forty percent of the world's mobile traffic is carried over an Ericsson network. Those metrics indicate just how far Ericsson has come since its founding, 139 years ago. Back then, the Senate was made up of only 76 members, and the wonder known as Mount Rushmore wouldn't break ground for another 50 years. As you can imagine, we have learned a great deal since then.

Mr. Chairman, you understand the importance of networks driven by access deficient—sufficient spectrum, and we would like to applaud your efforts, and those of this entire committee, to identify

spectrum for licensed use. Licensed spectrum remains the best option available today to meet insatiable consumer demand. It also ensures that the networks we build and operate handle traffic as efficiently as possible. For example, underserved communities will benefit from the Federal Communications Commission upcoming 600 megahertz auction, spectrum ideally suited for rural communities. That's where the importance of unfettered infrastructure deployment, the subject of today's hearing, comes into play.

Decades ago, wireless deployment served only a narrow purpose for a narrow constituency. Today, it provides nearly limitless ways to make life easier for all people through the power of mobility. As we enter the next generation of 5G technology, we know that mobility encompasses more than telecommunications, and that includes enhanced user experience through the Internet of Things and enterprise applications such as utility smart grids. The key to all this, however, is connectivity through both access and coverage.

Now more than ever we must think beyond our coverage bars on our phones and to bandwidth capable of streaming video, supporting wireless applications, and connecting smart appliances. With every innovation comes the need for more wireless infrastructure, and not simply the 300-foot-towers-along-the-highway variety. We're talking about small cells, low-powered radio access points that mobile operators use to extend service coverage and increase network capacity on light and power poles, including building facades, and even on bus stops, all to provide connectivity on each city block. With spectrum being so scarce, it is small-cell technology that will allow you to launch your favorite application or stream a video in downtown Washington in the year 2020.

Today, Ericsson's focus is centered on delivering the highest-quality speed and service to meet ever-increasing customer demand. Ericsson's own statistics, released in August, cited a 55-percent growth in data traffic year-over-year between the second quarters of 2014 and 2015 alone. To help satisfy that need, we're implementing new approaches, like using small cells and micro facilities installed on light and utility poles, upgrading existing antennas with better capacity and the ability to use multiple frequency ranges, replacing older T1 backhaul with higher-capacity fiber, and finally, deploying temporary facilities for festivals, parades, and sporting events to meet short-term demand.

For its part, the Federal Government has made some important strides to help remove existing barriers to broadband deployment. For example, the FCC shot clock has reduced to months, a zoning and permitting approval process that often dragged on for years. In addition, Federal efforts to assist local jurisdictions to expedite the deployment of equipment for facilities that meet certain criteria have been very helpful. And, of course, Federal programs such as the Connect America Fund, or CAF, provide badly needed resources for broadband services in our rural communities.

These efforts have been effective, but there's still plenty more that can be done. In my submitted testimony, I provide in greater detail ways that Congress and the Federal Government can even—be even more helpful in removing barriers to deployment. But, for the purpose of this statement, I will highlight three key suggestions: streamlining access and jurisdictional processes for the in-

stallation and deployment of dark fiber and small-cell technology; streamlining access to light and utility bowls to standardize deployments; and finally, standardizing the application process for the deployment of wireless infrastructure on federally owned buildings and property, the idea incorporated into the Wireless Innovation Act.

Mr. Chairman, these steps to reduce regulatory bureaucratic red tape may not sound terribly exciting, but they're absolutely critical to our ability to carry out our vision and your vision to reduce the cost of deploying wireless broadband services.

Looking ahead, the future is exciting and our mission remains clear: to transform networks, which will, in turn, transform businesses and communities, nations and governments, and, most importantly, lives. Ericsson remains committed to delivering on this promise, have a networked society, and looks forward to working with Congress and the Federal Government to accomplish that goal.

Thank you again, Mr. Chairman, for the opportunity today to be here, and I look forward to answering any questions the Committee may have.

[The prepared statement of Mr. Morrison follows:]

PREPARED STATEMENT OF BRUCE MORRISON, VICE PRESIDENT, OPERATIONS AND NETWORK BUILD, ERICSSON INC.

**Summary of Key Points**

- At Ericsson, we believe in a "Networked Society," where individuals and industries are empowered to reach their full potential.
- Licensed spectrum remains the best option available today to meet insatiable consumer demand.
- Decades ago, wireless deployment served only a narrow purpose for a narrow constituency. Today, it provides nearly limitless ways to make life easier for all people through the power of mobility.
- With every innovation comes the need for more wireless infrastructure such as small cells—low-powered radio access points that mobile operators use to extend service coverage and increase network capacity.
- To help deliver the highest quality speed and service to meet ever-increasing demand, Ericsson is implementing new approaches like:
  - Using small cells and micro-facilities;
  - Upgrading existing antennas;
  - Installing high-capacity fiber;
  - Implementing new strategies for complex environments; and
  - Deploying temporary facilities to meet short-term demand.
- For its part, the Federal Government has made some important strides to help remove existing barriers to broadband deployment such as the Federal Communication Commission (FCC) shot clock and 'Connect America Fund' (CAF) funding.
- These efforts have been effective, but there is still plenty more that can be done, such as:
  - Streamlining access and jurisdictional processes for the installation and deployment of dark fiber and small cell technology;
  - Streamlining access to light and utility poles to standardize deployments; and
  - Standardizing the application process for the deployment of wireless infrastructure on federally-owned buildings and property, an idea incorporated into S. 1618, "The Wireless Innovation Act."

- Ericsson remains committed to delivering on the promise of a networked society and looks forward to working with Congress and the Federal Government to accomplish that goal.

**Written Testimony of Bruce Morrison, Ericsson Inc.**

Thank you, Mr. Chairman, and good morning to all the members of the Committee. I want to thank you for the kind invitation to be here today.

My name is Bruce Morrison and I lead the team that builds, deploys, and manages networks for Ericsson here in North America. That includes real-estate acquisition and permitting, tower construction, radio base station installation, and everything in between. Ericsson has thousands of employees and subcontractors handling the deployment of broadband networks in the United States, including the integration of tens of thousands of communication sites in the last year alone. In my fifteen years of infrastructure deployment, I have seen tremendous change and progress, and I look forward to sharing some of that experience with you here today.

At Ericsson, we believe in a "Networked Society," where individuals and industries are empowered to reach their full potential. Our infrastructure, services, and software enable and improve the efficiency of networks around the globe. Forty percent of the world's mobile traffic is carried over Ericsson networks.

Those metrics indicate just how far Ericsson has come since its founding 139 years ago. Back then, Senator Hannibal Hamlin, Abraham Lincoln's Vice President, walked these very halls; the Senate was made up of only 76 members; and the wonder known as Mount Rushmore wouldn't break ground for another 50 years. As you can imagine, we have learned a great deal since then.

Mr. Chairman, you understand the importance of networks driven by access to sufficient spectrum. And we would like to applaud your efforts, and those of this entire committee, to identify spectrum for licensed use. Licensed spectrum remains the best option available today to meet insatiable consumer demand. It also ensures that the networks we build and operate handle traffic as efficiently as possible. For example, underserved communities will benefit from the Federal Communications Commission's (FCC) upcoming 600Mhz auction, spectrum ideally suited for rural communities. That's where the importance of unfettered infrastructure deployment, the subject of today's hearing, comes into play.

Decades ago, wireless deployment served only a narrow purpose for a narrow constituency. Today, it provides nearly limitless ways to make life easier for all people through the power of mobility. As we enter the next generation of 5G technology, we know that mobility encompasses more than telecommunications. It includes enhanced user experience through the "Internet of Things" and enterprise applications such as utility smart grids. The key to all of this, however, is connectivity through both access and coverage.

Now, more than ever, we must think beyond the coverage bars on our phones to bandwidth capable of streaming video, supporting wireless applications, and connecting smart appliances. With every innovation comes the need for more wireless infrastructure and not simply the 300-foot-towers-along-the-highway variety. We're talking about small cells—low-powered radio access points that mobile operators use to extend service coverage and increase network capacity—on light and power poles, building facades, and even bus stops, all to provide connectivity on each city block. With spectrum being so scarce, it is small-cell technology that will allow you to launch your favorite application or stream a video in downtown Washington in the year 2020.

Today, Ericsson's focus is centered on delivering the highest quality speed and service to meet ever-increasing demand. Ericsson's own statistics, released in August, cited a 55 percent growth in data traffic year-over-year between the second quarters of 2014 and 2015 alone. To help satisfy that need, we are implementing new approaches like:

- Using small cells and micro-facilities installed on light and utility poles;
- Upgrading existing antennas with better capacity and the ability to use multiple frequency ranges;
- Replacing older T1 backhaul with higher-capacity fiber;
- Implementing new strategies for complex environments like stadiums; and
- Deploying temporary facilities for festivals, parades, and sporting events to meet short term demand.

For its part, the Federal Government has made some important strides to help remove existing barriers to broadband deployment. For example, the FCC's shot clock has reduced to months, a zoning and permitting approval process that often dragged on for years. In addition, Federal efforts to assist local jurisdictions to expe-

dite the deployment of equipment for facilities that meet certain criteria have been very helpful. And of course, Federal programs such as the "Connect America Fund" or "CAF," provide badly needed resources for broadband services in our rural communities.

In addition, the Telecommunications Act of 1996 allowed jurisdictions to rewrite relevant rules which have allowed for cell site facilities. Many jurisdictions have also allowed a hierarchy for siting priority that streamlines deployment for facilities. Examples include:

- Collocations on existing structures/buildings/water tanks that were exempt from zoning requirements;
- Exemption from public hearing and public notice requirements for facilities that meet certain requirements;
- Exemption or administrative review process for facilities in commercial or industry zoning classifications;
- Exemption or administrative review process for facilities designed with stealth technology;
- Expansion of new locations and designated contacts established for cell site facilities available on Federal and state land, on city and county parks, in utility districts (water tanks, power poles, transmission towers, etc.), and on right of ways.

These efforts have been effective, but there is still plenty more that can be done by Congress and the Federal Government to help removing barriers to deployment. They include:

- Streamlining access and jurisdictional processes for the installation and deployment of dark fiber and small cell technology;
- Standardizing the application process for the deployment of wireless infrastructure on federally owned buildings and property, an idea incorporated into S. 1618, The Wireless Innovation Act;
- Streamlining access to light and utility poles to standardize deployments;
- Distinguishing process requirements so that the installation of equipment on a flag pole isn't considered the same as doing so at a stadium or a hospital;
- Assisting jurisdictions to process the use of small cells;
- Providing relief from onerous Federal requirements that lack technical descriptions;
- Advancing a regulatory approach that allows the quick deployment of small cells in metropolitan jurisdictions;
- Updating the current rules surrounding "Local Exchange Carriers" support and deployment requirements for backhaul;
- Improving the "Mobility Fund" by targeting infrastructure funding to truly unserved areas. Senator Joe Manchin recently sent a letter to the FCC supporting this idea;
- Improving the "Spectrum Relocation Fund" to increase its flexibility and to provide for new allowable uses of funds to facilitate improved spectrum planning and relocation while improving spectrum utilization. These reforms would hasten the transition of government spectrum for commercial use which we strongly endorse. Senators Jerry Moran and Mark Udall recently sent a letter to the Office of Management and Budget outlining areas where improvements can be made;
- Developing requirements or support for shared infrastructure and hardening. For example, at a typical cellular tower, each wireless carrier has its own generator. Shared infrastructure would mean that only one generator is required per site; and
- Implementing a requirement to incorporate dark fiber or green field (empty) conduit attached to all federally-funded roadway projects.

Mr. Chairman, these are just a few areas where Congress could assist infrastructure companies like Ericsson in carrying out your vision to "reduce the cost of deploying wireless broadband services."

Looking ahead, the future is exciting and our mission remains clear—to transform networks which will in turn transform businesses and communities, nations and governments, and most importantly, lives. Ericsson remains committed to delivering on the promise of a networked society and looks forward to working with Congress and the Federal Government to accomplish that goal.

Thank you again, Mr. Chairman, for the opportunity to be here today and I look forward to answering any questions the Committee has.

The CHAIRMAN. Thank you, Mr. Morrison.

We'll proceed to 5-minute rounds of questions.

And I would just point out that this particular tool [holds up smartphone] right here, if connected, is a very powerful tool that can keep me, hopefully, if I know how to use it, somewhat productive. But, without the infrastructure and facilities to support it, it's really nothing more than an expensive paperweight. And that's why the discussion that we're having here today is so important in the overall goal that we have of further getting deployment of broadband across this country.

And, with that in mind, I wanted to turn to Mr. Reed for just a moment. Rural America is well represented on this panel. And so, we understand the unique challenges that are faced in these areas when attempting to spur growth in and ensure the vitality of America's rural economies. So, as such, your mention of a rural technology gap is quite concerning. And you note that cost for infrastructure, land acquisition, and rights-of-way for rural broadband deployment are higher than in urban areas, which I have to say seems somewhat counterintuitive. So, could you perhaps elaborate or address the cause of these costs and the associated impact on our Nation's agricultural sector?

Mr. REED. Yes, I can probably best describe the demand side of what's driving the need, and potentially talk a little bit about the cost.

On the need side, agriculture is going through a transformation, and the competitiveness of that industry is enabled through these services. Customers who in the past—and producers who in the past—have farmed on the average across their operation are today employing technologies that allow them to farm their fields in sub-inch level of accuracy, applying just the right amount of nutrient, the right amount of seed, the right amount of water to get the best response for both agricultural productivity, increase in yield, as well as cost management, not to mention the environmental effects. What this has created is an increasing demand on the infrastructure across rural America. That infrastructure's been met with the need to expand it. And along that expansion, it—a lot of the incentives available for carriers to do that are not available to them to extend their coverage areas into rural America.

Our proposal would include including cropland as a metric for how we determine and use funds available to providers and coverage areas and understand the coverage of rural America. Reducing—we need to reduce the overall cost associated with siting new facilities for those areas. Technically, what's happening is, increasing numbers of machines—it's not just the population; the rural employment is a very small number, overall, of people, but the machines that are going out with these technologies are increasing at increasing levels. Every large ag piece of equipment going into the North American market today is going out equipped with a 3G modem. In the future, it'll be 4G and, in the future, 5G. There's a lot of talk of the auto industry's approach to this. This has been going on in agriculture for nearly a decade. What that's created is tremendous potential, but also tremendous need and demand on

the infrastructure that doesn't always cover those areas of the country, because people now are the primary metric. And, while there are certainly people in communities that depend on that technology, the population is disproportionate to the economic impact and the drivers for production agriculture.

The CHAIRMAN. So, yes, and you're primarily talking about government programs or forms of public assistance that are more——

Mr. REED. Universal Service Fund, the Mobility Fund, those types of funds that are made available for the increase and extension of that infrastructure to not only meet the current demand, but to keep up with what we expect is an increasing growth in demand in the rural community.

The CHAIRMAN. It just seems that the planned acquisition, right-of-way, those sorts of things shouldn't be as much of a obstacle, you might characterize it that way, as it would be in a more urban setting. That was, I guess, what I was trying to sort of get at there.

Mr. Adelstein, in your testimony, you stressed the need to alleviate roadblocks to wireless siting at the local level. And you have specifically proposed removing requirements that a provider demonstrate proof of need or show a gap in service when siting a wireless facility due to the subjective nature of these determinations. So, I guess the question is, How, specifically, would you propose changing the law to remove these deployment barriers while still preserving the right of localities to have a corresponding role in the siting process at the local level?

Mr. ADELSTEIN. Well, Mr. Chairman, we would propose eliminating the gap-in-service test in Sections 332 and 253 of the Act. I think that Mayor Resnick is exactly right, there is a major role for localities in making sure that their consumers' needs are met, but is that role extending to deciding where service is needed? In the old days, people would say, "Well, there's no coverage here, so we need coverage, because there's no bars." But, we've moved from a coverage era to a capacity era. And now what's really driving investment is the need to meet that capacity. So, an extremely complex decision made by our radio-frequency engineers of the carriers and infrastructure providers that determine where there's going to be capacity, where there's going to be demand for it that's going to exceed that capacity. And it's something that's not really in the expertise of local communities. For them to second-guess and say, "Oh, there's no business case here, there's no need, there's no gap in service. I see bars on the phone"—literally, we've heard of consultants running around with a phone, saying, "You know, this phone works." But, they don't understand the complexities that go into it, nor should they; that's not the role of localities. There's an important role for them, I don't think that's one of them. And hopefully we could reach agreement with them on that.

Many localities don't do this. Let's, you know, put—make this clear, that it's those that are the sort of bad actors, the ones that are dragging their heels. Many local communities—and Mayor Resnick has said—have really gotten on it. Ten states have passed laws. But, those that are using this kind of an excuse to delay deployment, I think, is something that the Act could resolve.

The CHAIRMAN. All right, and I'll come back to some other questions later, but right now I'll turn to Senator Nelson because my time's expired.

Senator NELSON. Mr. Reed, when you were talking, it occurred to me—Is John Deere planning for the future of driverless tractors?

Mr. REED. So, agriculture has gone through tremendous change, and that change started with mechanization. Automation is the next of that phase, but, ultimately, optimization through information systems. We've, in fact, in your home state, been operating autonomous vehicles in confined situations in orchards for a number of years. That technology exists today. The ability to automate at that level exists today. And it has enabled, through both the use of GPS technology, machine-to-machine communication, machine-to-farm and to carrier-type technologies. So, the answer is yes.

Senator NELSON. And would the wireless technology, in addition to the GPS if you're operating directly off the satellite—does that enhance the ability for——

Mr. REED. It—yes—absolutely enhances the ability. They're complementary to one another. What wireless cannot do is give the level of precision of GPS. With GPS, we're able to get to sub-inch-level accuracy——

Senator NELSON. Right.

Mr. REED.—within 2 centimeters of accuracy. What wireless does is allow broad access to data communications on and off of the machine, which supplements that and moves both machine and agronomic data on and off of machines to both raise production and lower cost.

Senator NELSON. So, Mr. Chairman, you could be a gentlemen farmer. You could be plowing your field while you're sitting back drinking your cup of coffee in the farmhouse.

[Laughter.]

The CHAIRMAN. That's the kind of farming I would like, yes.

Senator NELSON. Mr. Adelstein, what has this shift in technology meant for infrastructure siting? Is it more difficult or is it easier to get approvals for small cells?

Mr. ADELSTEIN. Well, we're working closely with the FCC on small cells to facilitate deployment of them and distribute antenna systems. And I think the FCC's made some progress trying to make sure that there's a ability to get it sited on poles, in particular. We find that, inside of buildings, there's no real regulatory issues. It's more the outside deployments that can run into issues. And we want to make sure that we respect historical and local concerns, but, at the same time, we need to facilitate small cells.

So, I think that, you know, localities are increasingly getting it. I have to hand it to Mayor Resnick and the others that—they have these devices, too, and they know, as he said, what it means to their communities. So, we're seeing a number of states act to facilitate deployment. We're seeing some localities do it. But, there are some that don't, and that, for some reason, resist. And those are the ones I think we need to sort of bring everybody up to the excellent level of those that recognize that this is essential to their communities. And the shift to small cell and DAS is because of this capacity issue I was talking about. That's targeting in, particularly, urban areas, many of which, in your State, require more capacity

in downtown or dense areas, where there might not be room for a macro tower, a smaller cell.

Senator NELSON. Mr. Mayor, tell me, how has the availability of small cell technology affected the local review of the siting process?

Put your microphone on, please.

Mr. RESNICK. All right, thank you.

As Mr. Adelstein said, many local governments and states have amended their codes and how they process applications, particularly for small cells. We generally encourage and support co-location. And so, if small cells can co-locate on existing facilities, whether they're buildings or existing towers in the rights-of-way or towers on other property, that's certainly an easier review for local governments. Generally, it's just an administrative permitting review, and that's it. There's not a public hearing required for review of co-locations in those circumstances.

So, many local governments actually need more education as to how small cells work, how they're going to be deployed, and how they can support the communications services in their communities.

Mr. ADELSTEIN. Mr. Chairman, could I just add one point to that, which is that sometimes localities are telling us, "Hey, you could put a DAS system or a small cell system in, when a macro tower might make a lot more sense." It's a lot more expensive, it doesn't provide the same level of coverage. And that's an area where we get a little bit concerned about it. They try to dictate what the technology is as most efficient. Frankly, there's not enough capital to go around, and we need to do this as efficiently as possible. Sometimes——

Senator NELSON. Are we getting to the point, for our local elected officials, that the technology has advanced so much that the harassment and the huge controversies that would occur over the big tower that was so ugly, that now you've got this capability of putting these small cells that are almost undetectable—have we gotten to that point, Mr. Mayor?

Mr. RESNICK. Well, I still see, and I hear from my colleagues, that there still are plenty of applications for large towers. Yes, the small-cell technology seems to be growing and does offer a lot of alternatives to constructing these huge towers, which have a lot of issues, have a lot of problems, but the applications for large towers actually is not diminished, at least with respect to the communities that I'm familiar with in Florida. And NLC is indicated, as well, around the country. They're still—it seems, actually, to be growing now, the need for the industry to want to construct large towers, as opposed to small cells.

Senator NELSON. Well, when you get a controversy over a large tower, do you have any magic solutions on this?

Mr. RESNICK. Generally—a lot of local governments do. And many local governments have actually been proactive in this matter. My city, for example, has a large tower that we rented park space to construct the tower on, and that worked out well, because it's camouflaged facility, it's actually a—it's used as a light structure in a ballfield, so it fits with the design of our facility where we rented it. It works for the three carriers that are on it, in terms of providing coverage. When we redid the park—we just spent a

million and a half dollars to redo the park—it still fit into the plans for the park. And many, many communities are doing that, they're proactively identifying locations within their communities where they would like to see towers build. They're not saying, necessarily, "If you apply, we're going to approve it in that area," but they're being proactive about identifying areas where they think it would be appropriate to construct towers, which also the industry likes, because it can streamline the approval process. Communities are identifying those locations, having a sense already of whether there's going to be a lot of public opposition. And so, it could streamline the public hearing process. And it often can give the carriers access to residential areas, where they wouldn't ordinarily be able to find sites. Like, for example—and you may be familiar with this, Senator, but Miami Dade County School District, which is one of the largest school districts in the country—I think it's the fourth-largest school district in the country—has made a policy decision to rent school sites for towers. The carriers and the infrastructure companies would not otherwise get access in those residential areas for towers. They're adjacent, for the most part, to single-family homes. But, this gives them access to property as well as coverage in areas where they ordinarily would not have coverage.

So, yes, in answer to your question, local governments around the country are coming up with their own innovative ways to support large towers, which still need to be constructed.

The CHAIRMAN. Thank you, Senator Nelson.

Senator Wicker.

**STATEMENT OF HON. ROGER F. WICKER,**
**U.S. SENATOR FROM MISSISSIPPI**

Senator WICKER. Thank you.

Mayor Resnick, I appreciate your testimony. You mentioned that, as a result of a collaborative effort, there might be delays in wireless deployment. What is it about the collaborative effort that would stand in the way of wireless deployment?

Mr. RESNICK. I'm not sure I meant to say that collaboration between local governments and the industry would result in delays, but that delays can come from either party. I mean, we've seen tremendous changes in the industry side with respect to technology, how the industry is structured, et cetera, that we've seen, at the local level, result in delays in deployment. For example, a community I work with has had numerous applications from various carriers to co-locate antennas on existing towers in that community, and then they ask the community to stop processing those applications because the industry—that applicant—is going through a change of structure, ownership, whatever. And often those requests for delays will sit for months, years, whatever, until they determine what they're doing, who's acquiring them, who they're acquiring, and whether they still need that site, or not. So, it's not a collaboration between local governments and the industry that causes delays, but it could be delays as a result of different things occurring in the industry.

Senator WICKER. Do you have any suggestions for us in that regard?

Mr. RESNICK. That's a great question.

Senator WICKER. You can take that for the record.

Mr. RESNICK. All right, thank you.

Mr. MORRISON. Mr. Chairman, could I add to this subject?

Senator WICKER. Briefly, yes.

Mr. MORRISON. The Mayor is right, there are still applications coming in for the larger towers. However, Mr. Nelson also pointed out, "Is there a difference between the large towers, which everybody's familiar with, and small cells?" And there is. Again, I would argue that the—or make a point that I did in my testimony that the jurisdictions are actually getting more wireless-friendly. And we have a defined process. It's a defined timeline. It's gone from being a 2 to, you know, year process, it's down to months. So, we thank the local jurisdictions for that.

However, when we do talk small cell, if you just go outside on any urban street, you'll see the light poles. You know, we're looking to go on every third light pole. So, what we would argue is that, you know, putting a, you know, less-than 3-foot, less-than 90 pound piece of equipment shouldn't have the same process or timeline to put up a 300 foot site. So, again, it is industry's job, but we also need the Federal Government to help support us, you know, get that message across that the applications are very different, moving forward.

Thank you.

Senator WICKER. That makes sense to me.

Mr. Kinkoph, given the challenges of achieving sufficient mobile broadband coverage over the Nation's vast rural areas, how will FirstNet assure that public safety personnel in smaller cities and rural communities have reasonably comparable access to the devices and coverage?

Mr. KINKOPH. First, that is an independent agency within NTIA, and it doesn't fall within my area of responsibility, but I would be happy to take back your question to FirstNet.

[Mr. Kinkoph later replied as follows:]

Congress created FirstNet as an independent authority within NTIA responsible for deploying a nationwide, interoperable public safety broadband network. FirstNet reports that it has taken significant steps to meet the requirements set forth in the Middle Class Tax Relief and Job Creation Act of 2012, such as substantial rural coverage milestones in each phase of the network's deployment. These steps have included holding 55 state/territory consultations and collecting over 11,000 data surveys from states and territories to learn directly from public safety where they need coverage, how many and what kinds of devices they may need, as well as their rural deployment priorities.

Additionally, FirstNet has held numerous industry days to engage with rural telecommunications providers and associations to understand their capabilities and gauge their interest in participating in the deployment of the FirstNet network. These industry days are aimed at fostering creative solutions to public safety needs and encouraging partnerships among a diverse set of organizations. FirstNet has also taken steps to ensure that partnerships with rural telecommunications providers are part of the evaluation criteria for the upcoming nationwide Request for Proposals (RFP) that will be key to deploying the nationwide network.

Senator WICKER. OK. So, we'll take that for the record.

Let me get back to John Deere. You know, I—Mr. Reed, I've been trying to wrap my brain around precision agriculture for 15 years now. It's absolutely fascinating. We're going to need to feed and

clothe billions of more people in the world. And precision agriculture is part of that, don't you agree?

Mr. REED. It's absolutely part of it. It's one of the critical enablers with population growth and the needs for increasing productivity. We're able to use this technology to actually put the precise correct amount of seed, nutrients, water, herbicides, crop protection products down only where and when it's needed.

Senator WICKER. So, Senator Thune is sitting in his air-conditioned, huge, multiple-hundred-thousand-dollar implement in South Dakota, drinking his cup of coffee, and there is an inch of soil, I think you've said, and the first half-inch of that soil needs more herbicide than the second half-inch of soil. Is that what you're saying? Or more water or——

Mr. REED. Yes.

Senator WICKER.—or less fertilizer——

Mr. REED. It's a continuum. Historically, most of farming's been done on the average across the farm—average number of seeds—30,000 seeds of corn or 200 pounds of nitrogen. What's happening is, the tools—the connectivity and the analysis tools and the flowing data have allowed us to prescribe to higher and higher levels of resolution the precise amount of input and need, down to the local level. And that moved from acre to square meter. And in institutions like Purdue or University of Illinois, they're working on crop-level, plant-level sensing so that you can provide to the plant exactly what it needs. That's the future. Today, largely that's done at the acre or even square meter level. We're getting to the point where it's moving even higher resolution down, potentially, to the individual plant level.

Senator WICKER. OK. Can you tell us, when you talk about these gaps, what you wish FCC would do and what you wish Congress would do to help us with these gaps?

Mr. REED. I think there are a number of things. You know, we mentioned earlier the cost. Often, the cost is evaluated on a per-capita basis, not as a lens of what's it enabling, in terms of the industry, and cropland being one of those. The opportunity to expand coverage to cropland and expand the use of funds to ensure that cropland is considered as one of the coverage factors is extremely important. To sustain and use the Universal Service Fund to extend support for middle-mile capacity, each one of these—each one of these systems in the geography requires a middle-mile carrier to take that information back and to communicate it back. The ability to increase the Mobility Fund—most of these—and there's a lot of plans that allow for wired facilities, wired broadband into local agricultural communities. These are roving machines. These are wireless machines that need the same connectivity you'd have in a mobile phone to be able to connect to those machines. The Mobility Fund is extremely important. And allow rural carriers to retain their support when they offer standalone broadband that might be decoupled from telephone services. This service is unique from that. And those same rules should apply for standalones—allow delivery to standalone broadband technology.

Senator WICKER. Thank you very much.

And thank you all.

The CHAIRMAN. Thank you, Senator Wicker.

Senator Moran.

**STATEMENT OF HON. JERRY MORAN,**
**U.S. SENATOR FROM KANSAS**

Senator MORAN. Mr. Chairman, thank you very much.

Let me address my question, initially, to Mr. Morrison. Senator Udall and I, along with a number of members of this committee back in April, wrote a letter to the Office of Management and Budget asking them about how they would suggest we improve the Spectrum Reallocation Fund. You've mentioned that letter in your testimony. Pleasing to me is, OMB responded in a very specific and detailed way. It appeared to me they didn't just treat this as a typical congressional response, and I value the input that they're providing. The end goal, here, is to introduce legislation that deals with the issues that they raise, and others, on the topic of spectrum.

What I want you to do is to tell me, about Ericsson or others, what the industry is doing to make mobile broadband technologies more spectrally efficient, and what the result of that could mean, as far as availability of spectrum.

Mr. MORRISON. That's a very good question, Senator.

Ericsson, like other vendors, has worked with many operators that have limited spectrum holdings. And that has forced us and the rest of the industry to come up with innovative technologies for maximizing spectral efficiency in order to keep up with mobile broadband traffic growth. For example, techniques such as carrier aggregation, multiple antenna, MIMO—which is multiple input, multiple output—network coordination, and LTE broadcast. It allows us to increase LTE network capacity and to deliver high-definition video more efficiently without adding new spectrum or new cell site locations.

Network efficiency is continually improving with each new software release, and there are more technology innovations to come. However, these technologies do have their limits, and so it's important that we continue to explore the ways to free up more spectrum for mobile broadband services even as we continue to introduce more efficient radio technology.

Senator MORAN. I think what you're saying is that spectrum efficiency is valuable, important, creates a greater opportunity to use less spectrum in specific applications, but it isn't the total solution to availability of spectrum. We still need access to additional spectrum. That correct?

Mr. MORRISON. That's spot on. The bottom line is that, as a product manufacturer, our customers expect us to be as efficient as possible with the equipment we provide. However, there are limitations. Again, we are looking towards 5G and, again, you know, the benefits that it will bring, from an efficiency perspective, but, at the end of the day, we need more spectrum.

Senator MORAN. Mr. Adelstein indicated he'd like to respond.

Mr. ADELSTEIN. Yes. Well, there's really three basic ways you can get more throughput on existing spectrum. There's additional spectrum. There's better technology, which Mr. Morrison was talking about. And there's infrastructure, a subject of today's hearing. Now, infrastructure, if you densify the network and put more cell sites

in, you can reuse the same spectrum over and over again. So, roughly, if you put ten times as many cell sites in one little area, you can get ten times the throughput. Not exactly, but it's very roughly that way.

If you look at the three different, basically, leverage you can use to get more throughput to address the fact that we have 700-percent increase in demand over the next 5 years projected, technology, we expect, will be maybe 100 percent of that. We just sold $45 billion worth of spectrum that you enacted the ability of FCC to sell. Twelve percent additional spectrum went into that—12 percent more. So, for $45 billion, we got 12 percent. So, there's—12 percent, you got 100 percent, we're still down to 588 percent of that 700 percent to deal with. And, largely, I think, in the next 5 years, infrastructure is going to play the key role for that. And I think that's why this hearing is so critical today.

Senator MORAN. Thank you very much.

Mr. Kinkoph, what can you learn from the private sector, as far as efficiencies?

Mr. KINKOPH. Well, I—from an NTIA standpoint, the spectrum area does not fall in my area of responsibility, but NTIA is currently working on the directive from the President to allocate or identify 500 more megahertz of spectrum. And I—my understanding is, they're about halfway to that. So, I think that's a critical step in ensuring that, over the—by 2020——

Senator MORAN. When is that to be concluded?

Mr. KINKOPH. By 2020 was the directive. I'd be happy, though, to have our spectrum folks that are working on that meet——

Senator MORAN. And I may have interrupted something you else—something else you wanted to say.

Mr. KINKOPH. No, I think we're good.

Senator MORAN. OK.

Mr. Chairman, thank you very much.

The CHAIRMAN. Thank you, Senator Moran.

Senator Gardner.

**STATEMENT OF HON. CORY GARDNER,**
**U.S. SENATOR FROM COLORADO**

Senator GARDNER. Thank you, Mr. Chairman.

And thank you all for being here today.

Mr. Reed, I wanted to talk a little bit more about agriculture broadband needs. And, you know, I can remember when we started in the—first with precision farming, that we would sell subscriptions to a satellite to try to get it if you didn't have a Coast Guard beacon nearby, where you could do some of the work on positioning. And, of course, I know in your testimony you stated you had a 6-month pilot study that found precision ag improved overall crop productivity by 15 percent. I would note that if you used red tractors, not green tractors, that would be 20 percent increase in productivity.

[Laughter.]

Senator GARDNER. But, appreciate the willingness to—as a red tractor dealer, I have to continue to get my jabs in on the green guys. So——

[Laughter.]

Senator GARDNER.—thank you for letting me do that. I'm just kidding.

But, wanted to just maybe get a bigger picture of what—when you pull into a field—when a farmer pulls into a field and they're either, you know, going in with a combine—and what happens to that combine, or maybe a planting is a better example—what happens, if you don't have adequate broadband, to that farmer?

Mr. REED. We can use either of those examples. Essentially, the system for communicating, if it's not available, a lot of the tools available to give customers a more precise use over the land start to get very difficult to use. It reverts to manual approaches of phone calls, people walking on and off of machines, using data sticks, providers having to drive trucks and infrastructure out to connect with the machines to take soil samples. The things that are automated today are possible in a manual state, they're just not scalable that way.

So, today, as the tractor enters the field to plant, the prescription for seed delivery, for nutrient delivery, is wirelessly loaded onto the machine. They press a button, and it, in an automated fashion, executes that prescription across the field. That's the state-of-the-art today. And that's only available when there's communication available to sync between that roving machine and a network that allows it to move back and forth freely.

Senator GARDNER. You know, one of the highest costs, obviously, for a farmer are the inputs to the fertilizer and others that they put into the field. And before precision agriculture, before the ability to really prescribe fertilization application for your particular farm, based on precision farming capabilities, how many times did the co-op, the local co-op come out and have a tank of fertilizer, and that tank was always empty by the time it left the farm. Now, with precision agriculture, that tank isn't always empty. There may be some left over, which means we're doing a much better job of managing our inputs, managing costs, and it's better for the environment that way.

Mr. REED. I think you point out two benefits, both the cost of—both the economics and the environmental side of this are aligned, in that, when we use only the nutrients required or only the seed required or only the crop protection required in a given acre, it's both a cost effect for the production cost side, the competitiveness of the industry, it's also very much an environmental effect, which is only using what's necessary to grow the productivity. Not only can they use less, but, ultimately, by putting what's needed in the right place, they can grow more using those same inputs.

Senator GARDNER. Thank you, Mr. Reed.

Mr. Kinkoph, the Wireless Innovation Act, which Senator Rubio introduced and I'm cosponsoring, requires NTIA, in consultation with the Commission and the Director of the Office of Management and Budget, to develop a framework for determining the commercial value of each Federal spectrum band. Further, every 5 years, the bill requires agencies that use Federal spectrum to compare the opportunity cost of that spectrum to the projected cost of relocating—co-locating, leasing, or contracting out their spectrum use to a commercial provider. Do the agencies have the tools on hand right now that they need to do that sort of economic analysis?

Mr. KINKOPH. As I've indicated, spectrum does not fall into my area of responsibility, but I would be happy to take that back to our spectrum team and——

Senator GARDNER. Fantastic. If you'd do that for the record, that would be great.

[Mr. Kinkoph replied as follows:]

While NTIA is not in a position to evaluate the resources of other agencies, it is highly unlikely that many agencies that use Federal spectrum currently possess the tools, expertise, or relevant information needed to conduct the expansive economic analysis required under the proposed framework. NTIA does not currently have the expertise or resources to develop the framework required by the proposed legislation.

There are numerous challenges in even considering the development of such a framework. Besides requiring a very large commitment of resources, one of the challenges with developing and implementing the proposed framework is the lack of quantifiable data necessary to account for the value of each Federal agency's congressionally-mandated mission. Under statutory changes enacted in 2012, NTIA is responsible for balancing "the best possible and most efficient use of electromagnetic spectrum resources across the Federal Government. . .with the needs and missions of Federal agencies." *(47 U.S.C. §902(b)(2)(U), added by Pub. L. 112–96, title VI, §6410, 126 Stat. 234 (2012))* Determining the opportunity cost of Federal spectrum based on the potential commercial value of the spectrum alone would not adequately account for or incorporate the social value of the government missions or programs that rely on this spectrum. The economic and non-economic societal benefits from meeting the public interest goals that led to Congress mandating and funding an agency's spectrum-dependent missions are difficult to quantify in economic terms. Consequently, quantifying the economic value to "the highest commercial alternative use" would not provide an informative proxy for assessing the total social and economic value of a Federal spectrum assignment. Additionally, since in most cases it is not a single Federal agency utilizing a spectrum band, allocating economic value between the various agency uses would be challenging.

Even if a framework for determining opportunity cost is developed and implemented for a given Federal band, it does not resolve whether it is possible and or practicable to make spectrum available while still ensuring no loss of mission or capability to the Federal agencies. Nearly every band used by the Federal Government is shared among several agencies and developing a relocation or sharing plan with associated costs is difficult, time consuming, and resource intensive., Requiring the agencies to determine potential relocation or sharing costs for every Federal system in every band in which the agencies operate is not practicable and may not lead to a scenario where a comparative cost analysis is possible.

Senator GARDNER. And you may or may not be able to answer this. OMB and NTIA currently, are they working with the agencies so they understand the economic value of their spectrum use?

Mr. KINKOPH. I would also have to take that question back for you.

[Mr. Kinkoph replied as follows:]

As directed in a 2013 Presidential Memorandum, the Administration is continuing to work with the Federal agencies, through the White House Spectrum Policy Team and the Office of Management and Budget (OMB), to evaluate spectrum efficiency in procurements and market-based incentives for the efficient use of Federal spectrum. For years, OMB guidance in Circular A–11 has instructed Federal agencies to consider the economic value of spectrum in weighing alternative proposals for deploying spectrum-based services. This guidance is intended to ensure proper stewardship of the spectrum resource and requires a certification from NTIA for the development or procurement of major spectrum-dependent systems (and all satellite systems) using congressionally appropriated funds.

Senator GARDNER. Thank you.

And another question to you. The Broadband Opportunity Council recommended the expediting of permitting on Federal lands. Was the Council able to do a comparison of Federal agencies and

their efficiencies—or inefficiencies and determine why some are better than others?

Mr. KINKOPH. No, that was not part of the review by the Broadband Opportunity Council. However, they are taking on and continuing on the 1316 616 work to ensure that we look at—and also the historical preservation to ensure that we kind of expedite the current permitting process.

Senator GARDNER. And were you able to come up with a list of your series of best practices as a result of that?

Mr. KINKOPH. That would be part of the work that will be ongoing now that the report has been released.

Senator GARDNER. Thank you.

And, Mr. Adelstein, as you may know, Senators Klobuchar, Daines, and I plan to introduce a broadband infrastructure bill that promises a "dig once" policy to couple broadband expansion with new highway construction and improve the broadband siting process on Federal lands. In your testimony, you described the current process of installing and improving broadband infrastructure on Federal lands as byzantine, and argue that you need predictability and consistency to encourage investment in this space. Do you believe our legislation would move us toward these goals, if you're familiar with it, and simplify the current process? And what does that mean for broadband investment and infrastructure?

Mr. ADELSTEIN. Absolutely. We support the Klobuchar-Gardner bill. I think it's a fantastic idea. It requires broadband conduits to be installed as part of certain highway construction projects. I think that's important for rural and urban areas alike. It's to—designed to reduce the number of repeated excavations that are required, lowers the costs for deployment by avoiding duplicative Federal reviews and the need for multiple permits for work performed at the same location. I think it assists in connecting wireless facilities to larger network by getting those conduits in place. As demand increases, we'll be able to use those to move forward, whether it's for macro cell towers, DAS, or small cells that we talked about earlier. All of these facilities require backhaul. Basically, the wireless antenna's got to get back to the wired network, and these conduits that you would enable through your legislation will facilitate that. So, I think it would be very important legislation to promote broadband deployment.

Senator GARDNER. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Gardner.

Senator Daines.

**STATEMENT OF HON. STEVE DAINES,**
**U.S. SENATOR FROM MONTANA**

Senator DAINES. Thank you, Mr. Chairman.

Couple of weeks ago, we had a high-tech job summit in my hometown of Bozeman. Six hundred people showed up. Couple of our keynote speakers—one was Dr. Craig Barrett, of Intel fame, joined Intel in 1974, rose, became CEO 1998, and served as CEO til 2005. We had Doug Burgum there, of Intel, of—which, when it went through the—really, the high-growth phase—we had Doug Burgum there, the founder of Great Plains Software, as keynotes. And why

were they in Montana, keynoting an event? Because they were on their way to hunt, with their bows, elk and mule deer. And you have an intersection now of elk and electrons that are creating this revolution going on in the high-tech world, this high-tech ecosystem that we are seeing across much of western Montana.

But, one of the challenges that we face, certainly, is broadband and connectivity. In fact, this year members of the Northern Cheyenne Indian Reservation will have, finally, access to 3G service for the first time. So, we're not fighting for 4G and 5G right now in parts of Montana, we're happy to get to 3G at this moment here, and the Northern Cheyenne finally will have access to it. But, the fact is, many of our rural consumers and our tribes lack access to basic service and access to any kind of broadband on most tribal lands in Montana. It's virtually nonexistent.

And we've seen these high-tech jobs are growing ten times faster than other sectors in our economy, at least in Montana. And they're paying twice our average wages that we see in our state.

So, I want to start with Mr. Adelstein. In your testimony, you mentioned PCIA's involvement in working with tribal leaders. Can you tell me specifically what PCIA has done to work with tribal communities? And what are the biggest barriers to broadband deployment on tribal lands?

Mr. ADELSTEIN. Yes, you're certainly correct, Senator Daines, that tribal areas are the most difficult to serve. I mean, Chairman Thune and I are from South Dakota. We've seen the—both the potential and the challenges in tribal areas in our state. They're most in need of broadband because of the economic challenges they face, and yet they're the most difficult to build in. Part of it has to do with the land law and the fact that those parcels are divided up, so it's very hard to get access to rights-of-way. PCIA has participated in the FCC's annual workshops on this, and the FCC's made a real effort to try to help. We would love to serve tribal lands, but these processes can be—make it very, very difficult to do so.

We also are having issues, increasingly, with tribes in areas that aren't tribal areas, in getting their approval to site new builds because of some of the review processes that we think need to be streamlined somewhat. So, we'd like to work with tribes on both getting broadband to their communities as well as to all communities in the country, and respecting tribal sovereignty and respecting the historic preservation needs. At the same time, the need to get broadband out is essential.

Senator DAINES. Thank you.

Mr. Kinkoph, question. Your testimony states that past partnerships with tribal authorities have been effective. Is NTIA working to form these partnerships and help facilitate projects in other states like Montana to connect these tribal communities?

Mr. KINKOPH. Yes. We've, through our BTOP program, connected eight different tribal networks throughout the United States. And we continue to provide technical assistance, as needed, through Broadband USA. We're currently working with Merritt Networks, up in Michigan and Wisconsin area, with some of the tribes to help them with their current connection issues.

I think the Broadband Opportunity Council, though, presents several options to helping move this issue forward. And one is—the

first one is, the DOI is looking to conduct a tribal summit on broadband with—throughout the United States. So, bring in the tribes and have a sitdown and a discussion on broadband issues that they're facing across the United States. And that would be a multi-agency summit.

Second, the DOI has stepped up and has agreed to launch an interagency tribal school tech initiative to help bring more technology into the tribal schools.

Third, there is the DOL, which has agreed to start to expand tech-based job training into the tribal lands.

And then the fourth one that is part of the BOC is that DOI is looking to make available the 4,000 towers that they own on tribal and rural land available to the private industry, which I think will go a long way in bringing connectivity to some of those areas.

Senator DAINES. Thank you. That's a good update. Appreciate it.

I want to, as I close here—run out of time—Mr. Morrison, your testimony talked about the importance of a networked society. I couldn't agree more. We've seen what happens in places like southwest Montana, where you have a blue ribbon trout stream in your backyard, and you have connectivity—you can work where you also like to play, as we say in Montana. Congress needs to do away with the regulatory roadblocks, and helping these communities streamline investment for broadband infrastructure is one of the key components. Senator Gardner mentioned the bill he'll be introducing with Senator Klobuchar to address these roadblocks.

What can Congress, the Federal Government, do to incentivize companies to build out rural America?

Mr. MORRISON. Senator, that's a really good question. And it's an important one.

Senator, a very good question. I really believe, though, that the—that question would be better answered by the commercial carriers than by Ericsson at this time.

Senator DAINES. OK. All right.

I'm out of time. I'm out of time, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Daines.

Senator Manchin, followed by Senator——

**STATEMENT OF HON. JOE MANCHIN,**
**U.S. SENATOR FROM WEST VIRGINIA**

Senator MANCHIN. Thank you, Mr. Chairman. Appreciate it.

And thank you all for being here.

This, I guess, would be to Mr. Morrison.

Mr. MORRISON. Yes, Senator.

Senator MANCHIN. In preparation for the hearing, I reached out to the U.S. Forest Service to see if there was anything I could do to expedite permit approvals of the towers at Monongahela National Forest, which is predominantly in West Virginia. It turns out there are 14 towers located in the Forest Service property, and the Forest Service has received a grand total of zero applications for cellular or broadband installations in West Virginia. Zero.

While I'm committed to working with my colleagues to streamline the Federal permitting process, we have a much more immediate need in West Virginia, attracting enough private investment to build out basic wireless infrastructure. As you noted in your tes-

timony, I believe that $70 million has been returned to the Mobility Fund. I think you said $73 million to Mobility. It could be a great place to start. And I've invited Chairman Wheeler to come see firsthand the rural communications challenges that remain in rural America, mostly West Virginia.

What can we do, in your opinion, to attract investment in truly unserved areas? And do you think that the Mobility Fund could play a role in this?

Mr. MORRISON. Senator, that actually wasn't in my testimony.

[Mr. Morrison later amplified his testimony in writing below:]

Ericsson supports improving the "Mobility Fund" by targeting funding allocated for infrastructure to the truly unserved areas that still exist in our Nation today. In our written testimony, we highlighted this support and acknowledged Senator Manchin's recent engagement with the FCC on this issue. We appreciate his leadership on this effort and recognize that he knows firsthand the challenges rural America faces with access to infrastructure. In terms of states with advanced wireless penetration, West Virginia ranks as one of the lowest, and that needs to change. Without investment by the Federal Government as well as incentives for private investment in such areas, states like West Virginia will never experience the full benefits of a networked society.

Senator MANCHIN. Seventy million? Well, somebody's testimony. Which one of you want to speak up?

[Laughter.]

Mr. ADELSTEIN. I can certainly address the issue, Senator Manchin.

I think one of the reasons you're not seeing any applications for Forest Service in your State——

Senator MANCHIN. I think you mentioned it, sir, but that's all right.

Mr. ADELSTEIN.—is because our members that build these facilities are loathe to go into Federal lands, because it's almost impossible to get sited. You go——

Senator MANCHIN. No, we're—we have 14 towers. We've got nobody on them. Towers are there.

Mr. ADELSTEIN. But, are they available, really, for use? I think the Broadband——

Senator MANCHIN. Sure.

Mr. ADELSTEIN.—Opportunity Council made it much easier to use those, but there's a need for——

Senator MANCHIN. Well, the permitting process is tough. We know that.

Mr. ADELSTEIN. Right.

Senator MANCHIN. But, we have 14 towers in the national forest right now, and we're not utilizing the towers to the extent they could be. I don't know why you're not—who—how come you're not wanting to get on those towers?

Mr. KINKOPH. NTIA does——

[Laughter.]

Mr. KINKOPH. You know, I think the issue is——

Senator MANCHIN. We just want service is all we want.

We want just a little bit of service. Not much, just a little bit.

Mr. KINKOPH. As Jonathan was going to say—is that it is a—the BOC is looking at ways to streamline the process and get it on. What of the things I do know is that agencies—the recent Middle-Class Tax Cut Relief Act—GSA just finished helping to streamline

that process through master templates. But, even there, there's not an obligation for each Federal agency to adopt and use those. They're not required to. So, there is work to be done, and the BOC will continue to try to move that forward to improve efficiencies.

Senator MANCHIN. Well, you all work on the map, too, don't you?

Mr. KINKOPH. The map——

Senator MANCHIN. Do you all do the map?

Mr. KINKOPH. The map was actually transferred to the FCC the end of June. So, the FCC is now in charge of the map.

Senator MANCHIN. In charge of it. I know that you're showing my state, West Virginia, with 97 percent coverage. I would say you'd better look at that map again.

Mr. KINKOPH. We'll do that.

Senator MANCHIN. Who—I mean, it doesn't—it's not accurate.

Mr. KINKOPH. The map—the development of the map over time has evolved and become more and more accurate. The data collection came from—the State collects it from the providers. It is then provided to NTIA, and we have it uploaded by the FCC, historically. Now, the FCC has——

Senator MANCHIN. I'm saying you had Indiana, Mississippi, Kansas, Illinois, and Louisiana, and Texas at 100 percent.

Mr. KINKOPH. Yes.

Senator MANCHIN. Now, whoever represents—if—I'm sure if Senator Wicker was here, he would tell you that—maybe good old Mississippi is not quite there.

Mr. KINKOPH. Yes. Some of the——

Senator MANCHIN. I know we're not at 97 percent.

Mr. KINKOPH. Yes. Some of the verification—the states were obligated to do the verification, and that came down to resources. I know, in South Dakota, we were informed that they drove over 40,000 miles, literally, to check the cell-site reaches. So, they did it, basically, manually. That's how it's done. And some states have not had the resources to do that to the full extent.

Senator MANCHIN. Final question I would have is on the spectrum auction that was held. And I think you mentioned, I think, Mr. Adelstein, you said $45 billion, and that reduced our deficit by $28 billion. How do you believe private companies can help accelerate the transition process? And what Federal regulations might prevent them from playing a role in that process, for us to be able——

Mr. ADELSTEIN. In terms of using the—spectrum?

Senator MANCHIN. Absolutely.

Mr. ADELSTEIN. Yes, I think it—we need to clear that as quickly as possible. One of the problems with that spectrum is, it's encumbered by Federal users. NTIA has done a good job, I think, of trying to corral them, but we need to get that spectrum that was paid for so dearly into use as quickly as possible.

Senator MANCHIN. What's taking it so long?

Mr. ADELSTEIN. Well, it——

Senator MANCHIN. Why do you find that—you're stating it could be a 5-year transition?

Mr. ADELSTEIN. It—well, there are a number of reasons why it takes so long to implement spectrum. One of them is the need to relocate Federal users and get them moved, but also there's a need

to build the infrastructure and get it all sited. There's a need for handsets to be changed out.

Senator MANCHIN. But, the private will move a lot quicker and then—than what we're—the Federal. I'm saying, if we're the impediment, this is a committee that you should work with and give us an idea of what we can do to release that or kind of spur the Federal Government in releasing that spectrum, letting it go.

Mr. ADELSTEIN. I think it's urgent for NTIA to do everything they can to help move those fellow users. I know they're taking that responsibility very seriously and they're doing it. It can't be done quickly enough.

But, there are not only, you know, Federal issues. I mean, it takes time to, basically, get spectrum into use. Already I think very shortly we'll be able to use some of the——

Senator MANCHIN. Mr. Resnick, you said—Honorable Mr. Resnick here is shaking his head like the dickens, no.

[Laughter.]

Mr. RESNICK. Well, we've got the—thank you, Senator. And I'm not the expert in this area, either, but it's——

Senator MANCHIN. You've got an——

Mr. RESNICK.—known in the communications industry that many entities that purchase this spectrum do so not necessarily with the intent to use it right away, but to hold it in the event that their business plans change and they may need it or to prohibit competitors from obtaining it and boxing them in to not having access to it. So, there's a tremendous amount of spectrum out there that's held now by satellite companies that——

Senator MANCHIN. Speculated, right? Speculation?

Mr. RESNICK. Yes.

Senator MANCHIN. So, what you're saying is, when we sell the spectrum, it—basically, you should use it or lose it?

Mr. RESNICK. Like any other permit.

Senator MANCHIN. Gotcha.

The CHAIRMAN. The Senator from West Virginia. And I think the statement you were looking for was in the cloud.

[Laughter.]

The CHAIRMAN. That's a—you're way ahead of the rest of us, Senator Manchin, so——

Senator Ayotte.

**STATEMENT OF HON. KELLY AYOTTE,**
**U.S. SENATOR FROM NEW HAMPSHIRE**

Senator AYOTTE. Thank you, Chairman.

Mr. Kinkoph, I wanted to ask you—one of the goals of the Broadband Opportunity Council is, of course, to modernize Federal programs to expand support for broadband investment. You've heard a number of my colleagues asking about, How do we do that, particularly in rural areas? New Hampshire is one of the states under the Universal Service Fund that continues to be underfunded. I think my constituents get a pretty raw deal, because we're receiving 41 cents for every dollar that we contribute. I would welcome any of you to come drive around my state in Coos County, in Grafton, and even areas of Cheshire, that you cannot get full access to broadband, which is very important to economic develop-

ment and access in general. I also would ask, How do we reform this program, and what can the Rural Utilities Service and NTIA, along with other Federal agencies, do to encourage the FCC to tackle USF contribution reform? Because I have to say to my constituents, "I'm sorry you're paying all this on your phone bills, because you're not getting it back." We still have a lot of needs. And so, I'm kind of like, Why are we doing this? Is there any look at reforming USF to make it more viable—more responsive to what we need in the country?

Mr. KINKOPH. I would defer that to the FCC, who has jurisdiction over that program.

I would say that the Broadband Opportunity Council has many options in front of it, or several options in front it, that could be beneficial——

Senator AYOTTE. With all respect, as the Broadband Opportunity Council, I would hope that you would make recommendations as to what the FCC could do to take this issue up, because it's a very important issue.

Mr. KINKOPH. Thank you. So, on the—so, some of the issues that would have a benefit to your state in helping to promote broadband would be—the Department of Transportation is currently looking at pushing down the rules and clarifying rules to the states for providing opportunities to access the conduit, the pole attachments in those states today. There's a lot of clarity that needs to be pushed out to the states as to how current infrastructure related to the Department of Transportation could be used for broadband. I think that's going to go a long ways in letting people understand how to utilize it.

The DOI, as I mentioned earlier, the towers that are throughout all the rural and Federal lands—there's 4,000 of them—that, you know, clarity on how the private industry can get access to those to provide wireless is also a critical step in that direction.

And then there is the open data inventory, which—of Federal assets—which is one of the BOC initiatives, which is an inventory of all the assets that are available that external private industry can look at and potentially utilize to help leverage those to provide broadband, whether wirelessly or wired.

So, I think those are three big steps for rural states and other states around the country that it will help expand and promote the use of broadband.

Senator AYOTTE. Mr. Adelstein, do you have any comment on USF? It seems to me this is an important issue as you look at opportunity to expand broadband and how we're using Federal resources effectively to do that, and properly.

Mr. ADELSTEIN. I think you're absolutely right. And we'd love to see the Mobility Fund—the FCC's created, but not funded the Mobility Fund—to make sure that there's—is funding for wireless systems to build the infrastructure to provide the business case to build that.

It's also important that there be predictability. I used to head the Rural Utility Service, and some of the changes in USF, I think, undercut the ability of rural communities to apply for loans and get them repaid, because they weren't certain what the revenue flow would be. You know, if you take out a loan, you have to know what

the revenue's going to be if you want to build a wireless system or a wired system. I think it's very important for there to be predictability and consistency and understanding, going forward, of what that's going to be.

You know, the challenge in rural areas is one for our industry of trying to find the capital return on investment. And having these Federal programs are really essential to make up for the fact that you have lower densities and similar fixed costs.

Senator AYOTTE. It's just really hard sometimes for me to justify this fund to my constituents. If they could keep this pot of money in New Hampshire, and our Governor and legislature could have it to build out broadband and opportunity, they could get a lot more efficiency out of it and probably cover much greater parts of our state. That's what the challenge is, because we feel like we're subsidizing areas that aren't rural, actually, and so the fund sometimes is used to build out duplicative areas. Do you see that as an issue that needs to be addressed?

Mr. ADELSTEIN. Well, certainly a lot of the fund is going also to individual phones, called the Lifeline Program, which is very helpful, but there's been some abuse of the system. We'd like to see the funds go into infrastructure.

Senator AYOTTE. Where everyone can benefit.

Mr. ADELSTEIN. Right.

Senator AYOTTE. Yes.

Thank you.

The CHAIRMAN. Thank you, Senator Ayotte.

Senator Udall.

**STATEMENT OF HON. TOM UDALL,**
**U.S. SENATOR FROM NEW MEXICO**

Senator UDALL. Thank you, Chairman Thune. Thank you very much.

And being from South Dakota, Chairman Thune, I know you understand the digital divide and the real challenge facing rural areas.

Having no cell phone reception is not just an inconvenience for people, it can mean not being able to call 911 in an emergency. And I know you all realize that. And the—during the years, we've had many people come forward and talk about some of those devastating consequences, in terms of not being hooked up to the emergency network.

Mobile broadband also enables innovation and new opportunities for job creation. And that's something we really want to see in New Mexico in our rural areas. Our constituents living in rural areas should not be left behind.

So, I'm glad, Chairman Thune, that you're focusing the Committee on this subject.

Mr. Adelstein, when you were RUS administrator—you just mentioned that—I had the pleasure of hosing you in Moriarty, New Mexico, for a broadband and smart-grid summit. And I know, you know, you enjoyed that. You've got a smile on your face still. So, I know you understand that building broadband infrastructure in New Mexico and other rural states can involve approvals from multiple Federal agencies, such as the Bureau of Land Management,

the Forest Service. And I want to ask you about ways to streamline the permitting process for broadband deployment on Federal lands. Could you discuss potential changes that could reduce the cost of deployments, such as piggybacking on existing rights-of-way? For example, installing a fiber optic line along an existing powerline or other infrastructure where the ground has already been disturbed, rather than chopping it up for a new line.

Mr. ADELSTEIN. Yes, thank you. We—I hope we've made progress on broadband in New Mexico since then, but I know——

Senator UDALL. We have. We have, with your good help.

Mr. ADELSTEIN. And your great leadership. I know you've been committed to this issue for a long time. And I think Federal lands, which control so much of your State, are really critical, because those are vast rural areas that have virtually no coverage, because our industry is afraid to go there, because they get caught up in these reviews.

There's actually a bill—I see Senator Klobuchar is here, that she's considering legislation on this. Senator Rubio's introduced legislation, S. 1618. Senator Gardner talked about this earlier. We think that there are things you can do. You can create a standard fee schedule so our people know exactly what the rates are going to be across different agencies, and have it be based on real costs. You can have fee retention by agency, which that bill would enable, which would allow the agency, basically, to take a piece of the pie to help pay for other cost of doing the processing of those forms so that they have an incentive to get these things done instead of agencies that, like, you know—I'm not going to name any agencies that are going to be mad at them—but, you know, just put it at the bottom of their pile, because their job is to manage Federal lands, not to enable broadband. I think having common forms and contracts would be extremely helpful. It's in that bill. Have an expectancy of lease renewal. Sometimes on Federal lands, we get very short lease periods. You want to invest a huge amount of capital to build, say, a tower, for example, that's got a 30-year life, and you get a 5- or 10-year lease expectancy, it's very helpful if you can get a longer term. We—the bill calls for point of contact. And—oversee a negotiation process to get that done, to make sure if something gets caught up, that it gets moved. And regular reporting on progress to Congress.

I think the Broadband Opportunity Council had a lot of great ideas. There are other ideas that could build upon it that this committee could address through legislation.

Senator UDALL. Yes. Well—no, thank you very much for that answer. And it's really good to see fellow Senators working on this, including Senator Klobuchar and Senator Gardner.

Do—other members of other panel, do you have ideas on this specific area?

Please.

Mr. KINKOPH. The Broadband Opportunity Council will be addressing this issue. And we have sat down with several providers that have shared very similar lists as PCIA, here. So, I think that it goes a long ways in sharing that information with the Committee as we move forward to try to implement some of this streamlining.

Senator UDALL. Great.

Mayor? Please.

Mr. RESNICK. Thank you, Senator. Again, it's a privilege to be here.

My committee at the FCC, the Intergovernmental Advisory Committee, consists of mayors and State legislators and Indian tribe members from around the country. So, we have a broad perspective of the status of broadband and what needs to be done around the country.

But, one of the things that we've recognized is that there are many Federal programs, especially dealing with transportation initiatives, that do not allow broadband to be built under the grants that are awarded under those programs. I have two members of my committee from Kansas, and I, as well, even though I'm from an urban area in Florida. We wanted to use grants that we receive from four transportation projects, and we were not—to install conduits—and we were not allowed to install conduits as part of those projects. So, if there are ways of eliminating some of those barriers under existing Federal programs, that would be helpful.

Senator UDALL. Great. Thank you very much.

I've run out of time, but if you want to give a very quick answer, with the Chairman's permission——

Mr. MORRISON. I was just going to echo the sentiments of the representative from PCIA, but also add that each department within the Federal Government sometimes has its own processes. If the process was the same, it would be quicker and more commercially viable for commercial carriers to deploy quicker. You know, one checklist would be very helpful, moving forward.

Senator UDALL. Great.

Thank you for those answers.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Udall.

Senator Blumenthal.

**STATEMENT OF HON. RICHARD BLUMENTHAL,**
**U.S. SENATOR FROM CONNECTICUT**

Senator BLUMENTHAL. Thanks, Mr. Chairman. And thank you for having this hearing on a really important topic that has national implications, I think in every state in the country.

In Connecticut, for example, a recent article by AP reporter Stephen Singer, which appeared widely in our state, entitled "Digital Divide: Northwest Hills of Connecticut Struggle to Gain Broadband Access," demonstrated very graphically how the northwestern part of our state suffers from great gaps in coverage and laggard reception in many areas. This area has about 22 towns and 200,000 residents, including Meryl Streep and Henry Kissinger and a number of other boldfaced names that would be well known to you, but it is covered in a way that local officials and residents say is extremely limited—in fact, lacking—so that business growth is stalled, schools are undermined, not to mention ordinary households suffering from a lack of coverage.

I ask that this article be placed in the record.

The CHAIRMAN. So ordered.

Senator BLUMENTHAL. Thank you.

[The information referred to follows:]

*The Register Citizen*

# DIGITAL DIVIDE: NORTHWEST HILLS OF CONNECTICUT STRUGGLE TO GAIN BROADBAND ACCESS


(AP Photo/Jacquelyn Martin)

By STEPHEN SINGER, AP Business Writer

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HARTFORD >> Connecticut's Litchfield hills, which boast premier antique shops, vineyards and 18th century inns, also feature cellphone dead zones and super-slow Internet service that infuriate residents and frustrate businesses.

Telecommunications companies say hilly terrain and dense woods are to blame and angry residents accuse the companies of refusing to wire the region because the investment doesn't pay in sparsely populated areas.

"We're not going under, but it's increasingly painful," said Klaus Knuth, innkeeper at the Blackberry River Inn in Norfolk.

Guests expect to connect to the Internet on their phones, tablets or laptops, but Wi-Fi is only "so-so" in the building that houses most of the inn's rooms, he said. "The rest is dead," Knuth said.

Some businesses such as Founders Insurance Agency in Salisbury and Torrington rely on coaxial cable that transmits data, but not graphics or video. Frank Buonocore, a company vice president, called the service reliable and "adequate for our purposes."

Others, such as Steve Bowen, a retired advertising executive, make private arrangements to secure broadband. He said he paid $5,000 to bring a line to his Sharon home and now advises residents and officials how to market their campaign for expanded broadband access.

"We can wait 10 years for it to come here naturally or we can jump the gun," Bowen said.

Known for its natural beauty on the doorstep of the Berkshires in Massachusetts and New York's Hudson Valley, the Litchfield hills are home to celebrities such as Meryl Streep and Henry Kissinger and are a destination for tourists and New Yorkers who can afford second homes.

But local officials and residents say limited cellphone and high-speed Internet access stall business growth and undermine schools that depend on the web.

"It's difficult to attract people to that kind of a landscape," said state Consumer Counsel Elin Swanson Katz.

Connecticut officials promoting an initiative for super-fast Internet cannot force unregulated telecommunications firms to expand broadband. "We're sort of a catalyst," said Bill Vallee, the state's broadband policy coordinator.

State Rep. Roberta Willis, D-Salisbury, accuses telecommunications companies of failing to do enough to build broadband networks.

"You just can't say it's the topography and walk away," she said. "If electricity companies were deregulated like this there would be no electricity in my district."

Comcast spokeswoman Laura Brubaker Crisco said the telecommunications firm has extended its network nearly 62 miles in northwest Connecticut since 2005 and completed nearly 100 projects extending fiber more than 10 miles in the past two years.

"However, there are some low-density areas where it is not economic for Comcast or other providers to build out," she said.

David Snyder, vice president for engineering for the east region of Frontier Communications Corp., said due to the area's topography, "it's just natural the investment and the time become more challenging."

Frontier has connected broadband to 40,000 households in Connecticut, including the northwest region, since it began operations in the state a year ago, he said.

How many residents in the region are without broadband is not known. Katz and Kim Maxwell, the technical adviser to the group of officials and others working to extend broadband, said about 10 percent of homes in rural areas are estimated to have no access. Vallee said it could be more.

Closing the so-called digital divide separating those with and without high-speed Internet access has drawn funding from the Federal Communications Commission and the telecommunications industry. Alex Phillips, president of the Wireless Internet Service Providers Association, which serves rural areas, said too much money is spent on studies, "but the regular guy still doesn't have adequate choice or adequate service."

Northwest Connecticut includes about 22 towns with about 200,000 residents in 85,000 households, Maxwell said. Extending broadband in much of the area could be completed by 2018 at a cost of as much as $350 million financed by bonds, he said.

"People want this to happen," he said. "I'd be really surprised if this doesn't happen."

Senator BLUMENTHAL. So, let me ask you, Mr. Resnick—you've mentioned in your testimony, I think, some of the ways that Internet access can be—and wireless—can be broadened. Co-location, I think, is one of the methods. Can you suggest some others that local communities can use, as a mayor?

Mr. RESNICK. Thank you, Senator.

Yes. Many of us had—used to have access to institutional networks, fiber networks, that were used by the local governments, whether a county or a city, and we could get anchor institutions on those networks, as well as our own government facilities, so they could provide interconnection communications services for our police and fire, but also we could have schools, we could have hospitals, we could have other anchor institutions as part of those networks.

Most of us lost the ability to obtain those networks when State cable franchising came into play. And so, that might be something that, as a Federal—at the Federal level, we might want to relook at, because State franchising doesn't provide for the continuation of institutional networks. And so, now these entities that, before, built it, had it paid for through their fees, are now telling us that, "Oh, if you want to continue using this fiber, it's going—you're going to be under a managed solution, and it's going to cost us hundreds of thousands of dollars a year." So, as a result, we're now paying for broadband connectivity to schools and libraries, police stations, fire stations, hospitals, where, before, it was provided as an amenity as part of that process. That would be one solution.

Senator BLUMENTHAL. And the telecommunications companies often blame the terrain or woods. And northwestern Connecticut has plenty of both, hilly terrain and dense woods. Residents there believe that the telecommunications companies have avoided the investment because these areas are sparsely populated.

What about other methods, such as spectrum-sharing? I don't know whether any of the folks who are here today have perspectives on that issue.

Mr. Kinkoph?

Mr. KINKOPH. As I've said, spectrum is not in my area of responsibility, but NTIA does believe spectrum-sharing is critical to opening up enough spectrum for the broadband—wireless broadband community, and it is one of the ways that they envision—that NTIA envisions reaching the 500 megahertz goal by 2020. So, we do support it.

Senator BLUMENTHAL. And in your experience, Mr. Resnick, how ready and willing are the telecommunications companies to cooperate with you?

Mr. RESNICK. Well, as I indicated in my testimony, there's been a greater degree of cooperation with the industry associations and the local government associations. In particular, we issued a joint information in response to recent FCC regulations. So, I think—and Mr. Adelstein and I have a long history of working together—that there is an interest in cooperation. It doesn't do either of us any good to try and point fingers and say, "You're the reason why infrastructure cannot be deployed as quickly as we would like." And so, I think the area of—the intent of cooperation would continue.

Senator BLUMENTHAL. There really is a common goal here.

Mr. RESNICK. Absolutely. As I indicated in my testimony, the communities definitely want access to advanced broadband services at an affordable rate throughout all of our communities, not just rural, but also urban. I live in a very urban area, and there are portions of my area that do not have access to advanced broadband services, either. And so, it's not just a rural issue, it's—there are a whole host of reasons why people do not subscribe to broadband services. Yes, there are issues with it being available, but the FCC, at least, according to information that was presented to my committee, the majority of folks that do not subscribe to broadband do so either because it's not affordable or because they don't see the value in it. They do not understand how it would improve their lives. And so, my city, for example, wanted to build a digital literacy center using CDBG funds, which we receive, and we were told that we're not allowed to use that Federal program for building a digital literacy center.

So, there are restrictions on funds that are already out there that might be—and I think that's part of the Broadband Opportunity Council's recommendations—is to look at those restrictions and open things up so that these Federal programs can be used for broadband deployment.

Senator BLUMENTHAL. Thank you very much.

Thanks, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Blumenthal.

Next up is my neighbor and best-selling author, Senator Klobuchar.

[Laughter.]

**STATEMENT OF HON. AMY KLOBUCHAR,**
**U.S. SENATOR FROM MINNESOTA**

Senator KLOBUCHAR. Well, thank you very much, Mr. Chairman. I was kind of smiling, looking knowingly at Senator Thune when Senator Blumenthal was talking about all the rural parts of his state that are sparsely populated.

[Laughter.]

Senator KLOBUCHAR. Which the Mayor has acknowledged that is true in every state in the country. But, we just have a little bit more of it.

And I appreciate your leadership, Mr. Chairman, in having this hearing, and also in the work that we have done to push the FCC to do something different with the Universal Service Fund and some of those requirements so we can free up more money.

I've really been struck, being at home the last year especially, with the number of people that are raising this issue. I've sort of figured out what happened, is they had some access in the rural areas, but it now—technology has changed, and their work is changing, and farmers are expected to, you know, go in to their suppliers and tell them exactly what's happening every day with the temperatures where their turkeys are being kept and other things. And so, what's basically happening is that their work is changing—in schools, not just in businesses—so that the high-speed aspect of this and having high-quality Internet is becoming incredibly important.

I've heard stories, on a reservation, of one house that had Wi-Fi, and the entire group of kids would be over in the yard—just try to picture it—trying to hook up to that Wi-Fi in one house's yard.

Or the story of farmers and small business owners that go to the McDonald's every day to be able to report back to some of their customers and suppliers, because they're not able to—while they might have Internet, they're not able to send—and they don't have the capacity to send the kind of documents and videos and other things that they have to send to do their jobs.

So, this is a real issue right at a time where our economy is stabilizing, we're seeing improvements, but we're still actually seeing a lot of rural poverty. We just saw some numbers on that. And so, this is, to me, not a crisis as much as an opportunity to make some improvements. And that's why I'm introducing the bill today, with Senator Daines and Senator Gardner—and I appreciate their support, and I'm sure others—to make some changes in how we streamline and invest in the broadband infrastructure. And that's the "dig once" concept. When there's Federal projects, it's also requiring the GSA to work with Federal agencies to consolidate and streamline contracts and fees for deploying broadband infrastructure.

And maybe I'll start with you, Mr. Adelstein, since you've been positive about this bill. And I know my colleagues have mentioned it, as well. Could you talk about the importance of doing that? And also, this issue of how population density drives where spectrum is

built out and what more we can do to reframe the deployment process to get more of this going in rural areas.

Mr. ADELSTEIN. Senator Klobuchar, I'm thrilled that you're introducing bipartisan legislation today to address this issue, these many issues, actually. Your bill would take care of improving broadband deployment on Federal lands, which, of course, comprise much of Minnesota. It also helps with the "dig once" policy, as I understand it, which is really critical to getting the backhaul that we need. Your cosponsor, Senator Gardner, also raised this issue, and we discussed the fact that every one of these antennas, which is increasingly where people are getting and—receiving and transmitting their data, has to connect back to fiber, ideally, and having that ability to get access to those conduits. Whenever something is being built in a rural area or in an urban area, we ought to have the opportunity to use that for broadband connectivity, because those are really the roads and bridges of the future. And so, when we're building today's roads, let's also build those digital highways so that we can continue to expand capacity to meet it.

So, your bill, I think, really hits the right notes, both for urban and rural areas, to expand broadband connectivity.

Senator KLOBUCHAR. Could you talk about the lack of consistency and the resulting uncertainty that's affecting your member companies' ability to deploy wireless broadband? What else can we do about that?

Mr. ADELSTEIN. Do you mean on Federal lands, in particular?

Senator KLOBUCHAR. Uh-huh.

Mr. ADELSTEIN. Yes. Each agency tends to have its own process. We were thrilled that GSA finally completed its model forms that you asked them to do back in 2012. Congress had to put a lot of pressure on them, but they got that done. And that'll help, but there's a lot more that needs to be done. I think that, you know, negotiations with the Federal Government take, on average, 4 years, compared to less than 2 for the private sector, and sometimes it can take 10 and more. The Federal Government's foregoing revenue, because our members will literally go right next door to Federal property rather than use Federal lands to site, even if Federal land might be in a better location to get service where it's needed.

So, I think that we need to have, like, a standard fee schedule that your bill proposes. We need fee retention for the agencies so that they can use those funds to process the applications. We need common forms and contracts. There's no reason that each agency needs to have their own separate process, and we have to run into all of these roadblocks that your bill would address.

Senator KLOBUCHAR. Thank you very much.

Last, Mr. Kinkoph, could you talk about why coordinating broadband deployment with highway construction is important?

Mr. KINKOPH. In the BOC, we have—there is a commitment from the Department of Transportation to push down and clarify the—that broadband should be considered a part of the opportunity when digging once. I mean, it is a clear benefit to the country to have these rules clarified to the States. A lot of this is run by the States, so it's really a clarification from the Federal level to the states that they can utilize and deploy conduit when they dig, et

cetera. So, I agree with Jonathan that we should be laying conduit wherever possible.

Senator KLOBUCHAR. OK, thanks.

I'm beyond my time, but I'll ask you one for the record later, Mr. Morrison, so we don't have to go into it, but it's this issue of towers being built, but the Federal permitting process actually slows it down. And so, it basically renders the tower useless if you can't get the broadband in there. So, I'm sure you're familiar with this.

Mr. MORRISON. Most definitely.

I did want to answer one of the questions that you asked earlier about what the Federal Government could do to move quicker as—when we talk about application processes. And let me just give you an example. As a—you know, we'll call it a landlord at the Federal Government, if we have an opportunity in wireless community to go to a roof, it's a quick sale to a commercial rooftop owner, "Sir, ma'am, you know, how much revenue is your rooftop generating?" "Well, it's actually costing me $5,000 a year to maintain." "Well, you know what? We'll go ahead and install a commercial antenna on there, and we'll actually pay you double that, so you'll cover your cost of maintenance, plus you'll have a little bit of money left over." Those transactions can happen as quickly as in 2 weeks. Sometimes, on average, maybe 2–3 months. Anytime we go through a process with the Federal Government to lease any kind of property—and we're not talking about the permitting, we're talking about the business aspect of it, the numeration—it is months, if not years, to make that negotiation. So, my suggestion would be that the Federal Government take a look at what the process is from a business perspective, just to be a little bit more nimble.

Senator KLOBUCHAR. Thank you.

The CHAIRMAN. Thank you, Senator Klobuchar.

Next up, Senator from Massachusetts, Senator Markey.

**STATEMENT OF HON. EDWARD MARKEY,**
**U.S. SENATOR FROM MASSACHUSETTS**

Senator MARKEY. Thank you very much, Mr. Chairman.

This hearing is about the future, obviously. This is where we should be the leader. And spectrum is the oxygen of the wireless world, and we need more oxygen so that more innovation can occur. And that doesn't make any difference that exists on this committee. If you want to be wirelessly following the Green Bay Packers or the Minnesota Vikings or the New England Patriots, you want a wireless device. And you can be out in the Berkshires and have bad system out there, so we need to do something about it.

And I think one of the areas that we can look at is how the Federal Government can move more of its spectrum out into the private sector. That's what happened in 1993. The Defense Department wasn't happy about it, but we took it, and it created the third, fourth, fifth, and sixth cell phone companies in America.

So, I've actually joined with Senator Fischer in introducing a bill, the Federal Spectrum Incentive Act, because this really does know no State boundaries. And what the bill does is, it incentivizes Federal agencies to give up spectrum by allowing them to receive a portion of the spectrum auction proceeds. Like 1 percent. That's all they get. But, it says to them, "Start thinking now about what

spectrum you can give up," and, as quickly as possible, you get your one percent return. And that's kind of a win-win, because you're not deciding which spectrum should go, but you're leaving it up to the agency and saying, "You get a reward for doing it."

And over on the House side, that's bipartisan over there, as well. It's Doris Matsui and Representative Guthrie, a Republican from Kentucky, OK, who have introduced the same bill. They're having a hearing on that today. And the bill has been endorsed by the Consumer Electronics Association as something that they believe will help to telescope the time frame it takes in order to get that spectrum out and into the marketplace to reduce the crunch that exists.

So, Mr. Morrison, maybe you could talk about that. What do you think about that as an idea that can help to move the spectrum out and into the private sector?

Mr. MORRISON. I appreciate the question, Senator, but I can't really provide an answer at this time. I'm happy to confer with appropriate parties within Ericsson and get back an answer that we'll submit in to the Committee for inclusion in the hearing. But, that's not my personal area of expertise.

[Mr. Morrison later submitted the following for the record:]

Ericsson supports the advancement of legislative efforts, including the "Federal Spectrum Incentive Act," to clear underutilized spectrum currently held by the Federal Government for commercial, licensed broadband use. We applaud the leadership of Senators Markey and Fischer whose bill offers new incentives for Federal agencies to relinquish badly-needed spectrum. This will ultimately make our networks more efficient, create jobs, raise revenue at a time when budgets are constrained, and foster innovation.

Senator MARKEY. OK.

Mr. Adelstein, do you think we should be incentivizing the Federal agencies to start moving the spectrum out? And do you think this is a potentially workable way of accomplishing that goal?

Mr. ADELSTEIN. Absolutely. I think it's an excellent bill, and I think that the agencies need incentive to move it. They've got—they're sitting on enormous amounts of spectrum. NTIA is trying to get them to move. But, if you actually have them have a piece of the pie so that they can pay for their own costs of moving to new systems, also they can maybe buy new radio systems—some Federal systems are very antiquated—and if you can say, "Look, if you'll get off the spectrum, you can use new equipment, use it more efficiently. Here are some funds to do it."—it takes Congress to do that, because right now the law requires that all proceeds from spectrum auctions go straight to the Treasury. Why not let some go to the agencies that need those costs to recover the cost of them to move? I think that bill would help to move more spectrum into the commercial mobile use, which we urgently need, as we've discussed throughout this hearing.

Senator MARKEY. Yes. I think we do need to find some way, Mr. Chairman, of incentivizing all these agencies to move, and maybe finding a little revenue stream that helps them with—pay for their costs.

And so, you know, I'd like to work with you—I know my staff's been talking to your staff about it, but I'd love to be able to work with you and Senator Fischer and try to find some smart way of

kind of replicating what we did in the past. These agencies have more spectrum than they need. And hopefully we could work together to accomplish that goal.

Do any of the other witnesses want to speak on that bill?

Mr. KINKOPH. From an NTIA standpoint, while it's not my area of expertise on the spectrum side, I do know that our Office of Spectrum Management is currently reviewing that. Be happy to put our staff in contact with yours.

Senator MARKEY. That would be helpful to us.

Thank you, Mr. Chairman.

The CHAIRMAN. The Senator from Massachusetts is right, the Federal Government is sitting on a large share of that spectrum. We need to figure out how to break that loose. So, I look forward to working with you.

The Senator who represents America's team, the Senator from Wisconsin.

[Laughter.]

**STATEMENT OF HON. RON JOHNSON,**
**U.S. SENATOR FROM WISCONSIN**

Senator JOHNSON. Thank you. Thank you, Mr. Chairman. I'm sure the Chairman would also agree with me that we obviously need that spectrum to broadcast Green Bay Packer games, you know, primarily.

[Laughter.]

Senator MARKEY. We'll see you in the Super Bowl.

[Laughter.]

Senator JOHNSON. I hope so.

[Laughter.]

Senator JOHNSON. Mr. Morrison, I want to kind of pick up where you left off, talking about the difficulty of negotiating with the government. Tell me, from your perspective, why that is. I mean, what is the impediment?

Mr. MORRISON. I think, first and foremost—and we talked about it earlier, my colleague with—from the PCIA —one, each Federal department has its own process. So, again, as we approach the Federal Government, it's, "OK, which organization within the Federal Government?" So, it's not standardized. The second thing is, the rules aren't the same. And then, the third component is that there's no set checklist. So, again, the Federal Government typically is good about, you know, providing, you know, lots of documentation on policies and procedures. In this particular area, we just need a simple checklist. We're happy to fill out all of the requirements. Just give us the checklist, let's stick to the checklist. And again, there really should be something driving the timeline—the timeliness of this, and that would greatly help the industry.

Senator JOHNSON. Mr. Adelstein, just last week the GSA indicated to my staff that it has taken steps to implement some of the siting provisions we included in the Spectrum Act of 2012. From your perspective, have they taken adequate actions? And, if not, what do they need to do?

Mr. ADELSTEIN. I think they could do more. I think it was very helpful. You know, you talk about long it takes the Federal Government to do things. Congress mandated they do that in 2012, and

here we are in 2015, almost 2016, and they got it done. So, you wonder what takes so long. We talked about the fact that you have to renegotiate sometimes every site is different. And we've asked, and you've talked about legislation that would help to improve that process. I think that there's a lot that the Broadband Opportunity Council could do further. I think they've done a lot. The report was very helpful, as far as it went. But, I think Congress can do more on Federal lands. The legislation that Senator Rubio and Senator Klobuchar talked about introducing with Senator Gardner today, and, I think, with your support, the Federal lands would be—would speed the deployment coming up with more standardized processes so each time we have to negotiate for a lease, it doesn't have to be reinventing the wheel every time with some bureaucrat who, frankly, doesn't care that much. I mean, it—to their own credit, they have other responsibilities, they're busy, they've got a big pile on their plate, and they're not thinking about broadband. But, the President has said, "You should be thinking about broadband." He put together a council to talk about it. He issued an executive order. And GSA still took 3 years to basically even put together a common lease form. So, there's a lot more that needs to be done. I think that the work by this committee in enacting legislation to promote that in—with your support and leadership, I think can really help to expedite, at least on Federal lands, getting broadband deployed.

Senator JOHNSON. You know, in order to get some of this legislation passed or some of these policies implemented, it's really nice to have a really good anecdotal story. Do you have any stories that just kind of speak to how absurd this is?

Mr. ADELSTEIN. Well, you know, I was talking to somebody a little while ago about—they were trying to get something through in the California area, which can be notoriously difficult, and it—he had planned on, "You know, OK, it's going to take a while. I need 5 years." Ten years later, he's still trying to get it sited there, an area where there is no broadband coverage, you're going down a major highway, and everybody gets their calls dropped there. So, you'd think, OK, this is the place to do it. It's a desert, where there's really not a lot you need to worry about. You put a tower there, it's—you know, might disturb a lizard or something, but, basically, what is, you know, the problem, here, when people are trying to get work done as they're commuting or somebody might be in the car, traveling with them. You shouldn't be on your cell phone in the car, but, you know, if you're—need that service as you're driving down—emergencies and public safety—why can't we get that done? Why does it take 10 years? And today, he still hasn't gotten that approved.

Senator JOHNSON. Mr. Morrison, do you have any a example? Or anybody else want to offer up a good anecdote to help get these things implemented?

Mr. MORRISON. I would just reiterate that, again, 15 years in the industry, I have several examples that corroborate that, that what should have taken one, maybe two, years, from a government perspective, drag on from 5 to 10 years. That's absolutely not uncommon.

Senator JOHNSON. Again, just basically put up a tower.

Mr. MORRISON. That's correct.

Senator JOHNSON. Yes.

I have no further questions. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Johnson.

I want to follow up. Mr. Morrison, you mentioned, in your testimony—you were talking about how long it takes to get this stuff done—how the FCC's 2009 shot clock action has significantly decreased the time spent on zoning and approval processes, and reducing a widely recognized barrier to deployment. And this question has to do with whether or not a similar shot clock applied to Federal agency decisionmakers could be similarly helpful.

So, I'd like to get the opinion of the full panel, and start with you, Mr. Morrison, about your thoughts on a shot clock for other Federal agencies, and how that shot clock might be implemented.

Mr. MORRISON. The shot clock, in my opinion, is very effective. I would acknowledge that not every jurisdiction necessarily follows it to the letter, but it has had a significant impact in reducing what could have been 18–24 month process, in some of other bigger jurisdictions, down to 6 months or less. So, in my opinion, though it's not 100 percent coverage or fully in effect, it's had a very significant impact, in that, yes, if the Federal Government were to adopt something similar, again, not just for permitting and zoning, but also for the lease opportunity, it would have a positive impact.

The CHAIRMAN. Others on the panel? Shot clock.

Mr. ADELSTEIN. Yes. I think—you know, shot clocks have been very effective in implementing broadband deployment. One of the things that Congress had to do was to tell localities that, "You can't require zoning again on a tower you've already zoned." That was literally what they were doing. If you have a shopping mall, you don't have them rezone it just because, you know, Kmart's moving out and somebody else is moving in, but that's what was happening.

So, it took great bipartisan leadership in this committee to get that done. And the FCC, in its wisdom, said, "OK, look, at the end of the process, if—even after all that, if you can't get it done within the period of the shot clock, we're going to deem it granted. We're going to say you've got to make a decision now." A shot clock doesn't require a decision in the affirmative. It just says you've got to decide within a reasonable period of time.

And on a situation like a co-location, I think it made sense that the FCC said, "If you're just putting something up to expand capacity on an existing already zoned facility, let's just deem it approved if you can't get it done within a certain period of time." And that's something that you might consider, as well.

Senator JOHNSON. Mayor?

Mr. RESNICK. Mr. Chairman, just—in my testimony, I mentioned that Florida adopted these time frames—similar time frames—actually, 3 years—prior to the FCC's shot clock. And that—those time frames were adopted in cooperation by cities working with the industry and coming up with the language of that statute. So, this was something that we worked cooperatively with the industry in coming up with, and it's worked well.

There are some important exceptions to those time frames written into the Florida statute that are not written into the FCC's

order that you might want to think about, like, for example, if there's an emergency and it's impossible to have the meetings or whatever that has to take place to process the application, there's tolling of the time frames. If there's a hurricane hitting Florida and the Governor sets forth a state of emergency, the time frames are tolled. Similarly, if the local government cannot have their review process conducted in that timeframe, just because it's not possible to schedule the public reviews that might be necessary, the time frames are tolled, as well as the applicant and the local government can agree to extend. And, in my experience in Florida, as—even after the FCC shot clock was announced, most of the times the extensions come at the request of the applicant. They're just not ready to proceed with all the information needed to pursue the application or to address questions that are going to come up at a public hearing.

So, I think if you set forth time frames for the Federal agencies—and I don't know how their review processes take place—but, you might want to build in to some of those time frames the exceptions to allow the time frames to toll.

With respect to the remedy if they don't meet the time frames, that's important. You can't just say, "It's deemed approved. Go build your tower." Because, one, it's going to be very difficult—Mr. Adelstein can talk more about this than I can—but, it's my understanding that it's going to be very difficult to get insurance to cover that construction and that tower if they're doing it without a permit. So, there is—there's still value in saying, "It's not deemed approved. You can go construct your tower, but you still need to get a permit." Whatever process is required for that under a Federal level, they should still have to go through the permit.

The one that you might want to consider, local governments have gotten very swift at negotiating leases for local property with infrastructure providers. Maybe as a remedy, have the Federal property be turned over to a local government. And I'm sure they'd be willing to take it, and we can negotiate a lease much swifter than the Federal Government, apparently.

The CHAIRMAN. That would be a reverse power grab, I guess——

[Laughter.]

The CHAIRMAN.—which I think many of my constituents would support.

But, it sounds like what you're saying is, you think what you have done could be applied to Federal agencies in the way that you——

Mr. RESNICK. Right. I mean, it's worked. I'm not aware of any instances, really around the country, where there's been tremendous fights because of not meeting the time frames. Perhaps Mr. Morrison might have specific examples. But, for the most part, it has worked, and the industry and the local governments continue to work cooperatively on processing these applications in a timely fashion. And again, I'm not familiar with the review that's required by the Federal agencies, but it's worked, from the local government standpoint.

The CHAIRMAN. OK.

Mr. Kinkoph, you have extensive experience implementing coordinating programs aimed at increasing broadband deployment

across the country. And, as you know, a broadly supported recommendation is to create a national data inventory of existing Federal property assets that may be suitable for facilitating broadband deployment and infrastructure. Such an inventory would include data on the condition, availability, location, and ownership of Federal property. It seems that NTIA is well positioned to manage such a data base, particularly considering the work your agency's already done on the national broadband map. Can NTIA, with support from Congress, obtain from other Federal agencies the key information needed to create this inventory?

Mr. KINKOPH. NTIA is currently going to be part of a team that is doing that through the Broadband Opportunity Council. And if so, it is being led by OSCP and NEC, and NTIA will be part of that team to gather that information and provided it on an open data source so that other organizations can create maps, or whatever they need to do with it. But, at this time, I'm not in a position to say that NTIA would take that on.

The CHAIRMAN. OK. Can't say that, but——

Mr. KINKOPH. I would have to——

The CHAIRMAN.—it could happen?

Mr. KINKOPH.—back.

[Laughter.]

The CHAIRMAN. OK. Well, that's—I mean, if we were to give some direction there, you seem well suited and positioned——

Mr. KINKOPH. Yes.

The CHAIRMAN.—your agency does, to do that.

Mr. KINKOPH. Resources are always an issue.

The CHAIRMAN. Right. OK. Well, that would certainly have to be addressed, as well.

In addition to the types of information that I mentioned, which—you know, location, availability, ownership, et cetera—what other types of data do you think ought to be included in that type of an inventory? And I direct that to you, and if anybody else wants to take a shot at that.

Mr. KINKOPH. It's a—you know, my view is, it's—I don't have a checklist, but, you know, location of towers, conduits, fiber, and—you know, there's other issues that have to be addressed that hasn't been addressed here, and I'll just raise it: national security, national—you know, Homeland Security's part in the BOC, and all those issues have to take in as you become—and you publish those—that type of information. But, I believe that it should be as broad and as sweeping as possible to help the industry know and be able to deploy quickly throughout the U.S. But, I don't have a checklist currently with me.

The CHAIRMAN. OK. All right.

All right. Well, if there are no other questions, we certainly appreciate your testimony today and thank you for your responses. There were a couple of questions for the record that we'll try and get, and, if you can, get those back to us as quickly as possible.

Of course, the hearing record will remain open for 2 weeks. During this time, Senators are asked to submit any questions for the record. And, upon receipt, the witnesses are requested to submit their written answers to the Committee as soon as possible.

Thank you all very much.

This hearing is adjourned.
[Whereupon, at 12:05 p.m., the hearing was adjourned.]

# A P P E N D I X

PREPARED STATEMENT OF HON. MARCO RUBIO, U.S. SENATOR FROM FLORIDA

The Internet is the greatest invention of our generation. The possibilities it has created—from enabling a single mom to attend college online, to allowing a human rights activist to make their voice heard on Twitter—are virtually endless. It has been a transformative innovation that has changed our world and brought greater opportunities, prosperities and freedom within reach of more people. None of this is assured forever, especially as policies are debated nationally and internationally that would fundamentally change the Internet as we know it.

For example, in 2010 the Federal Communications Commission identified the need for additional spectrum, the finite resource that makes the use of the Internet and wireless broadband possible. As we move toward an increasingly mobile digital economy, our national demand for spectrum will only increase. Unfortunately, the Federal gove1nment is relying on 20th century governance to oversee decisions regarding the future of our Internet and broadband capabilities.

Today and further into the 21st century, we will need greater commercial access to the infrastructure, including spectrum, that has made the types of innovation we have become familiar with possible. For this reason, I introduced the Wireless Innovation Act, which has been supported by five of my colleagues on the Senate Committee on Commerce, Science, and Transportation. This bill would release government-owned spectrum to increase commercial use, identify ways to increase the efficient and transparent use of spectrum by Federal users, and incentivize the deployment of broadband on federally-owned property.

I believe this framework is vital in bringing us closer to creating the infrastructure necessary for greater wireless access and closer to a global economy supported by the Internet of Things. That is why I have been working with my colleagues to pass the Wireless Innovation Act in order to bring our Federal plan for governing these resources more in line with 21st century realities.

We should be identifying federally-owned spectrum and reallocating those resources through an auction pipeline to commercial entities. In the age of our growing Internet, the Federal Government should be helping, not hindering, innovation and investment through this process. We should also recognize there is a role for unlicensed and shared spectrum, and approach the process of reallocating spectrum in a comprehensive manner that facilitates the best use of our existing resources, without creating an approval or authorization process that prohibits growth and innovation.

This process will in turn help to create more transparency and analysis around the use and the value of existing spectrum held by the Federal Government. We should know how our spectrum is used and, where possible, find ways to make it even more efficient. We should also have a streamlined process for the deployment of wireless infrastructure on federally owned or controlled property. This will allow data to move more quickly and allow for increases in coverage and capacity. Our government should not be a barrier to deployment because of outdated regulations.

One reason I believe the Internet has worked so well because, for the most part, the Government hasn't stepped in to ruin it. Let's keep it that way.

COMPETITIVE CARRIERS ASSOCIATION
*Washington, DC, July 29, 2015*

Hon. JOHN THUNE,
Chairman,
U.S. Senate Committee on Commerce,
Science, and Transportation,
Washington, DC.

Hon. BILL NELSON,
Ranking Member,
U.S. Senate Committee on Commerce,
Science, and Transportation,
Washington, DC.

Dear Chairman Thune and Ranking Member Nelson:

Competitive Carriers Association (CCA) respectfully submits this letter for the record regarding today's hearing on "Wireless Broadband and the Future of Spectrum Policy." CCA commends the Committee for beginning a bipartisan process to consider ways to meet future demand for wireless services through a long-term legislative solution.

Mobile broadband is a critical component of modern life, and spectrum is the lifeblood of mobile services. CCA represents over 100 competitive wireless providers ranging from small, rural carriers to regional and nationwide providers, as well as approximately 200 associate members consisting of small businesses, vendors, and suppliers that service carriers of all sizes. All CCA members depend on procompetitive policies that support their ability to access critical spectrum resources and continued growth of mobile broadband to meet their customer's needs.

In addition, mobile broadband powers advanced telemedicine, limitless education, employment prospects, public safety, precision farming, and other innovative new services and opportunities, both in urban population centers and in rural America. Indeed, nearly half of all United States households are now "wireless only" and PEW Research recently found that "nearly two-thirds of Americans are now smartphone owners, and for many these devices are a key entry point to the online world." While carriers continue to make impressive progress to provide innovative services, there is still work to be done. CCA supports the Committee's focus on fueling broadband investment and growth with additional access to spectrum and by promoting policies that remove barriers to competition and facilitate the next disruptive innovation.

**Ensure Competitive Spectrum Policies**

Building on the Spectrum Act and the progress made implementing it, Congress has a key role to play in creating durable, enduring processes to meet our wireless nation's spectrum needs. Looking over the horizon, rather than focusing on a particular spectrum band or technology, policymakers should foster efficient spectrum management that maximizes utilization of this finite, taxpayer-owned resource.

While we all must cooperatively work to identify additional spectrum resources for mobile broadband use, competitive principles currently in place should guide future spectrum policy. For example, spectrum must be interoperable to support open ecosystems that allow carriers of all sizes and technologies to maximize use of spectrum to unleash new services. Interoperability was required for the original Cellular spectrum band, and policies requiring or restoring interoperability in other spectrum bands provide carriers with the certainty that scarce spectrum resources can be used to enhance competition and service offerings. Future spectrum allocations must be interoperable to support a competitive mobile ecosystem.

Additionally, the FCC should continue to allocate spectrum in smaller geographic license sizes. CCA applauds efforts to reinforce this principle, and commends Chairman Thune's repeated support in previous hearings for using smaller geographic license sizes to encourage interest in rural areas. Smaller geographic license sizes, like Cellular Market Areas or Partial Economic Areas, are necessary for smaller carriers to be able to compete for spectrum at auction and support utilization nationwide, particularly in rural areas. Furthermore, policymakers should consider appropriate build-out requirements and, as required by the Communications Act, policies that help to avoid excessive spectrum aggregation that impedes competition.

**The Next Band: A Broad Range of Solutions Should Be Considered**

There is no one-size-fits-all solution to making more spectrum available for mobile carriers, and each additional spectrum band will have unique utilization challenges and opportunities. Congress should consider a broad range of ideas that collectively add up to new and enhanced opportunities for access to additional spectrum resources. Market-based proposals, like those contemplated in the Rural Spectrum Accessibility Act (S. 417), provide incentives for wireless carriers to enter into business agreements to partition or disaggregate a spectrum license to make unused spec-

trum available to small carriers or for carriers to serve rural areas, particularly when this spectrum may otherwise go unused.

Despite recent efforts to repurpose the AWS–3 band, the Federal Government remains the holder of the largest amount of spectrum. While Federal users must retain access to resources necessary to complete their missions, Congress should consider policies to support reallocation where appropriate. A good example is the Wireless Innovation Act (S. 1618), which supports identifying Federal spectrum that can be reallocated for mobile broadband use and encourages deployment on Federal buildings and lands. Another example, the Federal Incentive Auction Act (S. 887) provides monetary incentives for Federal users to reallocate spectrum for commercial use in exchange for a percentage of the auction proceeds. These legislative efforts provide opportunistic uses of spectrum which encourage more efficient use. As FCC Commissioner Rosenworcel has articulated, carrots to incentivize spectral efficiency among Federal users allow the mobile broadband industry and the Federal Government to cooperate to identify opportunities to maximize use of otherwise under-utilized spectrum.

Increasing demand for spectrum, and the limited amount of new spectrum resources available for license, requires policies that consider opportunities that unlicensed spectrum offer for innovators, entrepreneurs and existing mobile operators to maximize spectral resources. Unlicensed spectrum, as a compliment to licensed spectrum, helps to support enhanced services and competition. In identifying future spectrum bands for potential reallocation for commercial use, higher frequency spectrum can support on-the-spot capacity solutions, while continued work to identify lower frequency spectrum to support wide area coverage, particularly in rural areas. Progress in identifying spectrum for unlicensed use in the 3.5 GHz and 5 GHz bands provides a good example of ways to support new technologies while enhancing licensed carrier services. Stakeholders prefer exclusive use of licensed spectrum, yet facing today's realities all options should be on the table. Access to new frequencies and technologies, with open ecosystems that support the availability of devices in all spectrum bands, for all carriers, should be encouraged.

**Role of Technology**

Spectrum availability, as vital as it is, requires sound standards-setting to support both competition and meet growing wireless demands. Policymakers should continue to play a role as standards are developed to ensure all Americans benefit from new innovations and technology advancements. Establishing core competitive principles for emerging technology while avoiding unnecessary regulation will help bridge the digital divide between urban and rural areas. New technologies like LAA, LTE–U, smart antennas, dynamic spectrum access and cognitive radio may help alleviate network congestion and provide carriers with new avenues to offer faster, more efficient service to otherwise unserved areas. This is a particular focus of CCA members that do not have the same spectrum portfolios of their largest rivals. Ensuring the capabilities of future networks now will help us to meet the needs of urban and rural consumers alike and in turn will spur development of 5G services. The United States has led the world in 4G deployment. The same should be true of 5G deployment, and these policies will foster that leadership. Policymakers should keenly emphasize that new technologies and services are available nationwide to maximize spectrum utilization and make sure that rural areas are not left behind as new services evolve.

**Infrastructure**

While spectrum is the invisible infrastructure over which mobile services ride, carriers also depend on towers and other physical network components. Wireless broadband is necessarily dependent on costly infrastructure to provide services. Competitive carriers depend on reasonable facilities siting policies to deploy critical wireless services. Many competitive carriers serve the most rural areas of the United States and often face challenges obtaining prompt collocation or tower construction permits or rights of way for siting on Federal lands. Efforts to streamline the siting process and remove unnecessary red tape encourage faster deployment of mobile broadband infrastructure and services to consumers.

The Bureau of Land Management (BLM), National Parks Service (NPS), United States Forest Service (USFS) Fish and Wildlife Service (FWS) and other Federal agencies own, manage, or administer significant portions of land, particularly in western and rural states. Competitive carriers seeking to deploy mobile broadband in these areas face unreasonable delays and other impediments to constructing and siting on these lands. Barriers to deployment often raise a carrier's cost through onerous administrative, legal and regulatory requirements. Consolidating Federal requirements, and trimming excessive or duplicative rules when multiple Federal

agencies are involved in approving the same infrastructure project would help to streamline an otherwise laborious process. For example, creating an application clearing house to coordinate all Federal permitting required for a project would reduce delays and utilize limited resources more efficiently.

Similarly, carriers depend on timely responses from state and local governments on siting applications. Shot clocks and other defined time frames and parameters allow for efficient application consideration without creating unnecessary delays or obstacles for carriers to expand their facilities. The Supreme Court's ruling in *T-Mobile South LLC* v. *City of Roswell,* which requires local and state governments to act expeditiously and clearly state their objections to a tower siting application, is a step in the right direction. Should further disputes regarding state and local authority continue to arise, we encourage Congress and the FCC to provide additional guidance to provide clear rules of the road for tower siting.

**Certainty Regarding Other Inputs to Wireless Broadband Supports Continued Investment**

While today's hearing is focused on spectral inputs for continued growth of mobile broadband services, CCA would be remiss not to mention the need for certainty regarding access to other inputs and incentives. For example, carriers, non-nationwide carriers in particular, require access to reasonable data roaming, access to devices, and certainty regarding the Universal Service Fund (USF) to continue to invest to meet growing demands. Congress created USF to provide reasonably comparable services to urban and rural consumer alike, requiring that support be predictable and sufficient. These policies have enabled years of expansion of mobile wireless services in rural America. USF injects a healthy dose of funding to supplement and compliment competitive carriers' private sector investments to expand mobile broadband service in rural and high cost areas that are otherwise uneconomical to serve. Any uncertainty regarding existing and future support has the potential to delay or prevent deployment of broadband infrastructure.

Uncertainty regarding existing and future support has the chilling effect of stalling deployments and forcing carriers to make difficult decisions regarding existing and planned mobile broadband services. In addition, this uncertainty has the potential to strand existing investments, leaving behind a legacy of rusty towers and reduced services. Congress must continue its oversight to ensure that USF support is sufficient and predictable to support wireless service throughout rural America.

Similarly, uncertainty regarding the availability of devices to utilize new spectrum allocations or access to backhaul and roaming to provide services limits smaller carriers' ability to invest and provide services in rural and underserved areas. As the legislative process continues, CCA encourages the Committee to focus on providing carriers of all sizes with access to all inputs necessary to meet continually growing demands.

In conclusion, CCA applauds and supports committee efforts to provide additional spectrum resources for mobile broadband and welcomes the opportunity to help craft a proactive approach to potential solutions. Enacting policies that provide competitive carriers with certainty while eliminating or streamlining burdensome procedures and creating innovative solutions to access finite spectrum resources will encourage investment and expansion in mobile broadband infrastructure and foster continued innovation and economic growth. Consumers across the United States, especially in rural areas, will benefit from Congress's continued focus on policies that support competition and investment in mobile broadband. CCA appreciates the opportunity to contribute to the record for today's hearing, and looks forward to continued work with the Committee, its Members, and the FCC on these important issues to increase mobile broadband services and support competition in the industry. Please do not hesitate to contact me with any questions.

Sincerely,

STEVEN K. BERRY,
*President and CEO.*

AEROSPACE INDUSTRIES ASSOCIATION
*Arlington, VA, October 6, 2015*

Hon. JOHN THUNE,
Chairman,
Committee on Commerce, Science, and Transportation,
United States Senate,
Washington, DC.

Hon. BILL NELSON,
Ranking Member,
Committee on Commerce, Science, and Transportation,
United States Senate,
Washington, DC.

Dear Chairman Thune and Ranking Member Nelson:

The Aerospace Industries Association (AIA) represents an industry that directly employs more than one million workers across the country, and provided $220 billion in revenue and $118 billion in exports in 2014 alone. This industry supports a broad swath of the American economy, including the civil aviation industry, which contributed $1.5 trillion to the Nation's economy in 2012. Equally importantly, our members design, develop and manufacture the cutting-edge aircraft, satellites, and weapon systems that keep our Nation safe and protect U.S. national interests around the globe.

As you know, many of the technologies the aerospace and defense industry depends upon, develops, and delivers are spectrum-dependent. Without continued and reliable access to spectrum, Federal agencies and military service members may not be able to accomplish their missions effectively. Consequently, our industry is a critical stakeholder in the debate on spectrum policy and the management and use of spectrum by the Federal Government. We understand that the civilian economy demands increased access to additional spectrum for commercial broadband. However, changes in spectrum policy must take care to ensure that any such transition not be conducted to the detriment of our national security, intelligence capabilities, or new entrants to our economy such as the integration of unmanned aircraft into our national airspace.

Existing manufactured systems should be taken into account when considering spectrum policy changes. Many aerospace and defense systems are developed in accordance with international standards to operate in certain frequencies. Many missions and applications require technologies to operate on specific frequencies given the constraints placed on technology by the laws of physics. Yet, as technology advances and subscriber usage and markets evolve, the frequencies where some services can operate may also change. For example, the commercial wireless industry has pursued higher and higher frequency bands to complement their existing systems, whereas it was once thought that only lower frequencies could be technologically or economically feasible. As such, AIA requests that policymakers undertake a cautious approach and determine the readiness of alternative technology solutions and associated impact to end users by working collaboratively with the U.S. aerospace & defense industry in formulating policy.

The systems built by our members are primarily developed and manufactured in the United States. All of AIA's members are U.S. manufacturers. We have an established industrial base and supply chain that makes enormous contributions not only to our country's economy, but also to our Nation's safety and well being. Our ability to accomplish these goals relies on the continued availability of spectrum to support our systems and solutions.

I respectfully request your approval, if appropriate, to place a copy of this letter in the hearing record of your October 7, 2015 hearing titled "Removing Barriers to Wireless Broadband Deployment." We greatly appreciate your expertise and leadership on spectrum issues, and as you pursue changes in spectrum policy in the current Congress, I hope you will consider the needs of our industry and consider us a resource in future stakeholder discussions.

Sincerely,

DAVID F. MELCHER.

*Aerospace Industries Association—Issue Paper*

SPECTRUM—CRITICAL TO U.S. AEROSPACE & DEFENSE INDUSTRY CONTRIBUTIONS TO U.S. ECONOMY AND GLOBAL LEADERSHIP

**AIA Recommends Spectrum Principles for U.S. Policymakers**

The Aerospace Industries Association (AIA) recommends that U.S. policymakers advance spectrum principles that:

- Include the interests of all spectrum stakeholders, including U.S. aerospace & defense industry.
- Recognize that our industry contributes high-tech jobs, exports, technology innovation, research and development (R&D) benefiting both the U.S. economy and U.S. national security.
- Enable the aerospace and defense industry to continue as the single largest U.S. net exporter of technologically-advanced systems and solutions.
- Promote U.S. economic growth by ensuring continued safe, stable and secure operation of U.S. systems and technologies—aeronautical, radar, satellite—that enable critical weather forecasting, public safety, air traffic control, navigation, flight testing, earth monitoring, and national security activities.
- Ensure our industry's ability to access critical spectrum to support R&D, and safe, efficient and secure facility and manufacturing operations.

**Key Facts About the U.S. Aerospace and Defense Industry**

- Employs more than 1 million workers across the United States.
- In 2014 generated over $220 billion in revenue and exported over $118 billion.
- The U.S. civil aviation industry contributed $1.5 trillion to the U.S. economy in 2012. Last year 848 million passengers flew on U.S. domestic flights and on foreign airlines serving the U.S.

**Discussion**

Spectrum is vital to everything that the U.S. aerospace and defense industry creates, so it is critical that policymakers take the needs and concerns of the industry into account in debates on spectrum sharing, Federal spectrum repurposing, and commercial spectrum requirements. The performance of high-tech, advanced platforms, systems and solutions that we innovate, develop, manufacture, and deploy are dependent on spectrum preservation and access. Therefore, we have a vital stake in discussions about Federal spectrum policy.

*Critical Spectrum Uses for Technology Operation and Development*

Spectrum is an enabler of advance aerospace and defense systems, solutions and services provided to commercial, Federal and international customers. The U.S. aerospace & defense industry invests substantially in *new and existing technologies* that rely on spectrum, including:

- Civil Aviation and NextGen
- Unmanned Aircraft Systems
- Commercial Space Transportation
- Critical Infrastructure Protection
- The Global Positioning System
- Radars
- Earth Observation
- Weather Forecasting
- Secure Global Communications
- Maritime Communications
- Missile Launch Warning

The U.S. aerospace and defense industry is comprised of large manufacturers, as well as medium and small suppliers, which rely on certain frequencies with specific technical characteristics in the manufacturing and testing process. These cutting-edge technologies must be safely and securely tested to ensure our systems meet the safety requirements of our customers. Civil aviation users include airlines, business aviation, and private pilots. Government users include the U.S. military, law enforcement, customs and immigration enforcement, and state agencies.

*Technological Considerations*

Existing manufactured systems should be taken into account when considering spectrum policy changes. Many aerospace and defense systems are developed in accordance with international standards to operate in certain frequencies. Many missions and applications require technologies to operate in specific frequencies given the constraints placed on technology by the laws of physics. Therefore, it is not always possible to simply move technologies to new frequencies. While our industry is open to discussions on relocation and sharing where it makes technological and

financial sense, sometimes it may not be feasible for a particular application or mission, due to the technical operating characteristics of specific frequency bands—including signal range, power requirements, signal penetration into objects like buildings, and interference with other systems.

Yet, as technology advances, the frequencies where some services can operate may also change. For example, the commercial wireless industry has pursued higher and higher frequency bands for their systems, whereas it was once thought that only lower frequencies could be economically feasible. As such, AIA requests that policymakers undertake a cautious approach and determine the readiness of alternative technology solutions and associated impact to end users by working collaboratively with the U.S. aerospace & defense industry in formulating policy.

**Summary**

AIA supports a long-range vision that provides reliable access to spectrum for the aerospace & defense industry, the wireless broadband industry, and government investments alike. AIA looks forward to engaging with U.S. policymakers, both as a stakeholder and as a resource to ensure the U.S. has a robust, balanced, and inclusive spectrum policy that preserves our Nation's civil aviation, communication and navigation systems, and national security.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. DEB FISCHER TO DOUGLAS KINKOPH

*Question.* Earlier this year, Senator Klobuchar and I introduced the Rural Spectrum Accessibility Act, which would incentivize wireless carriers to lease unused spectrum to smaller rural carriers. Have any of the witnesses had an opportunity to review this proposal or others to incentivize spectrum sharing? Do you believe this would help expand access?

Answer. NTIA manages Federal use of spectrum while the Federal Communications Commission (FCC) manages non-federal use. Thus, the FCC may be in a better position to comment on the specifics of the proposed Rural Spectrum Accessibility Act. The Administration has not taken a position on this specific proposal. However, NTIA generally supports appropriate initiatives to expand access to spectrum and facilitate efficient use of scarce spectrum resources, which are clear objectives of the proposed measure.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DAN SULLIVAN TO DOUGLAS KINKOPH

*Question 1.* Companies in my state that are currently trying to build much needed broadband infrastructure have been delayed by unexpected requirements in the permitting process. How can we improve transparency in the permitting process to avoid this?

Answer. State, local, and Federal permitting delays often impact broadband construction projects, and all levels of government should work to increase transparency to facilitate the permitting process. At the Federal level, President Obama recognized the importance of transparency when he issued Executive Order (EO) No. 13616, "Accelerating Broadband Infrastructure Deployment," to facilitate wired and wireless broadband infrastructure deployment on Federal lands, buildings, and rights-of-way. While Federal agencies have made significant progress in streamlining Federal processes, the 2015 Broadband Opportunity Council (Council) received input from stakeholders indicating that the Federal Government can still do more to help service providers obtain the necessary permits and permissions to build out broadband networks on Federal lands and use Federal assets or cross Federal rights-of-way, particularly by streamlining Federal permitting processes. Building on the EO 13616 actions, the Council's report includes agency commitments to create an online inventory of data on Federal assets, such as the Department of Interior (DOI) telecommunications towers, that can help support faster and more economical broadband deployments to remote areas of the country. Additionally, the Administration is committed to streamlining the applications for programs and permitting processes to facilitate broadband deployment and foster competition. The implementation of these agency actions should help to improve transparency and minimize delays in gaining access to Federal assets for increased broadband investments.

*Question 2.* Companies in my state have explained that they try to build their infrastructure across State, private, or Alaska Native land, rather than deal with the problems associated with crossing Federal land. Do you agree that it is a problem

that the private sector is avoiding building broadband infrastructure on Federal land, especially when more than 60 percent of Alaska is owned by the Federal Government?

Answer. Federal lands, buildings, and assets are important conduits for broadband deployment and should be readily accessible for deployment of broadband infrastructure. The Broadband Opportunity Council (Council) heard from multiple stakeholders urging Federal agencies to take action to streamline processes and standardize timelines for the review and processing of permitting applications and make such documentation easily accessible. One of the Council's guiding principles is that the Federal Government should strive for uniform definitions and common permitting and application processes to reduce the burden on local government, state government, non-profit, and private applicants applying for Federal resources. The deployment of broadband requires collaboration between the public and private sectors and often cooperation across multiple levels of government. Federal agencies should work closely with the private sector and local and state governments to ensure Federal policies facilitate investment in broadband services.

*Question 3.* I, along with some of my colleagues, sent a letter to the Co-Chairs of the Broadband Opportunity Council. In it, we asked for an analysis of current broadband initiatives. Can you point to any specific initiatives that are working particularly well? Can you point to any that are not?

Answer. NTIA was responsible for implementing the broadband grants programs established by the American Recovery and Reinvestment Act. We believe this program was a resounding success. It fully delivered on its pledges to create jobs, stimulate economic development, spur private-sector investment, and open up new opportunities in employment, education, and healthcare. NTIA's broadband grantees deployed more than 115,000 miles of new or upgraded network miles; connected more than 25,500 community anchor institutions; installed or upgraded more than 47,100 personal computers in public access centers; and prompted more than 670,000 people to subscribe to broadband services.

Through the ongoing BroadbandUSA initiative, NTIA is leveraging the expertise gained by overseeing this broad portfolio of broadband infrastructure and adoption grants to help communities expand their broadband capacity. NTIA's technical assistance ranges from workshops and webinars to more personalized one-on-one community assistance. NTIA can help communities navigate government rules and grant programs; find the best way to design and deliver a broadband adoption program; and attract broadband investment. To date, NTIA has held four regional workshops to bring community and industry stakeholders together to discuss how best to support their broadband needs. NTIA has also released field-tested guides such as our Broadband Adoption Toolkit, Public-Private Partnership Primer, and Guide to Federal Funding of Broadband Projects to inform community broadband efforts. NTIA has received very positive feedback on its broadband initiatives and plans to issue additional publications on broadband topics over the next several months.

Additionally, through the Broadband Opportunity Council (Council) all member agencies were surveyed to identify programs that could be modified to support or further support broadband. The Council then developed 36 immediate actions, with associated milestones, that the member agencies agreed to undertake. Once implemented, we believe that these recommendations will make a meaningful difference to communities seeking new tools and resources to promote broadband investments.

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### Response to Written Questions Submitted by Hon. Steve Daines to Douglas Kinkoph

*Question 1.* Mr. Kinkoph, you talked about the FCC's recommended download speed of 25 megabits per second and how over 50 million Americans' current broadband connection does not meet that standard. But does the average consumer really need 25 megabits per second? You can stream HD video at 4 megabits per second and 10 megabits per second is considered industrial strength. So why are we focusing on upgrading download speeds for Americans who already have broadband when there are still plenty of people—many in Montana—who have no connectivity at all?

Answer. NTIA recognizes that consumers' needs for broadband speeds will vary depending upon their broadband usage or the types of applications they demand. In its February 2015 Broadband Progress Report, the Federal Communications Commission (FCC) updated its broadband benchmark speeds to 25 Mbps for downloads and 3 Mbps for uploads to reflect advances in technology, market offerings by broadband providers, and consumer demand. The FCC noted that high-speed

broadband is essential to support video, telemedicine, distance learning, and other applications needed by such end users as hospitals, schools, and libraries. In many cases residential broadband connections serve multiple people as well as a variety of devices within a single household therefore increasing bandwidth needs and the demand for high-speed broadband. Additionally, consumers using broadband to stream and download HD video will require higher speeds to ensure they receive an acceptable quality of service. Still, NTIA knows that there are many areas of our country, particularly in very rural areas and tribal lands, where any broadband connection would be an improvement over what exists today.

NTIA has demonstrated a longstanding commitment to promoting broadband deployment and adoption in unserved and underserved areas, including parts of Montana. Through the Broadband Technology Opportunities Program, for example, NTIA awarded a $13.7 million grant in 2010 to Ronan Telephone Company (RTC) to deploy a new high-speed middle-mile network to expand broadband services and promote economic development and recovery for underserved communities of Montana, including the Blackfeet and the Confederated Salish and Kootenai Tribes. As of June 2015, the project deployed 299 miles of new fiber and upgraded 106 miles of existing fiber. RTC also signed agreements with local Internet service providers to facilitate more affordable and accessible broadband service for households and businesses in the area. To date, RTC has connected 34 Community Anchor Institutions (CAIs), including educational institutions, government facilities, public safety entities, and medical facilities. RTC also partnered with Health Information Exchange of Montana to facilitate telemedicine and improved healthcare delivery for rural residents.

While much progress has been made, challenges still remain in bringing broadband to unserved areas of the country. Much of the easy work has been done—building out broadband infrastructure where the business case is compelling or encouraging broadband adoption and use among those who are already digitally ready. NTIA is committed to tackling the hard work that needs to occur to reach those communities where geography and economics render broadband deployment, competition, and adoption difficult to fully realize. NTIA is taking action through its BroadbandUSA initiative to offer communities the technical assistance and support they need to overcome their unique challenges hindering investment in broadband infrastructure and adoption.

*Question 2.* Mr. Kinkoph, NTIA has several different programs and partnerships to carry out its mission with respect to broadband, as do dozens of other Federal agencies. In fact, as you mentioned, the Broadband Opportunity Council report gave recommendations to over twenty Federal agencies. That sounds like a lot of agencies involved in carrying out the one common goal to bring broadband connectivity to Americans. What programs and policies does NTIA have in place to ensure that there is no overlap or waste?

Answer. The President created the Broadband Opportunity Council (Council) to provide a vehicle for strategic coordination among Federal agencies to promote greater broadband deployment and adoption. While there are several Federal agencies involved in promoting broadband use and adoption, many of the agencies named to the Council had never viewed broadband to be part of their core missions. So an initial part of the Council's task was for each agency to look internally at their existing policies and programs to explore whether there was flexibility to do more to promote broadband. This exercise helped raise the profile of broadband as a tool that these agencies could use to fulfill their missions and further agency goals. Council members collectively became more informed about barriers and issues facing stakeholders trying to deploy broadband and promote broadband adoption.

NTIA will continue to co-chair the Council to promote coordination among Federal agencies and monitor implementation of the agency actions. Additionally, interagency coordination is a key component of NTIA's BroadbandUSA initiative. BroadbandUSA regularly receives requests from other Federal agencies to provide input on broadband policies, review proposed legislation and rulemaking on broadband issues, and participate in their workshops or outreach activities related to broadband. In this role, NTIA can strive to minimize any overlap or duplication in Federal agencies' various broadband initiatives.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. CORY BOOKER TO DOUGLAS KINKOPH

*Question.* It is clear from the recent spectrum auction, which attracted over $44 billion in bids, and from your testimony that the demand for licensed wireless spectrum is growing. While Congress is addressing the need for licensed spectrum, we must also take seriously the need to expand our reserve of unlicensed spectrum for Wi-Fi and other purposes. Just how important is unlicensed spectrum and Wi-Fi to the continued expansion of mobile device communication?

Answer. Wi-Fi, and unlicensed spectrum use more broadly, continues to be a tremendous innovation success story. The Administration has stated that both licensed and unlicensed spectrum must be part of the country's spectrum policy. The Federal Communication Commission's (FCC) upcoming incentive auction will open up bandwidth by allowing unlicensed wireless use in the resulting guard bands. Earlier this year, NTIA collaborated with the FCC to enable a three-tier licensing approach that includes more traditional incumbent and priority access as well as general authorized access licenses (which provide low-barrier access to spectrum, much like unlicensed use) to frequencies in the 3.5 GHz band through the adoption of innovative mechanisms for sharing the spectrum with incumbent Federal systems. Even in areas where all priority licenses are in use, this sharing regime will make up to 80 megahertz of spectrum available to users who simply need certified equipment to operate, which could potentially help create a new space for innovative services to flourish. NTIA also is working closely with the FCC, other Federal agencies, and industry to evaluate and facilitate compatibility between unlicensed devices and incumbent systems to enable spectrum sharing in the 5 GHz band. Finally, NTIA is also working with the FCC on innovative approaches to increasing unlicensed access in the 64–71 GHz band.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARCO RUBIO TO HON. JONATHAN S. ADELSTEIN

*Question.* I've introduced The Wireless Innovation Act to free up more spectrum for commercial use and to streamline wireless infrastructure deployment, particularly on Federal property. I'd like to know whether within the Federal Government there are agencies that your members find to be particularly challenging?

Answer. The myriad of processes and procedures among different Federal agencies often poses insurmountable obstacles to siting wireless infrastructure on Federal property. PCIA strongly supports the Wireless Innovation Act ("WIA") you introduced because, among other important provisions, it includes a number of critical reforms to the Federal siting process. WIA would be a tremendous help in making the siting process on Federal property friendlier to wireless broadband buildout. A more standard approach to siting would allow easier interaction with agencies borne of varied histories and comprised of different cultures and values. The agencies have good people doing good work, but to date there have been bad processes or a lack of processes. Congress is well suited to provide direction and clarity that is otherwise lacking in the broadband deployment process on Federal lands today.

Just recently, the GSA indicated that it has at last taken steps to implement some of the siting provisions included in Section 6409 of the 2012 legislation and that would be required under the Wireless Innovation Act. From what you know of GSA's actions, have they acted in a way that will expedite the process for siting on Federal properties? If not, what remains to be done?

PCIA commends GSA's recent actions to follow its statutory mandates, albeit they late in implementing them. Its actions are certainly a step in the right direction but much more needs to be done. For instance, all landholding Federal agencies are not currently mandated to use the GSA forms or contracts. Without a requirement to standardize these forms across agencies, GSA's actions could be for naught. In addition, further congressional action is necessary to encourage long-term leases, swift renewal processes, and publicly available fee schedules. Moreover, without individuals at each agency who understand the important Federal mandate to spur broadband deployment and are empowered to approve or deny applications that have stalled at the field level, these projects will languish or will be abandoned. Even in light of GSA's recent actions, many of the provisions contained in the Wireless Innovation Act are necessary to further improve the process to site wireless facilities on Federal lands.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DEB FISCHER TO HON. JONATHAN S. ADELSTEIN

*Question 1.* Mr. Adelstein, in your written testimony, you discussed challenges related to the "wireless data crunch." You also provided several examples of how to address the challenge including spectrum access, efficiencies, and infrastructure. Can you please expand upon your comments, particularly as it relates to infrastructure solutions and rural consumers?

Answer. As I mentioned in my testimony, there is today an abundance of choices available to network planners to address the wireless data crunch. Traditional tall support structures effectively provide much of the coverage and capacity necessary for wireless broadband. To fill coverage gaps and overlay capacity in high traffic markets, the industry is also increasingly deploying distributed antennas systems and small cells. Further, the networks themselves are getting smarter. Self-optimizing networks and the combination of intelligent software and hardware design allows a network to anticipate usage and provide greater resources to areas of need on the fly, enhancing the user experience. Unlicensed spectrum similarly continues to play an important role in this system, offloading traffic to the wired network and providing greater headroom for licensed mobile services. Today's infrastructure will provide the cornerstone of the Internet of Things, 5G, and the applications, services, and jobs that will make up the economy of tomorrow. This is especially true in rural areas. As technology improves, it may become easier to serve rural communities. Now, network planners have an abundance of choices to serve a diverse set of areas.

*Question 2.* Earlier this year Senator Klobuchar and I introduced the Rural Spectrum Accessibility Act, which would incentivize wireless carriers to lease unused spectrum to smaller rural carriers. Have any of the witnesses had an opportunity to review this proposal or others to incentivize spectrum sharing? Do you believe this would help expand access?

Answer. As I mentioned in my testimony, we need as much spectrum as we can get, as fast as we can get it. Whether it's new spectrum or reusing or repurposing current spectrum allocations, it is important to look at all potential solutions to ensure that all Americans and all communities are able to enjoy the enormous benefits that comes from wireless broadband.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DAN SULLIVAN TO HON. JONATHAN S. ADELSTEIN

*Question 1.* The construction season in Alaska is shorter than most. This does not allow for delays caused by roadblocks in the Federal permitting process. How can we improve the timeliness of permitting on Federal lands?

Answer. The current process for siting wireless infrastructure on Federal lands is fraught with complications. Each landholding agency has their own process for siting, with different requirements and often different fees. PCIA has worked closely with Members of both the House and Senate on legislation to streamline and expedite the process. It would be very helpful, for example, if all Federal landholding agencies were required to use a common set of forms and contracts. Further, providing leases with a public and transparent fee schedule would provide the necessary certainty when deciding whether to invest in new infrastructure and shorten the timeline for individual site specific fee negotiations. The availability of long term leases and automatic renewal would also improve the Federal siting process, as would fee retention for the landholding agency.

*Question 2.* One of our carriers in Alaska experienced delays and increased costs in getting permission to install towers in building out their network. This situation involved only a few towers, with a small footprint, in a large national wildlife refuge. Is this a situation where a "shot clock" could help speed up the permitting process?

Answer. Yes. Applying a reasonable time limit on siting applications is helpful in the build-out of wireless broadband infrastructure on Federal or state lands. PCIA members are often frustrated with unreasonable and unnecessary delays in obtaining permits. It is not necessary to usurp local authority, but only receive a timely "yes" or "no" answer from the local government or agency.

*Question 3.* Alaska has some of the most remote, sparsely populated communities in the U.S. Access to high speed broadband Internet enables these communities to connect locally and globally. Given Alaska's topography, and the remoteness of many communities, there is a strong need for wireless broadband to help serve these unserved and underserved communities. Considering that the Wireless Infrastructure Association (PCIA) works with federal, state, and local governments to re-

move barriers to wireless broadband deployment, how does PCIA work with Alaska Native leaders to identify and overcome barriers to wireless broadband deployment on Alaska Native lands?

Answer. I have visited Alaskan Native lands and leaders in your state, and recognize the pressing need for connectivity there. PCIA has consistently highlighted that wireless is the most cost-effective infrastructure for low-density regions. Wireless infrastructure has the power to provide rural areas like those in Alaska the ability to compete in the innovation economy. One of the barriers to deployment in rural areas that PCIA has emphasized is access to Federal lands and property. Many of them that would benefit from streamlined siting are by definition rural. Having better access to Federal lands and property will help increase broadband availability in rural areas. PCIA recognizes that much of Alaska is Alaska Native land. We have worked with Native leaders through organizing and participating in workshops at the FCC that provide education on tribal wireless siting review processes and the importance of broadband deployment on Native lands. PCIA has also forged relationships with Tribal Historic Preservation Office leaders by inviting them to attend and speak at our Wireless Infrastructure Show.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. CORY BOOKER TO HON. JONATHAN S. ADELSTEIN

*Question.* It is clear from the recent spectrum auction, which attracted over $44 billion dollars in bids, and from your testimony that the demand for licensed wireless spectrum is growing. While Congress is addressing the need for licensed spectrum, we must also take seriously the need to expand our reserve of unlicensed spectrum for Wi-Fi and other purposes. Just how important is unlicensed spectrum and Wi-Fi to the continued expansion of mobile device communication?

Answer. Spectrum is a critical component for economic growth, international competitiveness and wireless innovation. As I noted in my testimony, more spectrum must be made available—as much as we can get, as fast as we can get it—because the demand for wireless mobile data continues to explode. Licensed spectrum remains a top priority because it allows for the greatest level of certainty and quality of service. However, both licensed and unlicensed spectrum are needed to continue incentivizing the incredible amount of investment that has made the U.S. the global leader in wireless innovation. Unlicensed spectrum is an important testbed for new applications in the consumer and enterprise space, and as wireless data demand increases, unlicensed spectrum is handling more and more of the offload and backhaul requirements.

In order to continue to encourage private investment in wireless networks, Congress needs to modernize spectrum policy for both licensed and unlicensed spectrum uses. This is why PCIA supports S. 424, the Wi-Fi Innovation Act. Your bill recognizes that the U.S. faces both an unprecedented wireless data crunch and a digital divide that puts lower-income Americans at a disadvantage. This bill is a crucial step toward the adoption of policies that will ease the wireless data crunch and help bridge the digital divide.

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RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. DEB FISCHER TO HON. GARY RESNICK

*Question.* Earlier this year Senator Klobuchar and I introduced the Rural Spectrum Accessibility Act, which would incentivize wireless carriers to lease unused spectrum to smaller rural carriers. Have any of the witnesses had an opportunity to review this proposal or others to incentivize spectrum sharing? Do you believe this would help expand access?

Answer. I have not had an opportunity to review this proposed legislation and do not currently have a position on it.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. STEVE DAINES TO HON. GARY RESNICK

*Question 1.* Mr. Resnick, you mention in your testimony that local leaders are managing many infrastructure needs and that sometimes there are delays to deployment. Can you expand on that and tell us what the sticking points are and what you, as local leaders, are up against that cause difficulty in moving the deployment process forward?

Answer. Thank you for this question. As an initial matter, it is important to note that the industry has reduced, voluntarily, the number of wireless infrastructure sites between December 2013 and December 2014. (Source: *http://www.ctia.org/your-wireless-life/how-wireless-works/annual-wireless-industry-survey.*) Moreover, according to informtion provided to me, the industry is not seeking to add a significant number of new sites in 2016. Thus, there is not a crisis in terms of the industry looking to add new wireless infrastructure sites and not being able to do so. Quite the contrary, largely because of how many sites have been successfully processed by local governments and constructed, the industry is not seeking to add as many sites as it has in prior years. There are certainly no issues created by local governments with respect to deploying new facilities.

To expand on challenges faced by local leaders, we have many challenges to provide services with limited government resources. The vast majority of local governments nationwide do not have a large number of staff members to process applications, and these staff members review, provide comments, inspect and manage a wide variety of activities in response to applications and inquiries from the private sector, in addition to handling government initiated projects to improve the quality of life for citizens and economic development activities. These functions are in addition to processing applications for deployment of communications facilities that may be filed. Local leaders and staff manage infrastructure deployment both in the rights-of-way and on government and private property. These management responsibilities include public works and utilities staff and land use and planning staff. Such activities range from engineering work for utilities and roads, land use planning and zoning compliance, drainage impacts, parks planning, development impacts on groundwater, hazardous materials, legal issues and other issues as well.

I am not suggesting that there are deployment delays *because* these are communications facilities. Rather, I was referring to the need to address *all* of our staffs' obligations in due course, given limited staff and resource constraints. The industry as well has challenges and does not have unlimited resources to pursue the deployment of wireless facilities.

Perhaps the best way to address the question is to provide an example using my City, Wilton Manors, FL, as an example. We have a population of approximately 12,000, but are fortunate to be able to budget significant resources to be able to pursue and respond to land use and planning activities than many local governments our size. During our budgeting process for our 2015–16 Fiscal Year, we identified several large-scale private development and infrastructure projects expected to be submitted, as well as government initiated land use and planning activities we determined to address. For example, we have two fairly large private developments that will be submitting applications for approvals this year that will have significant government resources in terms of plans review, comments, public hearings, permitting and inspection. IN addition, our private electric utility will be applying for permits for significant infrastructure utility pole replacements in our ROW. Further, the private railroad that bisects my city will be expanding its ROW and seeking permits for construction and blocking roadways. The staff resources for these projects are expected to be over 4,000 hours. We are aware of these projects because the corporations involved, smartly, met with my City leaders to give us a "heads up" so we can plan accordingly. In addition to these private-initiated projects, for economic development purposes we decided to rezone a significant portion of an area of our City. We have also budgeted to undertake major water and sewer system improvements. Further, we have obtained grants in excess of $3 million for significant roadway improvements that are in various stages of design, engineering and construction. Like any business, we budget to ensure we have sufficient and appropriate staff or contractors engaged to handle this work, but of course, will not waste taxpayer dollars by hiring staff and engaging contractors that may not be needed. Because of the level of activity for our 2015–16 Fiscal Year, we decided to hire an additional full-time planner at a cost to our taxpayers of approximately $120,000 and pursued an RFP to engage an outside planning firm and expanded the contracts for our City engineering firm and building officials.

We also recognize that in addition to these known projects, there will be hundreds of other projects and applications that arise that cannot be anticipated. My City staff generally process 40 permit applications per month.

The wireless industry generally does not alert local governments to applications they anticipate filing, prior to actually submitting an application. We are unsure if we can require pre-application filing meetings as we do with other development projects, or if such process would commence the shot clock. If a wireless infrastructure application is filed, we will process it in due course. Actually, because of the FL shot clock (which pre-dated the FCC's and actually affords less time), such application will force our staff to delay processing other applications, delaying the rail-

road, utility infrastructure and private development projects, as well as government initiated water and sewer and economic development. However, the FCC determined that such applications are more important than any other projects the City may be addressing. Thus, to comply with Federal requirements and avoid a lawsuit, we will move such wireless application to the head of the pack. What is further frustrating, is that often after submitting applications, the wireless communications industry will revise its needs and plans and seek to place applications on hold, or delay providing information needed to move applications forward. That has been the experience with the last three applications submitted by the industry. We understand that this industry is in constant flux with mergers, acquisitions, changed business plans and new technologies. But starting and stopping government processing is not an efficient use of limited resources.

Of course, time is money for all these projects. If the railroad, electric utility or private developers complain about delays, frankly it's easy for local leaders to blame Congress and the FCC in deciding that instead of a first come, first serve, process, the wireless communications industry gets special treatment.

I hope this elaborates sufficiently on what I meant that local leaders face many challenges.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. CORY BOOKER TO HON. GARY RESNICK

*Question 1.* No discussion of facilitating greater wireless broadband infrastructure is complete unless it addresses issues of local access. It has been my experience that local governments are often best suited to provide innovative solutions to the toughest challenges facing communities. Do you agree that local governments should be free to adopt municipal broadband networks?

Answer. Absolutely. Local governments should have the freedom and flexibility to determine whether municipal broadband is an appropriate and viable option for their communities' technology and communications needs. The Intergovernmental Advisory Committee (IAC) of the FCC, which I have the privilege of chairing, submitted a recommendation to the Commission supporting local authority to adopt municipal broadband networks.[1] The IAC acknowledged the many and diverse broadband networks provided by local governments. In many community/local government broadband networks, the private sector has been involved in helping design, build, and/or operate the network, creating new business opportunities and jobs in the process. We further mentioned that we have noticed firsthand that the private sector has provided better and more affordable broadband service in response to communities even considering deploying their own broadband networks. The IAC noted for example, in the case of the City of Chattanooga, which Petitioned the FCC to overturn Tennessee's ban on municipal broadband, it was offering 1 Gigabit per second broadband service for approximately $70/month to consumers. Such local governments should be commended for their commitment to their residents.

There are many areas of this country where residents and businesses do not have access to broadband services or where there is only one provider of broadband. There may be many reasons why the private sector decides not to invest in broadband networks in a certain community. When only one service provider serves a market, the quality of service, rates, and customer satisfaction suffer in comparison with customers who live in competitive markets. When the private sector does not create a robust competitive market, local governments, on behalf of their residents, should have the option of developing a broadband system that will serve the needs of their local residents and businesses.

In addition, the National League of Cities, National Association of Counties, and National Association of Telecommunications Officers and Advisors all have policies which support local authority to adopt municipal broadband networks.

*Question 2.* What can we do at the Federal level to enable and empower localities with the flexibility and tools necessary to provide access to broadband to their constituents?

Answer. There are many and important actions the Federal Government can undertake to enable and to empower localities with the flexibility and tools to provide access to broadband to our residents.

First, the Federal Government can ensure that local governments have a seat at the table when it comes to discussions and potential legislation about broadband.

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[1] Intergovernmental Advisory Committee to the Federal Communications Commission Advisory Recommendation No. 2015–3, submitted February 2, 2015. (*https://www.fcc.gov/encyclopedia/intergovernmental-advisory-committee-comments*)

Often times, localities are left out of the discussion/consultation process, yet we are most in tune with our communities' broadband needs and the challenges and opportunities at the local level. For example, the "Dig Once" legislation has a lofty purpose, but there have been few opportunities for input from local governments, many of which have already adopted similar legislation and may be responsible ultimately for implementing components of the effort.

Second, the Federal Government should support the removal of barriers to localities providing broadband to our constituents, either directly or in public private partnerships. The FCC's recent action overturning certain states' bans on municipal broadband is an example of Federal Government action that allows greater local flexibility.

Third, other issues being addressed at the Federal level will affect local governments' flexibility and tools that may be available to address broadband access. For example, there are discussions underway about continuing the tax exempt status of municipal bonds, restricting certain local taxes, or making permanent the ban on taxation on Internet service. If local governments do not have access to financing and sufficient revenues, broadband access provided by local governments may be harmed. In a similar manner, Federal funding for transportation and infrastructure projects will enable local governments to consider deploying infrastructure to enable greater broadband access as part of such construction initiatives.

Finally, there exists significant fiber and conduit deployed already in rights-of-way, which may be abandoned, unused, or used currently by local governments for limited purposes. Often such fiber and conduit may be subject to restrictions so that local governments are not able to use such resources to enable broadband access for their constituents. Many such restrictions are relics of antiquated policies or anti-competitive goals put in place to limit local governments' ability to use broadband networks. The Federal Government should explore measures through which such valuable, but unused and underused fiber and conduit resources, can be used by local governments to provide broadband access to residents and businesses, particularly when broadband service is otherwise lacking in the community. Below please find several examples of restrictions that limit local government flexibility to support broadband:

- There are some federally funded projects, specifically traffic signal automation, where many cities and counties have installed conduit and other infrastructure that could be used to support broadband deployment projects. However, because of conditions on the Federal grant, these governments have been reluctant to use conduit/fiber for wireless communications and broadband or non-governmental purposes. In particular this is the situation facing the City/County of San Francisco. These facilities are conveniently located with mounting assets in the form of traffic signals. If such restrictions were removed, it could free up miles of existing assets already in place, especially in urban and suburban settings, and not require digging rights-of-ways and property.
- In my City of Wilton Manors, FL, while we are a small city, we have many residents who do not subscribe to broadband either because of the cost or because they do not see the value in their lives. We attempted to create a digital literacy center using Federal CDBG funds to provide broadband for free to those who could not afford it and to teach residents how to use broadband effectively. Unfortunately, CDBG funds cannot be used for such purpose. Removing such restrictions on Federal programs would provide localities with more flexibility.
- In Martin County, FL, the County has inventoried more than 90 cell towers that are within one mile of the County's Community Broadband Network, which it constructed for its own communications needs to avoid escalating prices for such services by the private sector. The County has engaged in discussions with private communications providers about utilizing the County's network and aggregating providers' backhaul. There are much more opportunities for DAS deployments on this network as well. Unfortunately, several years ago the State of Florida adopted restrictions on local governments offering communications services, which calls into question the viability of the County pursuing such endeavors with private providers.
- Many local governments utilize fiber INETs constructed by their franchised cable operators. Cable operators imposed restrictions on the use of such fiber to prohibit use for non-governmental purposes. Even though the cable operators have been paid many times over for the costs to construct such INETs, the restrictions remain in place. There are many methods to remove such restrictions, allowing local governments to utilize such fiber for greater purposes. One of the questions asked at the hearing was what the communications industry could do to remove barriers to broadband. Certainly, if the industry agreed to remove

such restrictions, it would allow greater flexibility for governments to use industry-constructed fiber networks.

*Question 3.* Can municipal broadband networks be an important part of expanding wireless availability in cities by providing additional support for small cell and other wireless networks?

Answer. Unequivocally, yes, city and county broadband networks can be an important part of expanding wireless broadband availability. As noted above, often municipal broadband networks are limited by antiquated restrictions, either established in state law or by conditions imposed by private entities that constructed such networks. Thus, such networks used by local governments in the U.S. cannot be used to their full potential. Municipalities and counties have been at the forefront of creating solutions for the wireless communications industry to expand wireless services, particularly in areas that lacked satisfactory coverage. Local governments control significant fiber and other resources that, if restrictions were eliminated, could be used to provide backhaul, redundancy and other vital technical support for small cell and other wireless systems.

Local governments have a long history of utilizing their infrastructure to support wireless communications. For years, local governments have been leasing government owned towers erected for public safety communications, water towers and buildings to wireless providers for installation of communications antennas and related devices. In addition, governments with unrestricted fiber and infrastructure already support wireless uses. By way of example:

- City and County-owned fiber can support wireless as a means of backhaul (including DAS) and can serve as backbone or middle mile for public or private last mile broadband deployment. If we put a list together, it would run to hundreds of communities that already do variations on both of these strategies. One quick illustration: Washington, DC's own fiber supports public safety wireless and a wide range of other City uses, while its unrestricted fiber is offered to commercial providers that use it to service the last mile.
- In Arlington County, VA, much of the County's Public Safety Ring, as it's known, co-opted the available ConnectArlington conduit used for traffic and general county purposes. Arlington County is completing a fiber backhaul project for its microwave tower used for simulcasting emergency and public safety officers handheld communications across the County.
- The examples in response to question 2, with San Francisco and Martin County, FL, further demonstrate the ability of cities and counties to use infrastructure, *already in place in many cases,* to support wireless and small cell networks.

In conclusion, local governments support broadband deployment. We are not only regulators of the infrastructure installation and seek to ensure that our constituents have access, but we are large consumers of these services. In many cases, local governments can provide creative solutions to improve broadband access, either on their own or by facilitating deployment by private entities. Often local governments are reluctant to explore such creative solutions because of antiquated laws that restrict the use of funds or infrastructure, or anticompetitive restrictions imposed by private entities. As a result, much existing infrastructure owned and controlled by local governments that could be utilized to support broadband and communications services remains unused or underused. Thank you for the opportunity to respond to these questions.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DEB FISCHER TO CORY J. REED

*Question 1.* Mr. Reed, you stated in your testimony that John Deere supports allowing the Universal Service Fund to cover only broadband services, instead of requiring both broadband and voice. Earlier this year we had a letter with 61 senators that supported that proposal as well. Can you expand on the importance of this issue?

Answer. Universal Service Fund support for stand-alone broadband is important to ensure that rural end users of communications service, both business and residential, have the same ability to subscribe to broadband-only services as end users in urban areas. The FCC's 2011 *Connect America Fund Order* redirected the universal service system from supporting voice to supporting broadband. Until recently, however, the CAF provided support for broadband-only lines offered by the larger incumbent providers but not the smaller, rural providers. Congress directed that all consumers in our Nation should have access to advanced telecommunications serv-

ices, which includes broadband connections that are increasingly necessary for active participation in the global economy. Providing CAF support for broadband-only services gives rural end users the same ability as urban end users to choose the technologies that best meet their needs for various communications services. Rural businesses need the flexibility to tailor their technology solution—whether fixed or wireless or some combination of both—in a way that best meets their particular needs. For example, a farmer that spends time in the field may prefer to "cut the cord" for voice communications, purchasing only broadband from the wireline provider and broadband plus voice from the wireless provider. Now that the FCC has amended its rules to give rural providers CAF support for broadband-only lines, rural consumers should have increased access to affordable wired broadband with or without wired voice service. This should help make broadband more affordable in rural areas, promoting greater broadband adoption. The FCC should be commended for updating its rules to support stand-alone broadband in all areas of the country.

*Question 2.* Earlier this year Senator Klobuchar and I introduced the Rural Spectrum Accessibility Act, which would incentivize wireless carriers to lease unused spectrum to smaller rural carriers. Have any of the witnesses had an opportunity to review this proposal or others to incentivize spectrum sharing? Do you believe this would help expand access?

Answer. Spectrum partitioning and/or leasing are important means of freeing up underutilized spectrum that has been licensed to one carrier to make it available for use by other providers serving users that need spectrum. As just one method of making better use of our finite spectrum resources, laws that permit and even encourage spectrum "disaggregation" and leasing play an important role in meeting demand for wireless services and promoting innovation across multiple industries. Innovation in wireless services and networks is an American success story that includes the modern cell phone network to the plethora of wireless devices emerging in the Internet of Things in a wide variety of applications. Deere's precision ag technologies are one just one example. Those wireless systems incorporate GPS-enabled high precision agricultural equipment wirelessly transmitting real-time agronomic and equipment data machine-to-machine and machine-to-farm. Farmhouses communicate wirelessly with domestic and world market interfaces, suppliers, customers, government agencies. These precision farming technologies are now available to any producer to improve his or her yields, significantly lower costs, and improve environmental sustainability. However, rural areas where agricultural operations are located often lack adequate wireless coverage.

Businesses and consumers should be able to resort to every available strategy to make better use of spectrum resources in urban and rural areas. To the extent we free up underutilized spectrum through spectrum portioning or leasing, we enable the development of new services and applications while preserving important existing services. Just in the past few years we have seen creative and flexible approaches to finding new spectrum resources through mandating greater channel efficiencies, repurposing spectrum, creating new sharing schemes, etc. The broadcast incentive auction, the AWS–3 auction, the FCC's 3.5 GHz Citizen's Band service and White Spaces decisions, are all examples of strategies to make greater use of spectrum resources and help expand wireless coverage.

Ironically, evidence shows that unused spectrum in rural areas is actually in abundant supply but it is often not easily accessible. There may be multiple reasons for this that call for a broad-based response. Not only can the business case for building wireless infrastructure in lightly populated areas be challenging but, according to some smaller providers, the FCC's auction and licensing rules sometimes make it difficult for smaller rural carriers to participate and gain access to spectrum. Therefore, there may be lightly used or unused spectrum in rural areas under large wireless carrier licenses that could be put to great use by smaller rural carriers. The Rural Spectrum Accessibility Act would take a significant step toward addressing this imbalance by creating an incentive for wireless carriers to offer their unused spectrum to rural and smaller carriers and expand wireless coverage. This measure, and other measures, will be necessary to address the inadequate wireless coverage in rural areas that persists today.

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### RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. STEVE DAINES TO CORY J. REED

*Question.* Mr. Reed, you mentioned the need to update and expand USF, particularly the Mobility Fund. Several Montana companies were beneficiaries of the Mobility Fund Phase I and were able to connect communities to mobile broadband for

the first time. But now it appears as though the FCC is scaling back the Mobility Fund and pushing funding for fiber rather than mobile broadband. Is this trend concerning to your company? And how will the underserved rural farmers become connected without these programs?

Answer. Thank you for asking specifically about support for wireless broadband and the Mobility Fund. Ag producers need access to all broadband technology options to reap the full benefits that new precision agriculture offers. John Deere customers need flexibility to adopt the appropriate technology solutions depending on ag equipment used, crops, livestock, terrain, climate, proximity to broadband interconnection points and population centers, and barriers to local land acquisition and access. However, we are concerned that the FCC's rural broadband support programs do not place sufficient priority on providing access to the full suite of technology options—wired, fixed and mobile wireless. Fiber, including fiber in the middle mile that supports last mile fiber and last mile wireless, is important to broadband coverage but it must not be the exclusive technology choice. In some circumstances, wireless access may be the best or even the only feasible solution.

This is why it is so important to preserve and even expand the Mobility Fund. The FCC created a support fund dedicated exclusively to mobile services for the first time in 2011. The Mobility Fund was created to ensure the availability of mobile broadband networks in areas where a private-sector business case was not supporting needed wireless services. The FCC's early plans contemplated a Mobility Fund Phase II but today, more than 5 years later, that fund is yet to become a reality. The Commission has since revised the program to retarget funds to support 4G LTE mobile broadband and voice service and in 2014, the FCC asked for further input on how best to distribute Mobility Fund Phase II support. Now, 2 1/2 years later, the FCC has yet to adopt rules to implement Mobility Fund Phase II and the effort appears to be stalled. Instead, despite the growing demand for and importance of mobile services in rural areas, the Commission's current commitment to the Mobility Fund is in real question and the Commission has even suggested that it may not continue the fund.

The Commission should confirm that expanded broadband in rural areas is a current priority by issuing a decision that preserves and even expands the Mobility Fund Phase II. While there is a need to update these support programs to better ensure coverage of agricultural areas, the Commission can and should act promptly to confirm the status the Mobility Fund Phase II while considering further updates.

Another area where policy preferences for fiber over wireless should be overcome is in the distribution of Connect America Funds (CAF) support. The method by which CAF funds are distributed will determine whether rural families and businesses in agriculture will have the flexibility required to apply the technology solution—whether fixed, wireless, or some combination of both—that best meets their particular needs. The "tiered" approach that the Commission has proposed would enable only wireline providers to bid in the first round of an auction, thereby giving wireline an advantage over wireless technologies. Carriers interested in providing wireless service could be excluded from accessing support funds; ultimately users' flexibility to employ the most appropriate technology solutions to meet a wide variety of circumstances would be limited. If a wireless service is a superior option for particular users (based on the cost and other efficiencies that apply to the equipment, terrain, distance and other specific attributes of a locale to be served), then wireless providers should not be precluded from bidding in the first round to meet these needs.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. CORY BOOKER TO CORY J. REED

*Question 1.* It is clear from the recent spectrum auction, which attracted over $44 billion dollars in bids, and from your testimony that the demand for licensed wireless spectrum is growing. While Congress is addressing the need for licensed spectrum, we must also take seriously the need to expand our reserve of unlicensed spectrum for Wi-Fi and other purposes.

Answer. John Deere certainly agrees that there is an important need for additional, unlicensed spectrum to be made available for mobile applications. This is especially true for the development and adoption of current and future innovations in production agriculture.

*Question 2.* Just how important is unlicensed spectrum and Wi-Fi to the continued expansion of mobile device communication?

Answer. John Deere believes that unlicensed spectrum is as important as licensed spectrum for continued expansion of mobile device communication. It is true that

the demand for *licensed* spectrum continues to grow, fueled by soaring consumer and business demand for continuous voice, data, and video connectivity. Congress and the FCC have acted to meet licensed spectrum demand in several ways: through the digital TV transition, advanced wireless auctions, and the impending 600 MHz incentive auction.

Today, however, mobile technologies include a broad range of services and devices that operate on *unlicensed* as well as licensed spectrum. Unlicensed devices complement licensed services, and meet a wide range of consumer and business needs that contribute tens of billions of dollars to the U.S. economy each year. Unlicensed spectrum, made available for public use decades ago, has become an essential platform for a thriving ecosystem of device and service innovations that are now a part of everyday life.

For example, Wi-Fi and Bluetooth are integral to many consumer, business, medical, industrial and other devices. Unlicensed spectrum is critical to the burgeoning "Internet of Things" in today's economy. This includes connected automobiles, wearable health technologies, remote energy monitoring, automated manufacturing, logistics and inventory control, and countless new applications that are still to be developed for commercial use.

As applied to the agricultural sector, GPS technologies and unlicensed spectrum combine to connect agricultural machinery operating in croplands, thus enabling farmers to achieve unprecedented levels of productivity, as well as energy, resource and environmental conservation. John Deere is pioneering such innovations in modern, high precision, data-driven farming and believes that access to unlicensed spectrum will continue to spur innovations that deliver important new public benefits.

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### Response to Written Question Submitted by Hon. Marco Rubio to Bruce Morrison

*Question.* Delays, needless paperwork, and moratoria mean higher costs for wireless infrastructure companies, correct? And would you agree that these factors contribute to less deployment? Would it be correct to conclude that many regulations ignore the realities of modern wireless technology—for instance, applying the same rules for constructing a new 200-foot tower to swapping out new antennas for older, existing ones?

Answer. Yes, Senator Rubio, the cost to deploy or build facilities is a key consideration when determining how to provide coverage to certain areas. Applying the same rules, regardless of the scope of the facility, typically slows down deployment however. Looking at low-impact sites (attaching antennas to existing structures, right of way deployment, and replacing existing equipment) under the same view as a full new tower site deployment typically incurs longer time frames and costs despite the fact that any impact on the environment or community is usually negligible.

Also, due to new technologies, there is an increased need for smaller, low-visibility sites that need to be deployed to handle gaps in the network based on customer demands. These sites typically cover a lot less area than a typical wireless site, so the ability to deploy in a quick, cost-effective manner allows for a more efficient build out. Many jurisdictional codes and processes already account for different deployment methodologies outside of wireless. Policymakers could help industry by applying similar approaches to wireless deployment.

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### Response to Written Questions Submitted by Hon. Deb Fischer to Bruce Morrison

*Question 1.* Mr. Morrison talked about a few new technologies that could change broadband infrastructure. Federal policy, however, can slow the implementation of these technologies or inhibit them altogether. Do you think there are structural changes that could be made to Federal agencies that would encourage the integration of new technologies?

Answer. Yes Senator Fischer, Federal policy can assist technology implementation by continuing to improve processes as they relate to: local jurisdictional review timelines (so-called shot clocks), environmental review processes, and use in the public right of way. New technology typically requires the swapping out or addition of new wireless equipment and as a result, having a streamlined process for carrier site modification is very important. This is not always captured however in shot-clock policy as deployment can involve replacing existing equipment (ground and antennas for example) or the expansion of additional equipment for other carriers.

Also, with new technologies comes the increased need for smaller, low-visibility sites that must be deployed to handle gaps in the network. These sites typically cover a lot less area than a typical wireless site, so the ability to deploy in a quick, cost-effective manner is very important and allows for better infrastructure build out. Many of these micro or small-cell sites have a minimal footprint and can be located in public right of ways such as rooftops and billboards.

It is important to note though that small-site technology shouldn't be subject to the same scrutiny and processes as a full macro-site deployment. Many jurisdictions account for this methodology outside of wireless. For example, the permitting process to construct an addition to an existing house is much more streamlined than one for an entirely new construction project. Wireless broadband infrastructure should benefit from a similar methodology.

*Question 2.* Earlier this year Senator Klobuchar and I introduced the 'Rural Spectrum Accessibility Act,' which would incentivize wireless carriers to lease unused spectrum to smaller rural carriers. Have any of the witnesses had an opportunity to review this proposal or others to incentivize spectrum sharing? Do you believe this would help expand access?

Answer. Ericsson believes that efforts to make broadband service available to unserved areas can reduce poverty, enable development, and foster better lives. Ericsson has the capability and capacity to support rural broadband infrastructure deployment at the request of our commercial customers, yet cost remains the biggest challenge in this area.

Proposals, such as the "Rural Spectrum Accessibility Act," that seek to incentivize major wireless carriers to collaborate with their smaller providers should be considered with the goal of expanding wireless broadband access to rural and underserved communities.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DAN SULLIVAN TO BRUCE MORRISON

*Question 1.* Thank you for providing the rural perspective at the Commerce Committee's broadband infrastructure hearing. While your testimony focused on agricultural areas, the needs and challenges are similar in areas where construction, forestry, and mining machines operate. What can we do to encourage broadband deployment in rural areas, not only where people are living, but also where they are working?

Answer. Deere agrees that it is important to promote policies that foster broadband deployment to rural areas where people work and travel, not only where they live. This includes areas where construction, forestry, and mining operations are conducted. Existing government efforts to promote broadband deployment in rural areas have historically assessed broadband availability or unavailability based on the state of broadband coverage in population centers, namely residential areas, along with "anchor institutions" identified as schools and hospitals. While this approach identifies needs of people at their homes, it often can mask a severe lack of broadband access in business and commercial locations in rural areas thus overlooking the need for broadband access to the very locations that are the economic lifeblood sustaining the rural community.

Deere is intensely interested in expediting the deployment of mobile broadband services to rural areas where, by definition, farming, ranching, and other agricultural operations are concentrated. Therefore, Deere respectfully suggests that U.S. government agencies with broadband deployment mandates, including the FCC, update the way they assess the need for broadband in rural communities. In particular, Deere recommends that agencies with deployment mandates view availability through an additional lens—one that incorporates geographic and functional usage that captures the importance of promoting broadband access to economic centers.

An important example of this is the need to assess broadband availability in areas of agricultural operations—specifically, croplands and the farmhouse center that manages the farming operations. Broadband infrastructure and services are sorely needed to support the growing demand in the agricultural sector for machine-to-machine services to optimize efficiencies in operations, provide real time access to market data and transactions, and manage vendor and materials resources. Together, croplands and farmhouse centers represent the economic drivers to most rural communities in the United States. As such, farmhouses should be considered an "anchor institution" in those programs that provide support to specific functions. Similarly, existing support programs do not adequately consider broadband availability in rural areas where construction, forestry and mining operations are concentrated.

Ensuring that these locations also have access to broadband services—in addition to population centers and traditional "anchor institutions"-is essential to supporting rural communities today and in the future.

In addition to treating farm institutions as "anchor institutions," for those rural areas that are identified as needing support for broadband deployment, policies should ensure that sufficient funds exist to support mobile broadband deployment, including in the Mobility Fund, which is of particular value in areas where wireline coverage over very large areas is costly and difficult.

Specifically, Deere supports:

- Retention and expansion of the Mobility Fund
- Addition of "cropland" as a metric to assess need and funding awards
- Treatment of farmhouses as "anchor institutions"
- Increased broadband speeds but not rigid performance thresholds that may discourage deployment of intermediate speeds or technologies that greatly improve on existing access to broadband.
- Funding of middle mile facilities for rate of return carriers
- Policies facilitating stand-alone broadband to foster deployment in rural areas.
- Eliminating barriers to infrastructure deployment, including streamlined environmental review of infrastructure projects, steps that make it easier to deploy infrastructure on Federal lands, "dig once" policies, etc.
- Use of public funds on sharable and open backhaul capacity

*Question 2.* I want to emphasize how important it is for the rural carriers in my State that there is certainty in our funding mechanisms for funding broadband infrastructure. Could you elaborate on this point?

Answer. All businesses, including providers of rural broadband and telecommunications services, need certainty to invest in new infrastructure to grow their business and bring cutting edge technologies to their customers. Understanding the rules of the road and knowing that they will not change mid-stream is imperative to long-range business planning. Rate-of-return carriers still cannot receive universal service support for stand-alone broadband and middle mile backhaul four years after the FCC adopted rules governing such support for price cap carriers. Similarly, wireless carriers are still waiting for FCC rules governing ongoing support in the Mobility Fund or elsewhere for upgrading wireless services in rural areas to offer high-speed broadband. The FCC needs to act, on its own or pursuant to legislative direction, as soon as possible to end this period of prolonged uncertainty so rate-of-return and wireless carriers can plan and execute broadband investments in rural America.

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## RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. STEVE DAINES TO BRUCE MORRISON

*Question.* Mr. Morrison, removing barriers to broadband deployment doesn't guarantee that companies will invest in networks in rural America. From your experience, what are some incentives that can encourage companies to serve rural consumers?

Answer. Thank you for the question Senator Daines. As a leader in the ICT industry, Ericsson aims to provide significant and measureable contributions to a sustainable "Networked Society," a world where individuals and industries are empowered to reach their full potential. To that end, Ericsson believes that efforts to make broadband service available to unserved areas, including those in Montana, can reduce poverty, enable development, and foster better lives. Ericsson has the capability and capacity to support rural broadband infrastructure deployment at the request of our commercial customers, yet cost remains the biggest challenge in this area.

Federal subsidiaries and allocation of funds to help with development have spurred deployment in the past. Additionally, facilitating the access or rights for low-band spectrum makes rural deployment more feasible due to signal strength. In addition, any incentives that can be provided to land and facility owners (public and private) for the placement of wireless equipment or to access utilities for power and backhaul needs would prove helpful as well.

Finally, to the extent that the Federal Government can incentivize investment by wireless carriers, through programs such as the 'Connect America Fund' (CAF) and the 'Mobility Fund,' rural and underserved communities will benefit greatly.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. AMY KLOBUCHAR TO BRUCE MORRISON

*Question 1.* Mr. Morrison, there have been cases in which a tower is built in a rural area but the Federal permitting process slows down the deployment of wireline backhaul rendering the tower useless. Is it sometimes the case that the barrier to broadband access is the permitting process which slows down deployment of wireline backhaul infrastructure?

Answer. To help avoid situations like the one you describe, wireless operators almost always develop a backhaul plan prior to the construction of a communications tower. The case you reference may occur when a tower is built for a government communication system that is also offered for collocation by wireless carriers. Without adequate backhaul from the tower location, those carriers may not have an interest in collocating. I don't believe that the permitting process renders a tower useless, but it certainly can delay and increase the cost of the development process significantly. Allow me to offer some additional insight and context into these processes.

Any cellular facility requires a connection to an appropriate backhaul source with enough capacity to handle the large amount of data being consumed for customer needs. Typically, that can be accomplished with fiber or in some cases, cable. Rural deployment of a proper backhaul network does create a barrier to tower placement and can be hampered by construction requirements (locating cables underground for example) and franchise/right of way agreements which dictate how and where equipment can be deployed.

This is the similar predicament for rural homeowners that do not have access to proper backhaul networks and must resort to dial-up or satellite options. One solution to satisfy this backhaul need is by utilizing a point-to-point microwave to connect to a fiber backhaul option. Even that option is not free of challenges however due to line-of-site, tower structural capacity, and microwave height considerations.

*Question 2.* What are the other barriers to deploying this infrastructure?

Answer. Lack of a sound business case that allows wireless operators to recoup the higher costs of infrastructure development and deployment in rural areas is one of the most significant challenges to wireless broadband infrastructure deployment.

The cost challenges to deploy in rural areas include: long distances, mountainous geography, shorter construction windows due to seasonal inclement weather, a lack of power availability, upfront costs/approvals for access roads, land clearing, government land ownership issues, and tower height limitations.

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RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. CORY BOOKER TO BRUCE MORRISON

*Question 1.* It is clear from the recent spectrum auction, which attracted over $44 billion in bids, and from your testimony that the demand for licensed wireless spectrum is growing. While Congress is addressing the need for licensed spectrum, we must also take seriously the need to expand our reserve of unlicensed spectrum for Wi-Fi and other purposes.

Answer. Ericsson supports both licensed and unlicensed platforms and integrates both types of solutions in our product offerings to customers. Ericsson is a member of, and contributor to, all of the technological development and standards groups furthering both licensed and unlicensed platforms (*e.g.,* the Third Generation Project ("3GPP"), the Institute of Electrical and Electronics Engineers ("IEEE") and its many working groups, and the Wi-Fi Alliance ("WFA")). We support the advancement of LTE–U/LAA, we support Wi-Fi, and we are committed to continued innovation and equitable access for multiple technologies using unlicensed platforms. LTE–U/LAA will allow a mobile network operator to combine licensed spectrum operations with access to unlicensed spectrum to opportunistically enhance users' data rates, performance, and experience. It offers a technology choice for offloading traffic using unlicensed resources, integrated with the licensed carrier's network. LTE–U/LAA is standards-based and designed to co-exist with other technologies using unlicensed bands, including 802.11/Wi-Fi.

*Question 2.* Just how important is unlicensed spectrum and Wi-Fi to the continued expansion of mobile device communication?

Answer. The world is fast becoming what Ericsson describes as the "Networked Society," where connectivity is the linchpin for new ways of innovating, collaborating and socializing. The transition to this Networked Society represents a fundamental shift in technology comparable to the Industrial Revolution. In the Networked Society everyone and everything will be connected everywhere in real time—and that,

of course, requires additional spectrum. Whether it is through solutions utilizing licensed, unlicensed (Wi-fi is one of many unlicensed technology innovations along with Bluetooth, an Ericsson invention), or shared spectrum, wireless communication is driving innovation and sparking new activities.

Ericsson's most recent forecast projects that North American mobile data traffic will balloon many times by 2020, and U.S. policy must embrace a combination of licensed and unlicensed spectrum initiatives if industry and innovators can hope to keep up. The mobile networks of today and in the future will need to use multiple, evolving aspects of licensed and unlicensed technologies to deliver the best mobile experience possible in any given environment. Access to more licensed spectrum is a critical element, but unlicensed spectrum is also an integral component for meeting the growing demand for mobile broadband.

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