H.R. 3125, THE RADIO SPECTRUM INVENTORY ACT, AND H.R. 3019, THE SPECTRUM RELOCATION IMPROVEMENT ACT OF 2009

HEARING

BEFORE THE

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OF THE

COMMITTEE ON ENERGY AND COMMERCE

HOUSE OF REPRESENTATIVES

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SUBMITTED MATERIAL

H.R. 3125, THE RADIO SPECTRUM INVENTORY ACT, AND H.R. 3019, THE SPECTRUM RELOCATION IMPROVEMENT ACT OF 2009

TUESDAY, DECEMBER 15, 2009

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON COMMUNICATIONS, TECHNOLOGY,
AND THE INTERNET,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 9:35 a.m., in Room 2123 of the Rayburn House Office Building, Hon. Rick Boucher [Chairman of the Subcommittee] presiding.

Members present: Representatives Boucher, Markey, Stupak, Doyle, Inslee, Matsui, Christensen, Castor, Space, McNerney, Dingell, Waxman (ex officio), Stearns, Upton, Shimkus, Buyer, Bono Mack, Walden, Terry and Blackburn.

Staff present: Roger Sherman, Chief Counsel; Tim Powderly, Counsel; Amy Levine, Counsel; Shawn Chang, Counsel; Greg Guice, Counsel; Pat Delgado, Chief of Staff (Waxman); Sarah Fisher, Counsel; Neil Fried, Republican Counsel; Will Carty, Republican Professional Staff; and Garrett Golding, Republican Legislative Analyst.

OPENING STATEMENT OF HON. RICK BOUCHER, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF VIRGINIA

Mr. BOUCHER. The subcommittee will come to order.

This morning the subcommittee convenes a legislative hearing on two measures related to the availability of the wireless spectrum, which is essential to meeting our future needs for mobile communications services.

The movement of personal communications to mobile services is both dramatic and accelerating. Earlier this year it was announced that for the first time, the number of homes having only a cell phone and no landline service now exceeds the number of homes having only a landline and no cellular service. At the end of 2008, there were approximately 270 million wireless subscribers in the Nation including an estimated 40 million active users of mobile Internet services. Daily, new attractive and useful applications are added to wireless services and data rates continue to increase as consumers require faster access to mobile communications. As more and more Americans use data-intensive smart phones and as serv-

ices like mobile video emerge, the demand for spectrum to support these applications and devices will continue to grow dramatically.

Today, the subcommittee continues its examination of possible ways in which federal telecommunications policy can be altered in order to meet these challenges with the goal of enhancing the consumer experience and facilitating the future growth of mobile services.

In July, I was pleased to join with Chairman Waxman, full Committee Ranking Member Barton and Subcommittee Ranking Member Stearns in introducing H.R. 3125, the Radio Spectrum Inventory Act. That measure, now before the subcommittee, would direct the NTIA and the FCC to undertake a comprehensive survey of the Nation's spectrum and develop an inventory of each spectrum band in the U.S. table of frequency allocations between 225 megahertz and 10 gigahertz. The inventory would include the identity of both federal and non-federal users of spectrum and the types of services they offer in each spectrum band as well as the amount of use in each band on a geographic basis. When the inventory is completed, the NTIA and the FCC would create a Web site in order to make the information gleaned from the inventory available to the public. They would report the results of the inventory to the Congress and that report would include a description of information that could not be made publicly available for national security reasons. It would also include a recommendation of which, if any, of the least utilized blocks of spectrum should be reallocated for commercial uses. The creation of the inventory is an essential step in making available more spectrum for commercial and wireless services and meeting the extraordinary spectrum demands that our Nation will soon face.

I have also joined our colleagues Jay Inslee and Fred Upton in introducing the Spectrum Relocation Improvement Act. This measure would address an urgent need which was brought to light after the FCC auctioned the advanced wireless spectrum, the AWS spectrum, in 2006. While that spectrum was auctioned more than 3 years ago, the winners of the commercial licenses still do not have full access to the spectrum because it has not been fully cleared by the government users. The bill that we have jointly introduced would hasten the process of clearing federal users from spectrum that the government has reallocated for commercial purposes. It would require the NTIA to publish the transition plan of each federal entity to be relocated after a spectrum auction and it would clarify the steps that federal spectrum users must take in order to receive payment for their relocation cost from the Spectrum Relocation Fund including a requirement that the spectrum fully be reallocated and vacated by the federal users within one year.

My goal is to have both the inventory legislation and the bill speeding the reallocation of previously auctioned government spectrum through the committee and through the House at the earliest possible time.

I want to thank our witnesses for joining us this morning. We look forward to your testimony and your views on the future demand for wireless spectrum and the ways in which we can take constructive steps in order to meet those challenges.

Mr. BOUCHER. That concludes my opening statement. I am pleased now to recognize the ranking Republican member of our subcommittee, the gentleman from Florida, Mr. Stearns.

OPENING STATEMENT OF HON. CLIFF STEARNS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF FLORIDA

Mr. STEARNS. Good morning, and thank you, Mr. Chairman. You mentioned both of these bills and you have talked about what they do, so we are very pleased to have this hearing. I am a cosponsor of both of these bills, original cosponsor.

It is very clear that the United States will need additional spectrum to meet the growing demand for wireless broadband. In fact, we may be victims of our own success here. The United States currently leads the world in wireless. Wireless providers have used spectrum to provide U.S. consumers with innovative voice and data services. The number of mobile voice customers in the United States has surpassed the number of wireline customers and the number of mobile broadband customers has increased exponentially over the past several years. As customers increase the amount of time they spend on their mobile devices talking, e-mailing and surfing the Internet, cell sites become constrained for capacity. As a result, providers need more spectrum, especially in order to increase the speed of mobile broadband services. We are facing, in the words of the FCC chairman, a looming spectrum crisis.

For example, a voice call requires approximately 10,000 bits per second while uploading and downloading video requires millions of bits per second. Countries will need 1.3 or 1,300,000 megahertz of spectrum dedicated for commercial use by the year 2015, according to the International Telecommunications Union. Yet the United States currently has only 500 megahertz allocated and only 50 megahertz in the auction pipeline.

So in order to increase the amount of spectrum available for commercial mobile services, the Administration and the FCC need to inventory the current uses of spectrum bands, especially those below 3 gigahertz that are ideal for mobile services. The bottom line is that we need to know who uses which spectrum bands and the purposes for which they use such bands. Once we have the answers to these questions, the government needs to decide whether to reallocate spectrum for commercial mobile users.

If the government is requiring existing spectrum users to vacate reallocated bands, the government also needs to establish a meaningful process for reallocating incumbent users. The process needs to begin sooner rather than later. Inventory reallocation and reallocation all take time and commercial mobile demand for spectrum is increasing, as I mentioned, exponentially.

Furthermore, one way to make more spectrum available for commercial purposes is to use government spectrum more efficiently and simply reallocate the spectrum saved. That was the idea behind the Commercial Spectrum Enhancement Act, which was enacted in 2004. The law is designed to provide funding to upgrade the wireless resources of government agencies while clearing additional spectrum for commercial use while the CSEA government frequencies identified for reallocation are auctioned to commercial licensees and the proceeds are used to improve the relocating agen-

cies of wireless facilities. Pursuant to the CSEA, the FCC held the advance wireless service one auction in 2006. Of the $13.7 billion raised by the AWS auction, approximately $1 billion has been spent to reallocate the wireless operations of 12 federal agencies. The reallocation procedures outlined in the CSEA worked well in most cases but some problems have cropped up.

For example, T Mobile paid $4.2 billion to build a 3G network. The Department of Defense and the Drug Enforcement Agency are behind schedule in clearing some of the spectrum. However, because of unforeseen costs and complexities in their moves which have been compounded by the confidential nature of some of the agencies' activities, problems like these have prevented the bidders from fully realizing the benefits of their investment in the time frames originally promised and may discourage participation in future reallocation auctions.

H.R. 3019 will make the process more efficient. The goal is to better coordinate reallocation so that perspective commercial bidders have increased confidence to bid on the cleared spectrum. This not only helps the commercial bidders but also the reallocating agencies since they will have increased revenue from the auction and a better planned transition.

Thank you, Mr. Chairman, for holding this important hearing. I look forward to hearing from the witnesses.

Mr. BOUCHER. Thank you very much, Mr. Stearns.

The chairman of the full committee, the gentleman from California, Mr. Waxman, is recognized for 5 minutes.

OPENING STATEMENT OF HON. HENRY A. WAXMAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. WAXMAN. Thank you, Mr. Chairman. I want to thank you for holding this important legislative hearing on two bills that if adopted will create incentives for efficient spectrum utilization and enhance our ability to develop forward-looking spectrum policies. Ongoing developments in wireless broadband technology along with increased consumer demand have raised questions about the sufficiency of current spectrum allocations for wireless communication service. Some experts estimate that the wireless industry in the United States needs an additional 150 megahertz of spectrum to simply keep up with the explosion in wireless data usage and to remain competitive with other nations.

Before we can start identifying bands of spectrum that might be made available for these new services, however, we need to understand how existing spectrum is allocated and utilized. In simple terms, we need better information about spectrum usage by federal and non-federal entities.

Accordingly, in July of this year, a bipartisan group of 18 Energy and Commerce Committee members introduced H.R. 3125, the Radio Spectrum Inventory Act. This legislation represents a critical first step in developing a forward-looking spectrum policy. H.R. 3125 is simply about making spectrum use and allocation transparent. It would direct the National Telecommunications Information Administration and the Federal Communications Commission

to develop a publicly available inventory of users and usage in the most valuable spectrum bands.

The bill also directs the agencies to examine whether there is underutilized spectrum that might be reallocated for more efficient uses. Of course, any comprehensive look at spectrum must be sensitive to military uses and the need to protect information about such uses. The bill therefore establishes a procedure by which information pertaining to national security will continue to be safeguarded. The committee will continue to work with the Department of Defense to make sure that we are sensitive to any concerns regarding our national defense.

I would also like to express my general support for H.R. 3019, the Spectrum Relocation Improvement Act of 2009. I commend Representatives Inslee and Upton for introducing this thoughtful legislation to improve the current spectrum relocation process by increasing the flow of information and resources as well as enhancing transparency.

Thank you again, Mr. Chairman, for holding this hearing. I look forward to working with you as we move these important bills forward.

Mr. BOUCHER. Thank you very much, Chairman Waxman.

The gentleman from Illinois, Mr. Shimkus, is recognized for 2 minutes.

Mr. SHIMKUS. Thank you, Mr. Chairman, and I appreciate the hearing.

I would say that we need to be working on D block, D block, D block. If we can't get the D block right, how in the heck are we going to do other allocations of other spectrums? And my focus on the D block is, as everyone knows, being involved with the E–911 caucus, is emergency services and communication, and hopefully my colleague Anna will show and even Jane Harman and we will say shame on us if we have a next disaster and we are not ready to communicate effectively. Shame on us if we have another 9/11. Shame on us if we have another Katrina and we have sheriff departments not talking to firefighters, we have firefighters not talking to the National Guard.

So I appreciate this focus, and we all understand the importance of having an inventory but if we can't get the D block right in a timely manner, who are we kidding ourselves? So I would hope, Mr. Chairman, and the full committee chairman that we would really work on the parameters to push for appropriate and proper auction in which we get all the benefits, we bring in additional revenue but we also develop the revenue streams which will allow us to provide grants and money to our first-line responders to get this one important aspect of our homeland security issues and debates in line, and I yield back my time.

Mr. BOUCHER. Thank you very much, Mr. Shimkus.

The chairman emeritus of the full Energy and Commerce Committee, the gentleman from Michigan, Mr. Dingell, is recognized for 5 minutes.

OPENING STATEMENT OF HON. JOHN D. DINGELL, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. DINGELL. Thank you, Mr. Chairman, and thank you for convening today's hearing on H.R. 3125, the Radio Spectrum Inventory Act, and H.R. 3019, the Spectrum Relocation Improvement Act of 2009. These two bills, of which I am an original cosponsor, will aid the federal Administration's allocation of spectrum, a commodity of increasing importance, especially given recent advances in mobile broadband services. Like all the rest of us, I am concerned about the allocation about the future and also about what we have done so far and whether it has contributed to the proper use of the spectrum for the future and for all of our people.

These two pieces of legislation are complementary to the Federal Communications Commission's duty to present to the Congress a national broadband plan as mandated under the American Recovery and Reinvestment Act. To be certain, the success of the development of such a plan and the implementation of its recommendations will be facilitated in no mean degree by a clear and better understanding of the spectrum available for use and a better and a more efficient process by which to allocate it for commercial use. This I believe will be accomplished in large part by enactment of the bills pending for the committee's consideration today.

With this in mind, I welcome our witnesses and look forward to hearing their views on the legislation before us. In particular, I hope they will engage in a frank discussion about the relationship between H.R. 3125, H.R. 3019 and proposals currently circulating in the FCC to reallocate spectrum from over-the-air television broadcasters to mobile communication providers as a part of the national broadband plan.

Thank you for your courtesy, Mr. Chairman, and I commend you again for this hearing and the foresight that you are showing with it. I yield back the balance of my time.

Mr. BOUCHER. Thank you very much, Chairman Dingell.

The gentleman from Oregon, Mr. Walden, is recognized for 2 minutes.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. Thank you very much, Mr. Chairman.

First of all, thank you for holding a legislative hearing on these two bills. I think that is really important in the improvement of our process to have this oversight before we mark it up.

I want to welcome my Senator, Gordon Smith, who has taken over the reins at the National Association of Broadcasters. I am still his Congressman, even if he is not now my Senator, but we have been friends and colleagues in the legislative arena in Oregon and here for many years and we welcome you at the NAB, and now that I have sold our broadcast stations and you have gone to the broadcasters, I am going to go into pea packing.

I want to point out a couple of things. First of all, I concur with my colleague from Illinois, Mr. Shimkus, on the D block issue. We need to resolve that. But I also want to point out another issue that has come up related to public safety and I am not sure it is

going to get spoken to today, and that is use of the band by amateur radio operators as well. As we evaluate the value of spectrum, understand that when 9/11 happened, when Katrina happened, when other communication systems failed and even any day when there is a hurricane or a disaster anywhere in the world, it is frequently the amateur radio operators who step to the fore with their own equipment and provide the emergency communication when everything else fails. It is hard to put a value on that unless you can put a value on saving lives and helping our law enforcement community and our rescue community get through really difficult times, so they are there when needed all the time and so that needs to be a part of what we consider.

Regarding the FCC's notice, I am very concerned about what I am reading regarding Professor Benjamin's comments and his paper. He is now a very top advisor to the chairman of the FCC. I hope this committee will look at some of the things he has had to say including how every dollar of additional cost for broadcasters is one less dollar for profit and thus reduces the attractiveness of over-the-air broadcasting as a business model but regulation would attend to entrench broadcasting in place on the spectrum. Then the regulation will not help free up spectrum and should be avoided. In other words, he is calling for the death of over-the-air free broadcasting, which I think is a real abomination, and we will get into that more.

I know my time is expired, Mr. Chairman, and I look forward to hearing from our witnesses.

Mr. BOUCHER. Thank you very much, Mr. Walden.

And the Chair now recognizes the gentleman from Pennsylvania, Mr. Doyle, for two minutes.

Mr. DOYLE. Thank you, Mr. Chairman, for holding this important hearing. I am going to waive opening statement and look forward to hearing from the witnesses.

Mr. BOUCHER. Thank you, Mr. Doyle. We will add 2 minutes to your questioning time for our panel of witnesses.

The gentleman from Washington State, Mr. Inslee, is recognized for 2 minutes.

OPENING STATEMENT OF HON. JAY INSLEE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON

Mr. INSLEE. Thank you, Mr. Chair, and thank you for holding this hearing. We know how important this is.

In my State, as we speak, I have got hundreds if not thousands of constituents designing these new Internet and broadband services of the next generation. It is very important to a lot of my neighbors, people I represent. It is important to the country as a whole for its job creation possibilities. President Obama has recognized broadband infrastructure investment has tremendous job potential but we know we are going to have to have additional allocation of spectrum for commercial use to really reach the fruition of the tremendous promise here. And in order to first identify that spectrum, I want to commend Chairman Waxman for his inventory bill, which is a first step. I am proud to be an original cosponsor and look forward to getting that done as a first step.

But once the spectrum is identified and ready for auction, we really have to assure that procedures are in place this time to adequately guide the auction process. In the 2007 advance wireless services auction, the process and reporting requirements were insufficient to appraise the length, complexity and size of federal relocation efforts. They also failed to ensure a timely transition of spectrum by federal agencies and business planning by commercial bidders. It is this very problem that the bill that I am prime sponsoring seeks to address.

Fundamentally, our bill will do two things. First, it increases the amount and quality of information available to potential bidders before an auction occurs, and second, it expedites the flow of auction proceeds to the relocating agency to keep the relocation process on track. I am convinced that this more complete information about the effective federal agency systems, the relocation cost estimates and schedules will reduce the risk for potential bidders, will ensure timely relocation payment and movement by federal agencies and will ensure that the next generation of consumer-demanded services are delivered. It will not cure the common cold. Otherwise it sounds pretty good.

I want to thank my colleagues, Mr. Upton and Chairman Boucher, for their work on advancing this and I look forward to moving this so that we can really fulfill the promise of our brilliant constituents. Thank you.

Mr. BOUCHER. Thank you very much, Mr. Inslee.

The gentleman from Nebraska, Mr. Terry, is recognized for 2 minutes.

Mr. TERRY. Thank you, Mr. Chairman, for holding this legislative hearing and I look forward to hearing our witnesses. We have to make sure that we do this right and in balance with the spectrum that is used in the military. I have the pleasure of representing the 55th Wing, which is an electronic warfare and information operation out of Offutt Air Force Base right outside of Omaha in Bellevue, and I have a letter from the Association of Old Crows that set out some of the issues that we may have discussing here with the spectrum and I would like to offer that letter into the record, Mr. Chairman.

[The information appears at the conclusion of the hearing.]

Mr. BOUCHER. Without objection.

Mr. TERRY. Then last, in our committee memorandum, it starts off with the introduction criticizing the Universal Service Fund and calling it ineffective, and then the second paragraph also starts off with Universal Service Fund. So somehow Universal Service Fund is important in this discussion and I look forward to your comments on how Universal Service Fund affects the spectrum and your usage of it. I yield back.

Mr. BOUCHER. Thank you very much, Mr. Terry.

The gentlelady from California, Ms. Matsui, is recognized for 2 minutes.

OPENING STATEMENT OF HON. DORIS O. MATSUI, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Ms. MATSUI. Thank you, Mr. Chairman. Thank you for calling this important hearing today. I would also like to thank today's witnesses for being with us today.

We are here today to discuss how we can promote greater transparency on spectrum issues for expediting the process in which we can allocate additional spectrum in the marketplace. According to recent estimates, there are approximately 270 million wireless subscribers in the United States but that number is growing. According to recent reports, the current economic recession has increased the number of consumers opting for only cell phones over traditional landlines. There is concern that the current allocation of spectrum for mobile broadband services is inadequate to meet the rapidly growing demand. In fact, the FCC recently warned of a potential spectrum crisis that could threaten the expansion of broadband services. While the DTV transition helped free up more spectrum, the need for commercial spectrum capacity will only expand as broadband continues to be delivered to more areas.

To ensure transparency and help ensure we meet demand, Chairmen Waxman and Boucher have introduced the Radio Spectrum Inventory Act, and Congressmen Inslee and Upton have introduced the Spectrum Relocation Improvement Act. I am a cosponsor of both pieces of legislation. Moving forward, spectrum availability will be key to ensuring competition, improved public safety, meeting growing demand for wireless services and any proposal going forward should ensure underserved urban communities are properly considered.

I thank you, Mr. Chairman, for holding this important hearing today and I yield back the balance of my time.

Mr. BOUCHER. Thank you, Ms. Matsui.

The gentlelady from Tennessee, Ms. Blackburn, is recognized for 2 minutes.

OPENING STATEMENT OF HON. MARSHA BLACKBURN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF TENNESSEE

Mrs. BLACKBURN. Thank you, Mr. Chairman.

I want to welcome the panel that is before us today. We are delighted that you are here, and I am also delighted, Mr. Chairman, that we are talking about legislation that actually represents what is a balanced give and take, and that is not something we often do in this Congress. All too often we are talking about taking from the American taxpayer and giving to big business, but today we are going to be talking about raising money from big business through an equal exchange of value for a commodity, and this represents good policy and good government and I am pleased we are having the hearing.

As we plot a strategy on how we move forward on broadband and how to best utilize the spectrum, I am one of many on this committee, as you have heard, who have long advocated for an effective and efficient inventory and assessment of what is available and how we best use it and how we best allocate it. I think it is impor-

tant. Mr. Shimkus mentioned D block and some of the work that needs to be done as we learn some lessons from that approach. We know that this is a robust industry. We know that well over 80 percent of consumers are happy with their wireless service, according to a recent GAO study. That is pretty good. Eighty percent of people like the product that is there and that is available. There is ample motivation to get as much information as possible on spectrum availability and evaluate all of our options for relocation, so I am pleased we are bringing many different parts of this discussion together today, and I yield back the balance of my time.

Mr. BOUCHER. Thank you, Ms. Blackburn.

The gentleman from California, Mr. McNerney, is recognized for 2 minutes.

OPENING STATEMENT OF HON. JERRY MCNERNEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA

Mr. MCNERNEY. Well, thank you, Mr. Chairman, for convening today's hearing on two bipartisan bills that are intended to help our country make better use of our spectrum. H.R. 3125, the Radio Spectrum Inventory Act, will provide for the gathering of information about spectrum use to increase transparency and help us understand exactly how the spectrum is now utilized.

This is no small task but it is absolutely essential to make informed decisions on allocating spectrum to meet the ever-increasing demand for wireless broadband spectrum. It has been reported that the U.S. allocation of spectrum compares poorly with OECD nations and is inadequate to meet the growing demand. We can't let that happen. We are going to do the best we can to help industry take the lead and make our Nation lead the world in broadband.

H.R. 3019, the Spectrum Relocation Improvement Act, streamlines the spectrum auction process and will reduce the time required to reallocate federal spectrum cleared for commercial use, allowing licensees to utilize their spectrum without unnecessary delay. As a cosponsor of both of these bills, I recognize the importance of properly managing available spectrum. I also understand that the sponsors of H.R. 3125 are working with the Department of Defense to ensure that the bill also protects ongoing military uses of spectrum and I look forward to working with my colleagues to improve this legislation.

I thank the witnesses for taking time to share their perspective on this legislation and I yield back the balance of my time.

Mr. BOUCHER. Thank you, Mr. McNerney.

The gentleman from Michigan, Mr. Upton, is recognized for 2 minutes. Oh, not here. The gentleman from Indiana, Mr. Buyer, is recognized for 2 minutes.

Mr. BUYER. Mr. Chairman, I would ask that my time be placed upon questions, and I welcome my friends, Steve Largent and Gordon Smith.

Mr. BOUCHER. The gentleman will have added time for questions.

The gentlelady from the Virgin Islands, Ms. Christensen, is recognized for 2 minutes.

Mrs. CHRISTENSEN. Thank you, Mr. Chairman. I am going to also waive my opening statement and put it into the record. I would like to welcome the witnesses, especially Senator Smith, who I believe is here for the first time. Thank you. I yield back.

Mr. BOUCHER. Thank you, Ms. Christensen.

The gentleman from Massachusetts, Mr. Markey, is recognized for 2 minutes.

OPENING STATEMENT OF HON. EDWARD J. MARKEY, A REPRESENTATIVE IN CONGRESS FROM THE COMMONWEALTH OF MASSACHUSETTS

Mr. MARKEY. Thank you, Mr. Chairman, and thank you so much for having this hearing.

Back in 1993, we were in a world where there were two cell phone companies. They each charged about 50 cents a minute, and it was analog, but in 1993 this committee moved over 200 megahertz of spectrum and we created the third, fourth, fifth and sixth cell phone licenses. They all went digital. And by 1996, the price had dropped to under 10 cents a minute. The first two companies had moved to digital as well and we had a revolution that was ongoing, and it was so successful that right now there are people sitting out here in the audience checking their BlackBerry rather than listening to my opening statement, and that is a tribute to what our committee made possible. And now we are on to the next stage of this revolution where we know that the Hulu, Google, eBay, Amazon revolution is something that continues on. This committee should be very proud of it. And by reallocating even more spectrum will make it possible for the entrepreneurs, will make it possible for these technology geniuses to once again brand a revolution made in America. We have to stay ahead of this curve. We have to make sure that it is something that is American. We did that in the 1900s. We have a chance to do it again.

I congratulate, Mr. Chairman, for your work on this issue. It was bipartisan then. It should be bipartisan again. We are into a wealth creation. That is what this is all about, and the more effectively that we can think this issue through, which is what you are doing, is the more likely that we will create the greatest amount of wealth that will help our country become more prosperous, and I thank you for doing that.

Mr. BOUCHER. Thank you very much, Mr. Markey.

The gentlelady from Florida, Ms. Castor, is recognized for 2 minutes.

Ms. CASTOR. Because it is impossible, Mr. Chairman, to follow Mr. Markey, I am going to submit my statement for the record and yield back my time. Thank you for holding the hearing.

Mr. BOUCHER. Thank you, Ms. Castor.

The gentleman from Ohio, Mr. Space, is recognized for 2 minutes.

Mr. SPACE. Thank you, Mr. Chairman, and I welcome our witnesses. I too would waive my opening.

Mr. BOUCHER. Thank you very much, Mr. Space.

That concludes opening statements from members of the subcommittee, and we now welcome our panel of witnesses this morn-

ing. We are pleased to have each of you with us today and we very much look forward to your testimony.

Just a brief word of introduction about each of our witnesses. Dr. Dale Hatfield is an adjunct professor with the Interdisciplinary Telecommunications Program at the University of Colorado. Steve Largent, former Member of the House of Representatives and former member of this committee, is the president and chief executive officer of the Cellular Telecommunications Industry Association, the Wireless Association. Mr. Michael Calabrese is vice president and director of the Wireless Future Program at the New America Foundation. Former Senator Gordon Smith, we welcome to this committee for the first time in his new role as president of the National Association of Broadcasters, and we look forward to a long and successful partnership with you. Dr. Ray Johnson is the senior vice president and chief technology officer of the Lockheed Martin Corporation, and Mr. Thomas Stroup is the chief executive officer of Shared Spectrum Company. We welcome each of you.

Without objection, your prepared written statement will be made a part of the record, and we would ask that you keep your oral summaries to approximately 5 minutes.

Mr. Hatfield, we will be happy to begin with you.

STATEMENTS OF DALE HATFIELD, ADJUNCT PROFESSOR, INTERDISCIPLINARY TELECOMMUNICATIONS PROGRAM, UNIVERSITY OF COLORADO AT BOULDER; STEVE LARGENT, PRESIDENT AND CEO, CTIA–THE WIRELESS ASSOCIATION; MICHAEL CALABRESE, VICE PRESIDENT AND DIRECTOR, WIRELESS FUTURE PROGRAM, NEW AMERICA FOUNDATION; HON. GORDON H. SMITH, PRESIDENT AND CEO, NATIONAL ASSOCIATION OF BROADCASTERS; RAY O. JOHNSON, PH.D., SENIOR VICE PRESIDENT AND CHIEF TECHNOLOGY OFFICER, LOCKHEED MARTIN CORPORATION; AND THOMAS STROUP, CHIEF EXECUTIVE OFFICER, SHARED SPECTRUM COMPANY

STATEMENT OF DALE HATFIELD

Mr. HATFIELD. Thank you, Mr. Chairman, Chairman Boucher, Ranking Member Stearns and members of the subcommittee. I am very pleased and honored to appear before you today to testify on the topic of radio spectrum management, and in particular on the issues raised by H.R. 3125 and by H.R. 3019.

My name is Dale Hatfield. In addition to the position that you just mentioned, I am also the executive director of the Silicon Flat Iron Center for Law, Technology and Entrepreneurship at the University of Colorado at Boulder. I should note in the past that I have engaged in independent consulting activities including for some members that are represented on the panel today. As I detailed in my prepared testimony, I have other affiliations but today I am testifying entirely on my own behalf as a private citizen.

Now, in my written testimony, I present some background on spectrum management and then focus on five overarching themes or points. It is those five points that I will briefly summarize now.

First, I have been involved in spectrum management issues for over 4 decades and it is very clear to me that we are now at an

unprecedented period of demand for access to spectrum in the critical frequency range of roughly 300 megahertz to 3 gigahertz. This increase in demand for spectrum is propelled by increases in the number of uses of the resource and the number of users and the amount of bandwidth or capacity consumed per user per use. While the exponential growth in commercial cellular bandwidth requirements is perhaps the most visible, there are a host of other increasing demands for spectrum in this range as well including important ones that support public safety, homeland security and national defense priorities. Thus, in my opinion, the spectrum scarcity issue that the legislation sets out to address is very real.

Second, in my written testimony I review five traditional techniques that we have used in the past to accommodate growth and demand for the resource: one, going higher in frequency; two, improving the technical efficiency of spectrum utilization; three, reallocating existing spectrum from use to another; four, increasing the amount of spectrum sharing; and five, reusing spectrum more intensely in the geographic dimension. I conclude that for technical reasons, going higher in frequency will be of limited utility in solving the current spectrum crisis associated with wireless mobile data applications, and that while further improvements in technical efficiency can help, they are apt to be inadequate in solving the problems associated with the orders of magnitude increases in spectrum demand. That leaves relocation, increased sharing and more intense frequency reuse at least in some services as potential solutions, albeit ones with unique challenges of their own.

Third, setting aside spectrum relocation for the moment, I next focused on increasing sharing and in more intense frequency reuse. With regard to the former, I comment favorably on past steps that the FCC has taken to encourage voluntary sharing of the resource through secondary markets. I go on to conclude that a combination of increased incentives or mandates for spectrum sharing coupled with more decentralized, more opportunistic and more technologically sophisticated techniques for accessing spectrum can be a significant helping in avoiding the looming crisis. In terms of increased frequency reuse, I first note that it is not always possible because of the nature of some services. In other words, some services like radar require very high power operating over long distances and therefore you can't reuse the spectrum on a geographic basis as easily. I also wanted to note that spectrum reuse may be constrained by the availability of suitable antenna locations and economic backhaul facilities.

Fourth, I comment that I am a strong supporter of conducting the spectrum inventory called out in H.R. 3125 and hence for the legislation itself because I am a strong believer in that old adage, you can't manage what you don't measure. It is that simple. I go on to conclude that a comprehensive and ongoing inventory is necessary to support two of the most promising of the three ways of averting a spectrum crisis, that is, relocation and increased sharing.

Fifth, I observe that while I am a strong supporter of conducting spectrum inventories, I also note based on many years of experience that there are potential shortcomings associated with a paper study, at least in some services. Therefore, I conclude that the in-

ventory mandated in the proposed legislation should be augmented by selected field measurements to gain additional information on actual usage in those bands identified as being the most promising for relocation or increased sharing.

That concludes my oral testimony, Mr. Chairman, and I would be happy to respond to any questions that you or the rest of the subcommittee might have.

[The prepared statement of Mr. Hatfield follows:]

Testimony of
Dale N. Hatfield
Executive Director
Silicon Flatirons Center for Law, Technology and Entrepreneurship
University of Colorado at Boulder
before the
Subcommittee on Communications, Technology and the Internet
of the
House Committee on Energy and Commerce

December 15, 2009

Chairman Boucher and members of the Subcommittee on Communications, Technology and the Internet, I am very pleased and honored to appear before you today to testify on the topic of radio spectrum management and, in particular, on the issues raised by H.R. 3125, the Radio Spectrum Inventory Act and by H.R. 3019, the Spectrum Relocation Improvement Act of 2009. My name is Dale Hatfield and I am the Executive Director of the Silicon Flatirons Center for Law, Technology and Entrepreneurship at the University of Colorado at Boulder. In the interest of full disclosure, I should also mention that I am on the board of directors of Crown Castle International, a major operator of radio towers for the wireless industry here in the United States and in Australia.

I have been involved in spectrum management issues for more than four decades and, in relation to that involvement, I have had the honor of serving in senior technical and policy positions at both the Federal Communications Commission ("FCC") and at the National Telecommunications and Information Administration ("NTIA") in the U.S. Department of Commerce. Currently, I am serving as the co-chair of NTIA's Commerce Spectrum Management Advisory Committee ("CSMAC"). While my testimony here today is based upon my experience and my current academic research interests, it reflects solely my own views and any recommendations that I offer should not be ascribed to any of the institutions with which I am affiliated.

In my testimony today, I intend to focus on five points or themes:

- *First*, in my opinion, the spectrum scarcity issue is real when viewed through the lens of traditional management techniques and current and forecasted demand for use of the resource.

- *Second*, and on the negative side, some of the basic techniques that we have used in the past to accommodate growth in the demand for the resource will likely have less utility in the future.

- *Third*, on the positive side, there are combinations of newer management techniques and technological advances that can go a long way toward alleviating the shortage in spectrum capacity.

- *Fourth*, the spectrum inventory that would be carried out by the FCC and the NTIA under the proposed legislation is a necessary step in the direction in averting – or at least postponing – that potential shortage.

- *Fifth*, the mandated inventory should be augmented by selected field measurements to gain additional information on actual usage.

Before I address these five points or themes, I would like to provide a little background on the characteristics of this important resource and how we have managed – or, too often, mismanaged – it in the past.

The radio spectrum resource can be shared in its frequency, space and time dimensions by multiple devices or systems but, as a practical matter, there is always a certain amount of interference produced between and among them because of "spillover" in the various dimensions. For example, two cell towers can use the same spectrum or channels but, if they are spaced too close together in geography, unacceptable interference can result – i.e., interference that causes coverage "holes" or dropped calls. In theory at least, additional users can always be accommodated in a given amount of spectrum. But practical constraints in terms of cost and complexity limit the number of uses or users that can be served in a given frequency range in a given geographic area.

Stated another way, as new uses and users are packed evermore tightly into a given amount of spectrum, the overall level of interference increases thereby (1) decreasing the quality and hence the value of the service received by existing users, (2) imposing additional costs on existing users to pay for technical or other changes to mitigate the added interference, (3) imposing additional costs on the new users in order to mitigate the interference they cause to – or receive from – existing users, or (4) resulting in some combination of the first three. It is in this sense that spectrum is recognized and treated as a scarce resource.

By further way of background, I should point out that not all radio spectrum is created equal and that the spectrum between roughly 300 MHz and perhaps 3 GHz or a little more is particularly valuable for technical and economic reasons. I don't mean to imply that higher frequency spectrum is not useful – and valuable – because in some specialized and common applications, it is; but for many critical terrestrial mobile radio systems the more limited 300 MHz to 3 GHz spectrum range I mentioned is much preferred and it is the portion of the spectrum where scarcity concerns are the greatest.

In our market-oriented economy, we traditionally allocate scarce resources among competing uses on a decentralized basis through voluntary transactions carried out by buyers and sellers who react to price signals that are produced by the forces of supply and demand interacting in free markets. However, in the case of the spectrum, we have traditionally managed the resource on a centralized, "command and control" basis wherein the federal government makes the most important decisions regarding how the resource is used. As proven so vividly in the former Soviet Union, it is extremely difficult to manage scarce resources on a centralized manner and it is especially difficult

when – as in the wireless industry today – the market is evolving so rapidly due to exploding demand and revolutionary changes in technology and services. Viewed from the "30,000 foot" level, it is this centralized management of a scarce resource that underlies most of the shortcomings of our traditional "command and control" method of the managing the resource. Said another way, it is extremely difficult – virtually impossible if you will – to sit in Washington, DC and determine how spectrum should be distributed optimally in the remote mountain town of Meeker, Colorado versus a major urban area like New York City.

The shortcomings of the centralized, command and control method of managing the scarce resource have long been recognized and, to its credit, the FCC has taken important and commendable steps in the direction of putting greater reliance on decentralized, marketplace forces to determine the details of how the spectrum is used across the country. Despite these steps, a large fraction of our spectrum is still managed entirely on a centralized, command and control basis or, if not entirely, it is still subject to residual aspects of the traditional regime.

Since the shortcomings of the centralized, command and control approach are well known, I will only summarize them briefly here. First, and perhaps foremost, the traditional approach produces excessive rigidity because it is so hard to change allocations and, in some cases, assignments and technical and service rules to reflect rapidly changing technology and marketplace conditions or, as I touched upon a moment ago, to adjust to differences in supply and demand in different areas of the country. This rigidity is exacerbated by the fact that the traditional approach provides innumerable opportunities for opponents of change to delay the process through long, drawn-out and contentious proceedings that allow them to hold onto their perhaps underutilized spectrum and/or to preclude new, potentially competitive entrants from acquiring spectrum. Finally, the traditional command and control approach often does not provide economic or other incentives for making more efficient use of the resource. For example, the service rules governing a band may prevent or discourage a licensee from introducing a more efficient technology in order to profit from selling or leasing the spectrum that is freed up by doing so.

Because of this excessive rigidity, it is not unusual to find through actual field measurements that large blocks of spectrum or large numbers of channels are unused or only lightly used even in areas of the country and at times when spectrum congestion and scarcity is apt to be most acute. In the spectrum management field, we refer to this form of scarcity as *administrative* scarcity to distinguish it from true scarcity in a physical sense.

Before I turn to the five points or themes upon which I want to focus my attention, I would like to add one further comment relating to this excessive rigidity. The comment is that, in the past, technological limitations associated with wireless devices largely precluded them from moving about from band-to-band in the frequency dimension and adapting their characteristics in order to opportunistically access spectrum that otherwise might not be used at a particular time and/or place. That is, heretofore, the

devices largely lacked the necessary processing power and flexibility to share spectrum on a dynamic rather than static basis. Increasingly this is not the case and even ordinary consumer devices – such as cellular smartphones or Wi-Fi access points – have enormous capability to assist on a more localized, decentralized, real-time basis in the management and utilization of the increasingly precious radio spectrum resource. As I will speak more of in a moment, one of the challenges of modern spectrum management is how to provide the opportunities and incentives for such devices to be introduced to reduce the rigidities associated with the traditional approach to spectrum management that I have outlined.

With that background, I would now like to turn to the five points or themes that I mentioned earlier.

1. The Potential for a Spectrum Crisis Is Real

As indicated earlier, I have been involved in spectrum management for over four decades and it is very clear to me that we are now in the midst of an unprecedented period of demand for access to spectrum in the critical range from roughly 300 MHz to 3 GHz. This increase in demand is propelled by increases in the number of users, increases in the number of uses for the resource, and greater bandwidth requirements per user. Early in my professional career there were actually mobile telephones available – big bulky, vacuum tube units that took up most of the trunk of the car and which sometimes required the modification of the vehicle's electrical system to accommodate the power needed to run the unit. There were only a handful of channels to carry the calls of these pioneering subscribers and it is no wonder that, at the time modern cellular systems began to emerge in the 1980s, there were only about 200,000 of such units in service. Now, of course, CTIA tells us that there are roughly 270 millions cellular handsets in the hands of the public. And a large and increasing fraction of these units are used to access the Internet and, in the process, consume orders of magnitude greater amounts of capacity than traditional voice. Putting it in more technical terms, we are going from perhaps 12 kilobits per second for a voice call to several megabits per second when we, for example, upload or download video clips. This translates directly into demand for more spectrum. On the non-commercial side, to pick just one example, the military is increasingly using drones or Unmanned Aerial Vehicles – UAVs – in their operations and these devices, which hardly existed only a few years ago, need substantial amounts of bandwidth for data collection, guidance and control purposes. Similarly, public safety agencies have increasing requirements for video surveillance and more esoteric systems such as gunshot detection systems. While it may be possible for these public safety agencies to procure the needed services from commercial operators in some situations, the need for the added spectrum capacity remains.

I understand that these increased demands are well known to the Subcommittee and I won't belabor the point further except to say that, in my experience, there are almost an unimaginable set of new devices and services that need access to spectrum and which can contribute enormously to our economic and social wellbeing. For example, I have been encouraging and providing unpaid support to an organization – the Alfred

Mann Foundation – which has a radio-based artificial nervous system that can restore mobility to individuals who have been paralyzed. I am fascinated by the potential of this technology to improve the quality of life of military personnel and others who have become paralyzed due to combat injuries or accidents of various types. But like all radio-based systems, this system requires access to the radio spectrum and these potential benefits will be denied if spectrum is not found to accommodate them. For all of these reasons and others, I conclude that the scarcity issue is real when viewed through the lens of traditional spectrum management techniques and current and forecasted demand for use of the resource.

2. Some of the Basic Techniques Employed in the Past to Accommodate Additional Spectrum Demand May Have Less Utility in the Future

We have faced large increases in demand for spectrum capacity before. In fact, very early in my career (ca.1966) a unit of the Commerce Department published a study entitled "Electromagnetic Spectrum Utilization - The Silent Crisis." As I recall, it dealt primarily with congestion in the shortwave radio bands that were heavily used for military and commercial intercontinental voice communications at the time and with the demands for spectrum to accommodate the growth of two-way mobile radio systems used by public safety and, increasingly, private sector organizations for communicating with units in the field. In my experience, there are five fundamental techniques for accommodating increasing demand for spectrum – five potential solutions to spectrum congestion, if you will.

First, one of the fundamental techniques for relieving spectrum scarcity is to go higher in frequency – that is, extend the upper range of usable frequencies. Indeed, when geostationary satellites were developed that were able to transmit large numbers of telephone conversations or television signals (with concomitant requirements for spectrum capacity) over great distances, they were allocated spectrum above 4 GHz. But as we move higher in frequency, the radio waves behave increasingly like light waves and can be easily blocked by natural or manmade structures and, going even higher, their range may be severely limited by atmospheric conditions such as snow and rain. While such spectrum will continue to be useful – even critical for certain applications – it is generally not useful for mobile/portable/nomadic applications that are currently experiencing such rapid increases in demand. In fact, it is these "laws of physics" effects that make the spectrum below 3 GHz or 4 GHz so valuable and subject to so much intense interest as I explained before.

Second, another fundamental technique for relieving spectrum scarcity is through technological advances that reduce the amount of information that has to be transmitted "over-the-air" (a technique known as data compression) and/or that increase the amount of information that can be conveyed in a given amount of spectrum or bandwidth. While I do not have the time to go into these techniques in detail, there are fundamental technical constraints and tradeoffs in terms of quality and robustness to interference that tend to limit the further improvements that can be expected from them. Perhaps better stated, these techniques can continue to produce incremental improvements in efficiency

(and should be pursued accordingly) but, alone, they are apt to be inadequate in solving the problems associated with orders of magnitude increases in spectrum demand.

Third, still another fundamental technique for accommodating new spectrum uses/users is to reallocate spectrum from a current use to a higher value use. This technique has been used extensively in the past and, consequently, it is well known to the Committee. The most recent example is the reallocation of television broadcast spectrum freed up by the transition to Digital Television ("DTV") to public safety and commercial wireless uses. Of course, it is getting harder to reallocate spectrum in the desirable range from 300 MHz to 3 GHz in part because it is increasingly difficult to identify suitable replacement spectrum for those forced to move and, more fundamentally, because the incumbents are aware more than ever of the value of the spectrum they control. It is unclear at this point what spectrum can and should be reallocated in this critical range but, as I will speak to more in a moment, taking and publishing an accurate inventory of current spectrum allocations in it (as called for in H.R. 3125) would play a necessary and critical role in that determination.

Fourth, another fundamental technique for accommodating new spectrum users/uses is spectrum sharing. Different services can use or "share" the same spectrum (in the frequency, time and/or space dimensions) where the risk of excessive interference is inherently minimal or can be reduced to acceptable levels by various engineering or operational means (i.e., through "frequency coordination"). There are various categories of spectrum sharing. For example, spectrum sharing can be accomplished on a static or dynamic basis. Static – or long term sharing – has been used extensively in the past and it based upon detailed *a priori* engineering studies to minimize interference risk. For example, fixed, point-to-point terrestrial microwave systems can share spectrum with geostationary satellite systems by taking advantage of highly directive antennas that sufficiently isolate the two systems. Dynamic sharing is a more recent development that involves wireless devices or systems that are more aware of their current radio environment though access to data bases and real-time spectrum monitoring measurements. By taking advantage of this more localized, real-time information they are potentially able to access unused spectrum that may be available on a moment-by-moment rather than just a long term basis. I will have more to say about this technique – Dynamic Spectrum Access – later.

Another way to categorize spectrum sharing is whether it is accomplished on an involuntary or voluntary basis. In the past, spectrum sharing between or among various government and non-government/commercial systems has been the result of the FCC or NTIA (or the combination of the two) mandating such sharing in accordance with appropriate rules and regulations to minimize the potential for unacceptable interference. Voluntary sharing of non-Federal government spectrum is a more recent development that has been facilitated by FCC actions to allow certain of its licensees to lease their unused or under-utilized spectrum on a static or dynamic basis. These actions were intended to shift their management of the resource away from the centralized, command and control approach in favor of putting more reliance on localized, marketplace forces to shape spectrum use. When I was the Chief of the Office of Engineering and Technology

at the FCC in the late-1990s, I was a strong advocate of such secondary markets and a supporter of software defined radio and cognitive radio techniques that facilitated Dynamic Spectrum Access techniques. I was a strong advocate because I believed that the resulting, voluntary, spectrum sharing could reduce the administrative scarcity that was a consequence of the traditional centralized, command and control approach to managing the resource.

Fifth, the final fundamental technique for relieving spectrum congestion is frequency or spectrum reuse. When a radio transmitter is operated at high power and the associated antenna is at a great height, the resulting signal – and associated interference in the space dimension – is spread over a wide area. This can be an efficient way of serving less populated areas but in a densely packed urban area with high demand for spectrum, it may mean that a single channel can be used only once in the area. By lowering the power and the antenna height, the interference range is diminished thus enabling the same channel to be used multiple times in an area where spectrum is scarce. This is the capacity increasing technique that is used by commercial cellular carriers and, as demand has increased, the carriers have dramatically increased the number of base station sites in major urban areas to allow additional frequency reuse.

Like some of the other techniques that I have mentioned, frequency or spectrum reuse has limitations. For example, some important systems (such as radar systems designed to track targets at great distances) by their very nature need to emit a large amount of energy over a wide area. Moreover, even with commercial cellular systems, increasing the number of base stations means that they are more dependent upon the availability of broadband terrestrial backhaul facilities to get from the base stations to and from their switching center or other point of traffic concentration. Thus, increased frequency reuse is not always possible because of the nature of the service or it may be constrained by the availability of suitable antenna tower locations and economic backhaul facilities.

To conclude this second point or theme, it appears that going higher in frequency will be of limited usefulness in solving the current spectrum crisis associated with wireless mobile radio systems. It also appears that advances in the technical efficiency of spectrum utilization, while useful, cannot produce the orders of magnitude improvements necessary to accommodate the phenomenal growth in these types of systems and thereby avert the potential crisis. That leaves reallocation, increased sharing and more intense frequency reuse (at least in some services) as potential solutions, albeit ones with challenges of their own.

3. There Are Combinations of Management Techniques and Technological Advances That May Help Alleviate the Looming Crisis

Setting aside reallocation for the moment, the two most promising solutions to the looming crisis appear to be increased spectrum sharing and more intense frequency reuse. In terms of spectrum sharing, I have already noted that the FCC has taken steps to encourage voluntary sharing through a series of decisions associated with its secondary

market initiative and certainly those efforts should continue. In some notable situations associated with non-commercial Federal and non-Federal government licensees or assignees, there may not be sufficient economic or other incentives to share spectrum even in less critical circumstances. A major focus of the Federal advisory committee (CSMAC) that I co-chair is to identify incentives that might be adopted to encourage voluntary sharing and potentially more intense, non-interfering spectrum usage. Where such incentives are lacking or, in the commercial sector, where strategic market behavior may serve to limit voluntary sharing, additional mandated sharing may be necessary. In both the voluntary and involuntary sharing cases, I continue to believe that the technological advances in Dynamic Spectrum Access can play a big part in ensuring that such sharing can be accomplished with an acceptable risk of harmful interference. In short, I believe that a combination of increased incentives (preferably) or mandates (less preferably) for spectrum sharing coupled with more decentralized, more opportunistic, technologically-based techniques governing spectrum access can be of significant help in avoiding the looming crisis.

In terms of increased frequency reuse in those services in which the technique is feasible, I would point the Subcommittee's attention to the connection between (a) the need to drive fixed broadband facilities to the user that is being addressed by the FCC in its preparation of the National Broadband Plan and by NTIA in its grant programs under the ARRA and (b) the need for additional broadband facilities to support the increased wireless backhaul that is associated with more intense frequency reuse. In short, local broadband facilities (e.g., fiber optic facilities) are not only needed to support broadband services to fixed locations such as homes and businesses but to support the phenomenal growth in wireless services as well.

4. Conducting a Comprehensive Spectrum Inventory as Mandated by the Proposed Legislation Is a Necessary First Step in the Direction of Averting – or at Least Postponing – the Looming Spectrum Crisis

I am a strong supporter of conducting the spectrum inventories called for in the proposed legislation because I am a strong believer in the old adage that "You can't manage what you don't measure." More specifically, a comprehensive spectrum inventory is necessary to identify spectrum that could be reallocated – all or in part – for other uses based upon such fundamental information as the type and importance of service being provided and the current extent of usage in the frequency, time and space dimensions. Similarly an inventory is necessary to identify spectrum that could be potentially shared and under what conditions and at what risk. The greater transparency would allow academic and other researchers to better gauge the long-term performance of existing spectrum management processes and to suggest better ways of managing the resource. On a shorter term basis, it would allow entrepreneurs better information on what spectrum might be shared on a voluntary basis and encourage innovators to develop more sophisticated engineering techniques that would promote such sharing. More succinctly stated, a comprehensive spectrum inventory is necessary to support two of the most promising three ways of averting the spectrum crisis – reallocation and increased sharing.

5. The Mandated Inventory Should Be Augmented by Selected Field Measurements to Gain Additional Information on Actual Usage

As I just noted, I am a strong proponent of conducting a spectrum inventory but it must be admitted that there are potential shortcomings in relying upon a purely "paper study" – at least in some spectrum ranges. For example, in some services there may be wide temporal or geographic variations in spectrum usage that may not be revealed in a study of allocation and assignment records. Yet this may be precisely the information needed to gauge the efficiency of current usage and to identify potential reallocation or sharing opportunities. In the mid-1970s – during the first of my two tours of duty at the FCC – I was associated with something called the "Chicago Experiment" which, among other things, involved intensive spectrum occupancy measurements using sophisticated monitoring vans. Those comprehensive measurements revealed spectrum that was lying fallow because the licensee – say a tow truck operator -- had gone out of business and failed to cancel the his or her license. In other cases it revealed spectrum that was unused because the private frequency coordinator given the responsibility of recommending specific frequency assignments mistakenly believed that the channel was unavailable under the FCC's rules. In other cases, the measurements revealed very light usage of a channel or significant variations in usage over time. These usage measurements provided valuable information on the efficiency of existing spectrum utilization. Spectrum measurements in the field can also reveal the presence of illegal or poorly designed devices the proliferation of which may complicate any reallocation or sharing initiatives. For example, spillover or spurious emissions from existing devices/systems in adjoining bands may make usage of what appears to be a lightly used band on paper problematical or it may necessitate substantial and time consuming remedial action to make the band usable.

While I am very much in favor of conducting field measurements of spectrum utilization in order to accurately ascertain the situation "on the ground," I believe they should be done selectively for two reasons. First, in some bands – say the GPS bands – there is no doubt that the associated signals are transmitted continuously and that coverage is nationwide and that the very nature of the service precludes sharing. There would be little to gain from spectrum occupancy measurements in such bands. Second, properly conducted, extensive spectrum monitoring in the field can be quite expensive and time consuming – although the cost is declining with automation and the falling cost of equipment. Because of these two factors, I recommend that the spectrum inventory be augmented by selected field measurements in those bands deemed to be the most likely candidates for reallocation or increased sharing based upon the paper studies. Of course, light use or even no use of a given block of spectrum does not necessarily mean that it should be reallocated or shared as there may be perfectly legitimate reasons that those conditions may hold. On the other hand, light or no use would suggest a starting place for further investigation.

Mr. Chairman that concludes my testimony and once again I want to express my appreciation for being invited to testify here today on these two important pieces of legislation. I would be happy to respond to any questions that you might have.

Mr. BOUCHER. Thank you very much, Mr. Hatfield.
Mr. Largent, we will be happy to hear from you.

STATEMENT OF STEVE LARGENT

Mr. LARGENT. Thank you, Mr. Chairman, and I want to thank you and the ranking member and say to all the members, hope you have a Merry Christmas, Happy New Year, hope you get there.

I want to thank you for the opportunity also to share the wireless industry's views on the Radio Spectrum Inventory Act and the Spectrum Relocation Improvement Act. These bills are much needed bookends for a process that will enable additional spectrum to be made available for the wireless broadband initiative and other services.

Today the United States is the world leader in wireless broadband. While having less than 7 percent of the global wireless subscribers, the United States is home to more than 20 percent of global 3G subscribers. Our 112 million 3G subscribers are more than any other country and more than the third, fourth, fifth and sixth countries combined. Additionally, the most advanced wireless devices which are manufactured by global companies and could be launched anywhere in the world routinely debut in the U.S. marketplace. As a pair of former NTIA administrators recently noted, the convergence of mobile wireless services and high-speed Internet access and the evolution of handsets from telephones to powerful handheld computers promises to transform the way we work, learn, deliver health care, manage energy consumption and enhance public safety.

The key to translating this promise into reality is access to more spectrum. CTIA believes there is an urgent need to identify additional spectrum that can be made available for wireless broadband and other advanced wireless services. By providing for a comprehensive and timely inventory of spectrum below 10 gigahertz, enactment of H.R. 3125 would represent an important step towards meeting rapidly accelerating demand and maintaining U.S. leadership in the global wireless marketplace

How much spectrum do we need? The ITU projects that by 2015, developed countries will need at least 1,300 megahertz of spectrum for commercial wireless operations. Since the United States currently has less than 500 megahertz of spectrum available for commercial wireless services, we have asked the FCC to identify additional spectrum that can be reallocated to help us meet the ITU's benchmark.

Many of our trading partners are taking steps towards this goal and the United States needs to keep up if we are to stay ahead. A properly constructed inventory effort is a sound place to start. The inventory is only the first step, however. Once the inventory is complete, policymakers must use it to reallocate spectrum for advanced wireless services.

History demonstrates that it can take a decade or more to reallocate spectrum for commercial use and put such spectrum in the hands of providers of commercial mobile services, more than a decade. Given the exploding demand for mobile broadband, we must move more quickly than was the case with either AWS or 700 megahertz efforts. We simply can't wait until 2020 or beyond.

We recognize there will be critics of the effort to move forward with an inventory and relocation of spectrum. They will claim that carriers should be more efficient with the spectrum already available, that we can build out way out of the problem or that we have already seen an expansion in the amount of spectrum available for commercial services through the recent AWS and 700 megahertz auctions. There are sound reasons why the subcommittee should dismiss these criticisms, and I have discussed these in my written statement.

Finally, once an inventory is complete and spectrum is identified for relocation and auction, the improvements to the spectrum relocation process proposed by H.R. 3019 will ensure that the relocation process works smoothly for all parties.

Thank you for the opportunity to discuss these matters with the subcommittee. We look forward to working with you to ensure that the U.S. wireless industry continues to serve as an engine for jobs, economic growth and the American competitive advantage. Thank you, Mr. Chairman.

[The prepared statement of Mr. Largent follows:]

Testimony of Steve Largent, President and CEO, CTIA – The Wireless Association®
on H.R. 3125 and H.R. 3019
before the
House Subcommittee on Communications, Technology, and the Internet
December 15, 2009

On behalf of CTIA – The Wireless Association® (CTIA), thank you for the opportunity to share the wireless industry's views on the Radio Spectrum Inventory Act (H.R. 3125) and the Spectrum Relocation Improvement Act (H.R. 3019). These complementary bills are much-needed bookends for a process that will enable additional spectrum to be made available for wireless broadband and other services.

Today, the U.S. is the world leader in wireless broadband. While having less than seven percent of global wireless subscribers, the U.S. is home to 21.3 percent of global 3G subscribers. Our 112 million 3G subscribers are more than any other country, and more than the third, fourth, fifth, and sixth countries combined.[1] Additionally, the most advanced handsets, which are manufactured by global companies and could be launched anywhere in the world, routinely debut in the U.S. market. As a bipartisan pair of former NTIA Administrators recently noted, the convergence of mobile wireless services and high-speed Internet access and the evolution of handsets from telephones to powerful hand-held computers promises to transform almost all aspects of the way we work, learn, deliver health care, manage our energy consumption, and enhance our public safety.[2] The key to translating this promise into reality is access to spectrum.

As a part of CTIA's analysis of how much spectrum will be needed to facilitate the continued evolution of the wireless ecosystem, we reviewed a study[3] by the International Telecommunication Union (ITU) that concluded that developed countries will need at least 1300 MHz of spectrum for commercial wireless operations by 2015. Since the United States currently has only about 500 MHz of spectrum available for commercial wireless services,

[1] Informa Telecom & Media Group, World Cellular Information Service database, accessed December 9, 2009.
[2] Larry Irving and John Kneuer, "Turbocharging the Wireless Engine," Washington Times, September 6, 2009, available at http://www.washingtontimes.com/news/2009/sep/06/turbocharging-the-wireless-engine/.

we have asked the FCC to identify up to 800 MHz of spectrum that can be reallocated to help us meet the ITU's benchmark.

Outside the United States, many of our trading partners and international competitors are already taking steps toward this goal. In addition to their existing commercial allocations, Great Britain has identified an additional 355 MHz that will be made available for commercial use, Germany 340 MHz, Italy 254 MHz, and Japan 165 MHz. Furthermore, China is looking to make a total of at least 1000 MHz available for mobile communication, and the Indian government has opened a proceeding to determine what additional spectrum may be necessary to enable the widespread deployment of wireless and mobile broadband across that country. Here in the United States, we have just 50 MHz in the pipeline, which suggests that we have a great deal of work to do if we are to retain our position as the world's leader. A properly constructed inventory effort is a sound place to start.

The inventory envisioned by H.R. 3125 is only the first step, however. Once that inventory is complete, policymakers must be ready to act immediately to reallocate spectrum identified by the inventory as un- or under-utilized for advanced wireless services. That will mean looking at all users and uses, including government spectrum usage. It is likely that underutilized spectrum currently assigned to the federal government will be a critical source for spectrum that can be repurposed. A comprehensive spectrum inventory may also identify underutilized non-government spectrum -- whether currently allocated or licensed to broadcasters, satellite providers, or others -- that can be put to a higher and better use as commercial mobile wireless spectrum. Accordingly, the inventory legislation should be augmented to direct NTIA and the FCC to not just conduct an inventory, but also to make specific recommendations about bands that can be made available for reallocation.

CTIA makes this suggestion in light of the lengthy nature of the process for identifying frequency bands for commercial mobile use, enacting legislation necessary for reallocation of those frequencies, auctioning such frequencies, and issuing licenses. For example, consider

[3] "Estimated Spectrum Bandwidth Requirements for the Future Development of IMY-2000 and IMT-Advanced," Report ITU-R M2078, 2006.

how long it took to issue licenses for the 700 MHz and Advanced Wireless Service (AWS) bands.

In the Omnibus Budget Reconciliation Act of 1993 (OBRA93), Congress required the federal government to vacate at least 200 MHz of spectrum and permitted the FCC to conduct auctions for commercial use of spectrum. Later that year, then Subcommittee Chairman Markey introduced a bill (H.R. 3636) that would have required broadcasters to return one of their two licenses once broadcasters transitioned to digital television. With the enactment of the Telecommunications Act of 1996, Congress imposed this requirement. In the Balanced Budget Act of 1997 (BBA97), Congress created an explicit framework to determine when broadcasters would be required to return their spectrum used for analog broadcasts, and required that portions of the 700 MHz band be auctioned for commercial use. The FCC auctioned a portion of the 700 MHz band in 2002, though broadcasters had not vacated the band.

In the Deficit Reduction Act of 2005, Congress required the entire 700 MHz band, excluding frequencies made available for public safety, to be auctioned by January 28, 2008. The auction began on January 24, 2008 and concluded on March 18, 2008, though the D Block did not meet the reserve price and has not been reauctioned. The FCC granted 64 of the 700 MHz licenses on June 26, 2008, almost 15 years after Congressman Markey introduced his bill to require broadcasters to return their licenses after transitioning to digital television.

The AWS frequency bands (1710-1755 MHz and 2110-2155 MHz) were identified for auction in BBA97. The 1710-1755 MHz band had previously been identified by the Commerce Department pursuant to the report required by OBRA93 (in which the Secretary was required to determine which frequencies occupied by federal government operations could be reallocated for commercial use). While Congress attempted to facilitate the relocation of government users of the band by permitting voluntary relocation, it was not until Congress enacted the Commercial Spectrum Enhancement Act of 2004 (CSEA) that procedures were implemented to fund such relocation. That law also produced the AWS auction, which began on August 9, 2006 and ended on September 18, 2006. The FCC

awarded approximately half of the AWS licenses on February 27, 2007, almost 14 years after enactment of OBRA93 and nine and a half years after BBA97.

The history of these auctions demonstrates that it can take a decade or more to reallocate spectrum for commercial use and put such spectrum in the hands of providers of commercial mobile services. Given the exploding demand for mobile broadband, CTIA believes we must move more quickly than was the case with either of those previous efforts if we are to stay ahead of consumer and enterprise demand.

We recognize that there will be critics of the effort to move forward with an inventory and reallocation of spectrum. They will claim that commercial carriers should be more efficient with the spectrum already available, that we can build our way out of the problem, or that we have already seen an expansion in the amount of spectrum available for commercial services through the recent AWS and 700 MHz auctions. There are sound reasons why the Subcommittee should dismiss these criticisms.

First, while it is true that efficiency gains can help carriers to make better use of existing allocations, U.S. carriers already lead the world in spectral efficiency. On a per megahertz of spectrum basis, U.S. carriers collectively serve more consumers than are served by carriers in other countries. In fact, U.S. carriers serve more than three times as many subscribers per megahertz than is the case in South Korea, the U.K., or France, and more than twice as many subscribers per megahertz as is the case in Japan or Germany. Additionally, experts have begun to caution that we should not count on efficiency gains to meet the exploding consumer demand for bandwidth.[4]

Second, simply building more infrastructure will not solve the problem. The FCC's recent decision to impose a "shot-clock" on the consideration of tower siting applications was a welcome and important step forward, but tower construction and frequency reuse alone do

[4] Rysavy Research, "Mobile Broadband Spectrum Demand," December 2008, available at http://www.rysavy.com/Articles/2008_12_Rysavy_Spectrum_Demand_.pdf , and "EDGE, HSPA, and LTE Broadband Innovation," available at http://www.rysavy.com/Articles/2008_09_Broadband_Innovation.pdf. See also "AT&T, Qualcomm Execs Stress Need for Carrier Network Management," TR Daily, October 8, 2009.

not improve the economics of providing service and are not sufficient to help the industry meet the growing consumer demand for mobile broadband.

Finally, the ongoing shift from voice to data poses an enormous challenge. While it is true that the FCC in recent years has authorized a three-fold increase in commercial spectrum, the problem is that many anticipate a 30-fold increase in wireless traffic.[5] A single smartphone generates more data traffic than 30 basic-feature cellphones, and a laptop aircard expands this multiple again by a factor of 15.[6] Addressing this sort of shift will require additional spectrum.

Without a clear indication that additional spectrum will be made available to meet this demand, carriers may be motivated to consider consolidation as a means by which to augment their respective spectrum inventories. While certain mergers might promote efficiency and represent the best way to serve users and shareholders, consolidation should not be the only path by which a carrier in need of additional spectrum can meet consumer demand and grow.

For these reasons, and because delay has additional costs (in terms of investments and services that are delayed, as well as in lost productivity) that we can and must avoid as we seek to put the American economy back on sound footing, Congress should move expeditiously on the inventory legislation.

Once an inventory is complete and spectrum is identified for reallocation and auction, the improvements to the spectrum relocation process proposed by H.R. 3019 will ensure that any bands that may be reallocated are made available in a timely manner and reduce the risks to auction participants by increasing the amount and quality of information available to bidders and federal agencies before an auction of federally-encumbered spectrum. The CSEA

[5] Prepared Remarks of Chairman Julius Genachowski, "America's Mobile Broadband Future," available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf.
[6] Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, January 29, 2009, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf.

represented an improvement in the framework for relocating government users, and the wireless industry has worked with Congress, NTIA, OMB, and the affected agencies to ensure that the spectrum relocation process following the 2006 AWS auction worked as intended. Nonetheless, we learned some lessons from that process that are reflected in H.R. 3019.

Of the $13.7 billion raised by the AWS auction, roughly $1 billion has been used to relocate communications systems for 12 federal agencies that were operating in those spectrum bands. While the procedures worked well for most of the affected agencies, problems affecting a few agencies were complex and their resolution has extended well beyond what was originally expected. That delay harmed both the agencies and the carriers that had been winning bidders in the AWS auction. Among the improvements proposed by H.R. 3019 is a requirement that each federal entity being relocated to new spectrum prepare a detailed transition plan in advance of the auction so that disputes and post-auction delays can be avoided. This and other reforms in H.R. 3019 will make it easier for government and industry to work together to achieve the broadband deployment goals that we all share.

Thank you for the opportunity to discuss these matters with the Subcommittee. We look forward to working with you to ensure that the U.S. wireless industry is positioned to meet the evolving needs of individual and business users while continuing to serve as an engine for economic growth and American competitive advantage.

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Mr. BOUCHER. Thank you, Mr. Largent.
Mr. Calabrese.

STATEMENT OF MICHAEL CALABRESE

Mr. CALABRESE. Good morning. First I would like to thank the committee's leadership for taking up these two very complementary and important pieces of legislation on a notably bipartisan basis. A national goal of not merely affordable broadband access but of seamless mobile connectivity anywhere and anytime will require an enormous increase in available spectrum capacity.

The Apple iPhone has proven to be the canary in the proverbial spectrum coalmine. Advanced smart phones consume hundreds of times the bandwidth of ordinary cell phones. With sufficient spectrum, pervasive connectivity will rapidly become integrated as well in applications for sensing networks, mobile health monitoring, energy conservation, education and more. This exploding demand and the continued focus on exclusive licensing by auction has served to reinforce the conventional wisdom that spectrum in scarce. In reality, the only scarcity is government permission to use spectrum, that is, licensing. Spectrum capacity itself is very abundant. Even in the most valuable beachfront frequencies below 3 gigahertz, actual spectrum use measurements show that the vast majority of frequency bands are not being used in most locations and at most times. This gross underutilization of the Nation's spectrum resource should be an urgent concern.

Spectrum is not only an immensely valuable and publicly owned resources but it is one that is infinitely renewable every millisecond. That is why New America and the Broader Public Interest Spectrum Coalition that we work with strongly support enactment of H.R. 3125, the Radio Spectrum Inventory Act. We agree that the more comprehensive inventory described in the House bill is needed. A more granular and comprehensive description of spectrum use in each market will assist policymakers, entrepreneurs and technologists to propose new ways to enhance both access and efficiency. We also agree it is important to extend the inventory up to 10 gigahertz, as the House bill provides.

Spectrum mapping would help facilitate expanded access to broadband in at least three ways. First, by improving the functioning of secondary markets for license transfers and leasing; second, it will provide information on what it would take to clear some very underutilized bands for new uses, and third, and perhaps more important, it will reveal the far greater number of frequency bands that can be made available for shared access in discrete geographic areas at certain times of the day or year or at certain altitudes or power levels. We expect rural areas to be the most likely and immediate beneficiaries of this mapping.

The one shortcoming of H.R. 3125, in our view, is that an inventory of spectrum assignments should be augmented by actual spectrum use measurements as Dale just mentioned. Measurements and eventually a system of spectrum use monitoring can provide a more nuanced window into how, when, where and to what extent bands are actually in use. We realize that measurements add a budgetary cost. Fortunately, we believe appropriated funds are available over the next 4 years for a very robust implementation

of the inventory act. As part of the Recovery Act, Congress appropriated $350 million for a "comprehensive nationwide inventory map of the Nation's existing broadband capabilities." Since NTIA will award less than half the available funding to the States for broadband mapping, Congress could clarify that a portion of the remainder be used to inventory the airwaves as well.

We also strongly support H.R. 3019, the Spectrum Relocation Improvement Act. Nowhere is spectrum underutilization more evident than in many of the bands reserved for use by the federal government itself. While we support H.R. 3019, we also believe the legislation should be broadened to take advantage of a critical opportunity to free up far greater spectrum capacity. H.R. 3019 would continue to limit eligibility for radio system modernization to agencies actually clearing off a set of frequencies. While only a tiny fraction of federal spectrum could be cleared and auctioned in the near future, a far greater number of bands could be shared more intensively by taking advantage of advances in smart radio technologies. Federal spectrum incumbents need the resources to take affirmative steps to enable more intensive access and band sharing by other users. This could be a real win-win for the military. New and upgraded federal systems could be designed and procured with the broader public interest and spectrum access in mind and not only in the very limited case of a band being cleared for auction.

I will stop there. Thank you very much, and I will be pleased to take any questions.

[The prepared statement of Mr. Calabrese follows:]

Testimony of

Michael Calabrese
Vice President & Director, Wireless Future Program
New America Foundation

Before the

Committee on Energy and Commerce
Subcommittee on Communications, Technology and the Internet
United States House of Representatives
Washington, D.C.

December 15, 2009

Legislative Hearing on H.R. 3125, the Radio Spectrum Inventory Act and H.R. 3019, the Spectrum Relocation Improvement Act of 2009

Testimony of

Michael Calabrese
Vice President & Director, Wireless Future Program
New America Foundation
December 15, 2009

Thank you, Chairman Boucher, Ranking Member Stearns and members of the Committee, for this opportunity to testify today on these two important pieces of proposed legislation.

My name is Michael Calabrese, Vice President and Director of the Wireless Future Program at the New America Foundation, a nonpartisan public policy institute here in Washington, DC. On issues concerning spectrum and wireless broadband policy, New America is part of the Public Interest Spectrum Coalition (PISC), which represents national consumer and advocacy groups including Consumers Union, Consumer Federation of America, Free Press, Public Knowledge and others. Most of my remarks reflect comments that we filed on behalf of PISC last month in response to the FCC's Wireless Innovation Notice of Inquiry (Docket 09-157) and in response to the National Broadband Plan more generally (Docket 09-51).

In addition to explaining why we support these two very complementary bills, I will make the following main points:

- The increasing capability and popularity of smartphones and other wireless computing devices will drive an explosion in mobile data demand.
- Contrary to conventional wisdom, there is an abundance of unused spectrum capacity that can be reallocated band-by-band for exclusive or for shared use.
- The spectrum inventory proposed in H.R. 3125 is critical to identifying underutilized bands and determining how best to expand access and improve spectrum efficiency.
- Actual spectrum use measurements and, ideally, spectrum monitoring, would add an important layer of useful data to the inventory; this and other NTIA/FCC costs for a robust implementation should be funded from unused appropriations for the national broadband mapping data under the Broadband Data Improvement Act.

- Many federal bands are particularly well-suited for increased sharing with private sector uses, but this will require not just streamlining the CSEA's Spectrum Relocation Fund process, but also broadening eligibility so that agencies have the means to upgrade systems to share capacity on a far greater number of bands.
- Together the inventory and the CSEA process can facilitate shared access to a far larger amount of spectrum capacity not being used at particular locations or times.
- A comprehensive spectrum inventory and CSEA reforms are also critical because it is neither practical nor desirable to rely entirely on new auctions of exclusively-licensed spectrum to meet the projected future demand for mobile data.
- Increasing opportunistic access to shared spectrum will enable hybrid networks, giving consumers the choice to transmit mobile data flows where feasible over unlicensed airwaves and local wired networks, rather than transporting most data over scarce licensed spectrum and relatively distant carrier infrastructure.

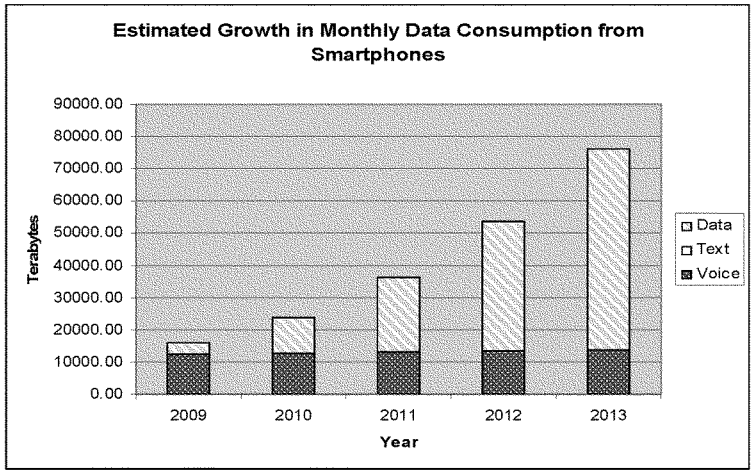
Mobile Data Demand and the Myth of Spectrum 'Scarcity'

Unleashing an abundance of spectrum and driving down its cost as an input for all things mobile is the single best means by which Congress, the Administration and the FCC can promote innovation and consumer welfare in wireless. There is no doubt that consumer demand for mobile data applications is exploding worldwide. The iPhone has proven to be the canary in the proverbial spectrum coal mine: with the equivalent of a mobile computer and thousands applications to choose among, iPhone users consume between five and ten times the bandwidth as other smartphone users – and hundreds of times the bandwidth of ordinary cell phones. The increasing market penetration and use of smartphones with capabilities similar to today's iPhone and Android is likely by itself to increase mobile data demand by a factor of 16 or more within five years (conservatively growing from approximately 3,700 to 62,000 terabytes – see Figure 1 below).

In addition, pervasive connectivity will rapidly become integrated in applications for sensing networks, health care (e.g., remote monitoring), energy conservation (e.g., smartgrid, home appliance networks), education, public safety and e-government – much as devices like the Kindle are already embedding wireless connectivity. Cisco's annual

projection of global Internet traffic predicts a 130% annual growth rate for mobile data over the next five years – with mobile Internet video driving overall consumption to 366,000 terabytes (see chart below).

***Figure 1*: Estimated Growth in Monthly Data Consumption from Smartphones[1]**



A national goal of not merely affordable broadband access, but of truly pervasive connectivity – seamless mobile connectivity anywhere and anytime – will require an enormous increase in available spectrum capacity. Despite the FCC's acknowledgment that traditional "command and control" spectrum management is outdated and inefficient, the government's continued focus on exclusive licensing by auction reinforces the conventional wisdom that spectrum is scarce. In reality, the only scarcity is government permission to use spectrum (licenses). Spectrum capacity itself is abundant. Indeed, while actual spectrum measurement studies are difficult to find, those in the public

[1] This smartphone data projection conservatively assumes the penetration of devices with capabilities similar to today's iPhone will increase from 17% to 50% in five years and that the average user will consume as much data (400 megabits/month) as today's iPhone user. Total mobile subscribership is assumed to grow at a rate of 3% per year. Growth rates for voice and text messages are assumed to be 3% per year and based upon monthly voice minutes and text messages reported from CTIA's 2009 Semi-Annual Wireless Industry Survey Results. Although 123 billion text messages were sent per month during the first half of 2009, each message is just 160 bytes (total of 19 terabytes/month) and therefore is not visible on the chart.

domain have demonstrated that even in the most valuable "beachfront" frequencies below 3 GHz, the vast majority of frequency bands are not being used in most locations and at most times. Spectrum measurement studies by the New America Foundation, by Shared Spectrum and others show that even in Manhattan and here in Washington near the White House, less than 20 percent of the frequency bands below 3 GHz are in use over the course of a business day. Spectrum usage rates are, of course, far lower in suburban and rural areas.

US Mobile Data Traffic
(Terabytes per month)

	2008	2009	2010	2011	2012	2013
Handsets						
Audio (Handsets)	638	1,444	2,946	5,696	10,630	19,331
Data and Messaging (Handsets)	320	734	1,552	3,160	7,630	16,670
Video (Handsets)	231	768	2,288	6,063	18,056	52,520
Video Calling (Handsets)	87	347	1,358	4,082	10,577	26,427
Laptops and Other						
Internet Gaming	101	241	508	1,008	1,993	3,610
Internet Video Communications	23	58	133	288	593	1,074
Internet Video to PC	1,723	5,591	15,138	36,127	82,091	153,745
Internet Voice	41	96	185	332	599	1,085
P2P	1,321	3,072	6,055	10,934	18,609	27,846
Web/Email	1,353	3,419	7,671	16,414	35,291	63,936
TOTAL	**5,837**	**15,770**	**37,835**	**84,103**	**186,068**	**366,245**

Source: Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, January 29, 2009 (U.S. data breakout)

The gross underutilization of the nation's spectrum resource should be an urgent concern for national broadband policy. Spectrum is not only an immensely valuable and publicly-owned resource, but one that is infinitely renewable: every millisecond that a frequency band is not used for communication, that capacity is wasted forever. In that respect, when former FCC Chairman Newt Minow famously called television a "vast wasteland," he could have been describing more literally the nation's spectrum resource under the prevailing exclusive zoning (licensing) system. One of the biggest obstacles to putting fallow spectrum to work, particularly in the grossly underutilized bands held by

the federal government, is the lack of transparency with respect to actual use and the types of systems and technologies that need to be accommodated to facilitate greater private sector access.

H.R. 3125: The Radio Spectrum Inventory Act

A critical step toward making substantially more spectrum capacity available for wireless broadband services and innovation is to determine and disclose how, where and when this publicly-owned resource is currently being used – or not used – by current public agency and private sector licensees. That is why New America and the broader Public Interest Spectrum Coalition strongly support enactment of H.R. 3125, the Radio Spectrum Inventory Act, as well as its Senate companion (S. 649). We agree with the bipartisan House co-sponsors that it is important to extend the inventory up to 10 GHz and not limit it to the range of frequencies most intensively used today, as the Senate bill does by restricting the inventory to spectrum below 3.5 GHz. Even if frequencies below 3.5 GHz are prioritized during the inventory process, policy should encourage continued innovation and access to the higher-frequency bands by making their use equally transparent. We also appreciate the more comprehensive scope of the inventory described in the House bill, since a more granular and comprehensive description of the actual spectrum use in each local market will assist policymakers, business entrepreneurs and technologists to propose new ways to enhance spectrum access and efficiency.

Spectrum mapping would help facilitate expanded access to broadband providers in at least three ways:

- First, more complete and transparent frequency-by-location data online will improve the functioning of secondary markets for spectrum license transfers and leasing.
- Second, it will provide information on what will be required to clear some heavily underutilized bands, so that they can be reassigned for commercial use.
- Third, it will reveal the far greater number of frequency bands that could be made available for shared access in discrete geographic areas, at certain times of day or year, or at certain altitudes or directions of arrival (azimuth, elevation).

Rural areas would be the most likely and immediate beneficiaries of a mapping of the U.S. spectrum capabilities. Wireless remains the most cost-effective and rapid means by which to bring broadband access to rural residents. It will quickly become clear that particular frequency bands are either completely unused or grossly underutilized in many rural markets. An online map of spectrum utilization on a localized basis (such as by Rural Service Area and Metropolitan Statistical Area) would provide the Commission or Congress with the information it needs to reallocate or to at least open underutilized frequencies for non-interfering use by rural broadband providers, as well as for wireless innovation more broadly. Already, thousands of locally-grown Wireless Internet Service Providers (WISPs), Rural LECs, public utilities, NGOs and local governments are utilizing wireless technology in conjunction with unlicensed spectrum to bring wireless broadband to unserved and underserved rural areas across the country. A substantial obstacle these small and local providers face in attempting to expand and scale-up their networks is access to additional spectrum.

It is also important that any federal spectrum mapping include actual and ongoing spectrum use measurements at a large and diverse sample of rural, urban and suburban locations around the nation. The major shortcoming of H.R. 3125, in our view, is that an inventory of spectrum assignments should be augmented by actual spectrum use measurements – and, eventually, a system of spectrum use monitoring – that can provide a more nuanced window into how, when, where and to what extent bands are *actually* in use. The Commission and the public need to have a more complete, comprehensive inventory of what frequencies are *actually* in use, for what purpose, with what technology, at what locations, frequencies and times. Both government and private sector assignments and uses should be included in the map. Actual spectrum use measurements in a large and regionally diverse sampling of markets should be part of the Commission's broadband mapping exercise.[2]

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[2] *See* "Ex Parte Comments of New America Foundation," GN Docket No. 09-29, Federal Communications Commission, March 25, 2009, http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6520203629, *see also* "Comments of the New America Foundation, Public Knowledge and Media Access Project, GN. Docket No. 09-51, Federal Communication Commission, June 8, 2009, http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6520220266 .

The NTIA conducted spectrum measurement studies in the mid-1990s, but virtually none in recent years. Indeed, one of the recommendations of the Presidential Task Force on spectrum policy in 2004 called for "spot compliance checks" and "signal measurement surveys" to check the accuracy of NTIA's records and provide data needed to "evaluate the utility of underutilized spectrum."[3] The Task Force recommended that:

> NTIA should evaluate all spectrum use by the federal government over a five-year period to determine spectrum efficiency and effectiveness. **The review should include spot compliance checks and signal measurement surveys to verify the accuracy of the records of the Government Master File (GMF), identify congestion and instances of duplicative operations that could be combined, and evaluate the utility of underutilized spectrum.** NTIA should use the results of these reviews in the development of new and improved spectrum management policies, and the Federal Strategic Spectrum Plan. [4]

There are proven methods for efficiently aggregating usage data across a wide range of frequencies and at relatively low cost. For example, early this year Ofcom, which regulates spectrum and communications in the United Kingdom, completed a nationwide study by mounting measurement equipment on the roofs of vehicles used by a UK-wide sales force. The mobile monitors aggregated data over a period of weeks on frequency bands from 10 MHz to 6 GHz.[5] In the U.S., a nationwide fleet service – such as the Postal Service – could aggregate continuous measurements, downloading the data automatically by WiFi each evening. Another method, currently being field-tested by at least one U.S. firm, involves continuous monitoring over wide areas by a meshed network of inexpensive sensors (less than $1000 per unit) that could be mounted on the roofs of public buildings.

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[3] The Task Force was part of the Spectrum Policy Initiative initiated by President Bush in 2003 and led by NTIA. U.S. Department of Commerce, *Spectrum Policy for the 21st Century–The President's Spectrum Policy Initiative: Report 1, Recommendations of the Federal Government Spectrum Task Force* (June 2004), at http://www.ntia.doc.gov/reports/specpolini/presspecpolini_report1_06242004.htm; *see also* http://www.ntia.doc.gov/reports/specpolini/presspecpolini_report2_06242004.htm; NTIA, *Presidential Memorandum on Spectrum Policy for the 21st Century*" (May 29, 2003), available at http://www.ntia.doc.gov/ntiahome/frnotices/2004/PresMemoonSpectrumPolicy.htm.

[4] *Ibid.*

[5] Ofcom, "Capture of Spectrum Utilisation Information Using Moving Vehicles," study available at http://www.ofcom.org.uk/research/technology/research/state_use/vehicles/.

We realize that adding a layer of actual use measurements to the inventory would entail a budgetary cost. Indeed, a very robust implementation of H.R. 3125 would also entail substantial staff time and costs, particularly if NTIA and FCC intend to display an easy-to-navigate visualization interface for the inventory on the Web. Fortunately, Congress has already authorized and appropriated adequate resources to both do measurements and to offset any extra costs associated with a very robust inventory. The American Recovery and Reinvestment Act appropriated up to $350 million, under the Broadband Data Improvement Act (BDIA), to develop and maintain "a comprehensive nationwide inventory map of *existing broadband service capability* [italics added]."[6] Just as fiber is the essential conduit for advanced wired connectivity, spectrum is the publicly owned conduit for wireless broadband. Spectrum is "wireless fiber" – the fundamental pipeline for wireless broadband service capability and we believe it would be in the public interest to have a clear and transparent mapping of those capabilities. Since NTIA is in the process of awarding less than half this appropriation to the states and territories, Congress could clarify that a portion of the remainder can be used over the remaining four years of the BDIA mapping program to map the airwaves as well.

We further recommend that spectrum mapping should be adopted as a presidential initiative coordinated from the White House under the guidance of the President's Chief Technology Officer. In addition to signaling the importance of pervasive connectivity to the economy and American competitiveness, White House leadership is necessary to secure the full cooperation of departments and agencies across the government. Federal agencies hold the rights to the majority of the spectrum frequency bands best suited for broadband services and applications. These rights are spread across dozens of agencies and coordinated by an office within NTIA (the Office of Spectrum Management) that historically has been conflicted by its primary role as defender of federal agency allocations and by dependence on spectrum management fees budgeted by these agencies. The FCC, meanwhile, is an independent regulatory agency that can neither command, nor be commanded by, the NTIA or other executive branch departments.

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[6] *See* Sec. 6001, The American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009).

Therefore, while the NTIA and FCC are the essential co-partners in this effort – and show promising signs of being able to work in tandem under their respective new leaderships – it will be critical for the entire executive branch to respond to this initiative as a presidential broadband imperative.

H.R. 3019: The Spectrum Relocation Improvement Act

Although spectrum mapping would greatly facilitate the identification of bands that can be reallocated for more intensive and efficient use, the process of unlocking unused spectrum capacity should begin immediately on a band-by-band basis. Nowhere is spectrum underutilization more evident than in many of the bands reserved for use by the federal government itself.[7] According to the Commerce Department's Office of Spectrum Management, federal agencies have exclusive use of 18.1% (629 MHz) of the "beachfront" frequencies between 225 and 3700 MHz, while non-federal users have exclusive licenses to 30.4% (1058 MHz). The remaining 51.5% is shared, with federal use primary and private sector use secondary.[8] Of the roughly 2400 MHz of federal spectrum allocations below 3.7 GHz, over 1700 involves radar, radionavigation and air telemetry systems, the effective operation of which are indeed critical to national security. At the same time, actual spectrum measurement studies indicate that the military and other agencies are actually using very little if any of that capacity on most days and in most geographic locations, particularly at ground level and in more densely populated metro areas where more spectral capacity is most needed.[9]

It is important to be clear that just because a frequency band is not fully or frequently utilized in a particular geographic area – which is what the New America and Shared Sectrum measurements indicate – this does not mean it is not serving its assigned

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[7] For an in-depth discussion of the utilization of federal spectrum and policy recommendations for reallocation of this underutilized spectrum, *see* Victor Pickard and Sascha D. Meinrath, "Revitalizing the Public Airwaves: Opportunistic Reuse of Government Spectrum," Wireless Future Working Paper, New America Foundation (June 2009); forthcoming in *International Journal of Communications* (2009).
[8] Karl Nebbia, Director, NTIA Office of Spectrum Management, presentation to the Commerce Spectrum Management Advisory Committee (CSMAC), December 9, 2009.
[9] Mark McHenry, "NSF Spectrum Occupancy Measurements: Project Summary," Shared Spectrum Company (August 2005)), available at http://www.sharedspectrum.com/measurements/. McHenry's 2005 study collected frequency use data in six locations along the East coast in 2004 and documented an average total spectrum use of between 0 and 3% at rooftop level across hundreds of MHz of federal spectrum.

purpose, or that its incumbent users can be relocated. Many military bands in particular are assigned for mission-critical training and emergency purposes that are episodic or geographically limited in nature. While in many such cases "clearing" a band of its current licensee and reassigning it exclusively to private sector licensees cannot be justified, there is nevertheless tremendous communications capacity that could be productively used at no cost or harm to the incumbent – just as the military today shares several radar bands with unlicensed users of low-power unlicensed devices.[10] At the same time, even a band that would register as "occupied" over the course of a day or week may still have tremendous unused spectrum capacity. A band of frequencies can be "white" (underutilized) and potentially shared on a number of different dimensions, including geography, time, power level, altitude and angle of reception.

A band-by-band approach will be necessary to determine the best means by which an underutilized band can be made available for more intensive use with minimum risk of harmful interference to incumbent services. In some bands, Congress or the FCC, in consultation with NTIA, may determine that it is feasible to relocate incumbent federal users to accommodate reassignment of frequencies on an exclusively-licensed basis, as occurred with the 45 MHz of federal spectrum at 1710 to 1755 MHz that was cleared for auction under the Commercial Spectrum Enhancement Act of 2004.[11] In a far larger number of bands, where it is not practical to relocate military or other federal users, or where that would take many years, spectrum capacity can be made available more rapidly by opening the bands to "opportunistic access" on a secondary basis that requires the user to avoid causing harmful interference with the incumbent use.

While we support the improvements to the CSEA that are proposed in H.R. 3019, we believe the legislation should be broadened to address a critical opportunity to free up far greater spectrum capacity for mobile broadband services and innovation. H.R. 3019 would continue to limit eligibility for reimbursements toward the cost of radio system

[10] *See* Michael J. Marcus, "New Approaches to Private Sector Sharing of Federal Government Spectrum," Wireless Future Program Issue Brief #26, New America Foundation (June 2009).
[11] On December 23, 2004, President Bush signed into law the Commercial Spectrum Enhancement Act (CSEA), Title II of Pub.L. No. 108-494; 47 U.S.C. 928(d)(2). CSEA created the Spectrum Relocation Fund through which federal agencies can recover the costs associated with relocating their radio communications systems from bands designated by Congress for reallocation to exclusive commercial use.

modernization to agencies actually clearing off a set of frequencies scheduled for auction. While only a tiny fraction of federal spectrum could be cleared and auctioned in the near future – primarily because most bands serve critical national security and other functions – a far greater number of bands could be shared more intensively by taking advantage of advances in smart radio technologies. Technologies such as spectrum sensing, dynamic frequency selection, geolocation databases and priority-in-use beaconing can enable a far greater degree of band sharing with non-federal users.

Federal spectrum incumbents need the resources to take affirmative steps to enable more intensive access and band-sharing by other users. This could be a win-win for the military. Although the DoD, for example, has begun sharing military radar bands (at 5 GHz) with low-power unlicensed operations, government users are entirely passive and take no affirmative steps to facilitate private sector use of lightly-used bands. Michael Marcus, a career-long chief spectrum engineer at the FCC, has argued that with the right incentives "a third generation of sharing could be based on new technologies for federal government radio systems that are designed with sharing in mind and that can actually *facilitate* sharing."[12] New and upgraded federal systems could be designed and procured with the broader public interest in spectrum access in mind – and not only in the very limited case of a band being cleared entirely of federal use.

We therefore suggest that H.R. 3019 be amended to broaden the purpose of the Spectrum Relocation Fund – turning it into a sort of revolving fund for modernizing federal systems not only to migrate off some bands entirely, but to facilitate the shared or more efficient use of other federal bands. Enhancing agency budgets with revenue tied to the purpose of upgrading to state-of-the-art equipment, we believe, would prove to be a far stronger and more focused incentive than giving agencies the option to lease unused capacity on secondary markets (which, if it ever generated more than trivial amounts of revenue, could not be counted on to increase the agency's overall resources since OMB or Congressional appropriators could view it as an offset). Funding federal agency relocation plans could remain the priority – and retain access to a guaranteed set-aside

[12] *See* Michael J. Marcus, "New Approaches to Private Sector Sharing of Federal Government Spectrum," Issue Brief #26, New America Foundation (June 2009).

within the Fund. But in addition the residual revenue, or some portion, should be made available to applications from agencies that could be recommended to OMB for approval – on an annual, competitive basis – by the new Technical Advisory Panel that would be appointed under H.R. 3019. Moreover, if there were any legitimate concern about auction revenues being insufficient for such purposes, Congress could revise the CSEA to direct that devices certified to operate on the newly-shared bands opened due to expenditures from the Fund pay a one-time certification fee to help replenish the Fund.

Opportunistic Access to Unused Spectrum Capacity

Opportunistic access to unused federal spectrum could be particularly useful given the lumpiness of spectrum demand by geography and population density (e.g., rural vs. suburban vs. urban). The greatest needs for capacity are not nationwide, or around the clock, but primarily urban and during peak use periods. Rather than an entire network needing additional spectrum, it may be a few cells that are substantially oversubscribed and would benefit from having access to additional spectrum for short period of time.

We believe the most promising mechanism for freeing up large quantities of spectrum capacity needed for wireless broadband deployments and other innovation is to build on the TV Bands Database, which the FCC will certify as the mechanism by which consumers identify and get permission to access "white space" channels not in use in discrete geographic locations across the nation's 210 local TV markets. Under the Report & Order adopted unanimously by the Commission in November 2008,[13] both fixed and mobile broadband devices will be allowed to operate on an unlicensed basis on unused DTV channels ("white space") provided that the devices have GPS and the capability to periodically check an online database of available TV channel frequencies in that discrete geographic location. TV band white space devices (WSDs) will be required to query a national database to determine available channels at their current location before transmit capabilities are engaged.

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[13] Unlicensed Operation in the TV Broadcast Bands, *Second Report and Order and Memorandum Opinion and Order*, ET Docket No. 04-186, ET Docket No. 02-380, FCC 08-260 (released November 14, 2008) ("*TVWS Order*").

There appears to be no reason to limit the functionality of the TV Bands Database to the TV band frequencies – and no reason not to add more fallow bandwidth to this "common pool." If a potentially useful frequency band is not being used at particular locations (e.g., used in New York City but not in West Virginia), or is being used only at certain times or at certain altitudes or angles of reception, then that currently wasted spectrum capacity could at a minimum be listed in the Database for opportunistic access, subject to whatever power limits or other conditions would be necessary to avoid harmful interference to sensitive incumbent operations.

Adding other bands to the TVWS Database could ultimately increase available spectrum capacity by hundreds of megahertz or more, particularly in rural areas where measured spectrum usage below 3 GHz is in the low single digits today. The FCC's access rules for TV white space anticipates the use of frequency-hopping, multi-band radios, which are increasingly common and affordable in commercial mobile systems. Device makers and service providers would simply choose the combination of frequencies most appropriate to their needs. Devices (whether fixed access points or mobile handsets) would scan and select the clearest frequency from among those that their devices can be tuned to utilize. Both federal and non-federal bands should be added to the Database, with access to each band subject to conditions that are tailored to avoid harmful interference to existing, licensed use. And to the extent that either a federal agency or private sector incumbents truly need compensation or incentive to facilitate shared access, a permission Database mechanism provides one means by which to collect "user fees." Another means would be to impose a one-time equipment certification fee on devices tuned to operate in bands governed by the Database, since the FCC must certify devices in any case.

New Exclusively-Licensed Spectrum Alone Cannot Absorb Mobile Data Demand

As this Committee takes up the Radio Spectrum Inventory Act and the Spectrum Relocation Improvement Act, it is important to bear in mind that meeting the exploding demand for mobile data access must increasingly include a focus on enabling shared, dynamic access to unused and underutilized bands. Currently, commercial wireless

providers hold licenses for just over 500 MHz of spectrum. While it may be feasible to clear incumbents from approximately 200 MHz of spectrum within three to five years, there appears to be no economically or politically feasible path to clearing the 800 MHz recently requested by CTIA, the Wireless Industry Association.

The CTIA projection appears to be based on a 2006 study by the International Telecommunications Union (ITU). The futility of meeting projected demand by clearing new bands for auction is highlighted by the fact that the ITU study estimated a considerably higher requirement for markets (such as the U.S.) that aim to sustain sufficient spectrum capacity for three or four competing ISPs in each market. The ITU's total spectrum requirement for three competing networks is 1,980 MHz by 2020 – and 2,240 MHz to support four competitive networks (see Figure 2 below). Clearing the additional 1,700 MHz of spectrum that ITU estimates is needed to sustain robust competition among multiple networks and technologies within the same local area – and with propagation characteristics that ensure quality of service – does not seem feasible within a meaningful time frame. What is more likely to result from a policy premised solely on clearing bands and auctioning exclusive licenses is a continuation of current trends: a sort of controlled scarcity that releases "just enough" spectrum, and does so at costs that deter competitive entry and innovation, while encouraging further industry consolidation and market power.

***Figure 2*: ITU Spectrum Requirements by 2020 for High-Density Markets**

	1 network	**2 networks**	**3 networks**	**4 networks**	**5 networks**
Total Spectrum (MHz)	1720	1760	1980	2240	2500

Source: *ITU, Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced* (2006).

While there is no question that the existing commercial wireless business model – based on exclusive licensing, tower-based hub/spoke channelization, centralized infrastructure and metered billing – will need more exclusive-use spectrum in the short-run to meet mobile data demand, it should be equally clear that this model is not

sustainable longer term. As high-capacity wireline connections and a consumer's ability to purchase hybrid mobile devices becomes more prevalent, it is neither cost-effective nor pro-consumer to encourage a model in which most mobile data would be transported over expensive licensed airwaves, and through relatively distant carrier-provisioned infrastructure. Instead this data could and should flow short distances over unlicensed airwaves and consumer-provisioned backhaul. Recent experiments with femtocells and with services such as T-Mobile's *@Home* service – in which consumers pay an extra fee to have a share of their traffic routed by WiFi over their own wired Internet connection – reflect a growing realization that it will be most efficient to re-use spectrum down to the level of the personal cell, while utilizing consumer-provisioned wired connections for backhaul. As high-capacity wired connections become prevalent in both homes and businesses of all sizes, consumers will already be paying for backhaul that could be used to offload mobile data traffic at a point far closer to the user than the carrier infrastructure can be sited.

Wise policy choices will be necessary to facilitate – and not impede – a market evolution toward these more spectrum-efficient and cost-effective hybrid networks. In addition to easy and robust access to shared spectrum with varying propagation characteristics, the Commission's pending extension of the *Carterfone* consumer protection rules to mobile Internet access services will be critical to ensuring that consumers have the choice to use devices capable of automatically switching between multiple wireless networks based on the consumer's (and not the carrier's) preferences. We would expect that freed from carrier control, wireless device innovators will be motivated to offer consumers hybrid devices that can determine on the fly what connectivity is most economical for the consumer at a given time and place.

The commercial wireless provider, relying on a necessarily limited amount of exclusively-licensed spectrum, and shouldering the capital costs for centralized infrastructure, should increasingly confine their role to being the "quality of service provider" within a heterogeneous network controlled by consumers at the edge. Consumers will happily pay for remote coverage, for needed mobility (connectivity on the move), or for the transport of latency-sensitive applications. But they should not need

to pay an incumbent carrier or intermediary to send the bulk of their mobile data over the publicly-owned airwaves when there is a far more economic and spectrum-efficient alternative using local control over shared spectrum. Consumer welfare and economic efficiency will be enhanced by cognitive and cooperative devices that default where feasible to a local, very low-power network transmitting on unlicensed or other shared spectrum. Indeed, as more shared spectrum enables more cognitive and cooperative devices, mobile consumers can more readily hop to wireline transit on a P2P basis even when away from open WiFi ports.

Conclusion

Spectrum is an infinitely renewable resource, yet studies show that only a fraction of even prime frequencies below 3 GHz are in use, even in the largest cities, at any particular place or time. Federal agencies sit on hundreds of MHz that are unused in most areas; and many private licensees are warehousing spectrum, particularly in rural areas. Underutilized bands not in use in discrete geographic areas, or at particular times, altitudes or angles of reception, can be listed as available for opportunistic sharing (or delisted if a licensee builds out in a manner that makes shared access infeasible due to interference) – providing the necessary capacity to fuel pervasive wireless connectivity in a manner that promotes innovation and optimizes consumer choice and welfare.

Both H.R. 3125 and H.R. 3019 represent essential first steps toward freeing up access to the spectrum needed to achieve this vision. While more exclusively-licensed spectrum must be reassigned to expand on current carrier business models, it is both impractical and undesirable to fuel the nation's wireless future with the limited number of bands that can be cleared and auctioned. Pro-active policy choices that build on the concepts in these two bills will be necessary to facilitate – and not impede – a market evolution toward more spectrum-efficient and cost-effective "hybrid" wireless networks that empower consumer choice and encourage spectrum efficiency. Policies that unlock spectrum abundance will enable both pervasive connectivity and world-class innovation.

Thank you for this opportunity to testify today.

Mr. BOUCHER. Thank you, Mr. Calabrese.
Mr. Smith.

STATEMENT OF HON. GORDON H. SMITH

Mr. SMITH. Mr. Chairman, Ranking Member Stearns, members of this honorable committee, it is indeed a pleasure and a privilege for me to be before you to speak a few thoughts about spectrum on behalf of the National Association of Broadcasters.

First, NAB believes that any inventory spectrum should be comprehensive. Let us look at all the bands and all the services including the federal government bands and let us view how each service is using its existing spectrum. Second, our national priorities should recognize the value that free over-the-air broadcasting brings to every American. Broadcasting and broadband are not either/or propositions, as some suggest. I believe that is a false choice. Third, we should challenge all services to be efficient and innovative users of spectrum.

Through our recent transition to digital, broadcasting has become more efficient. With your help, the transition was a resounding success and the benefits are remarkable. In a digital world, viewers receive many new programming streams and a wide variety of content and local news in high definition. It would be shortsighted to stunt that growth and dampen what is an even brighter future for broadcasting. If broadcasting is limited or eliminated, consumer investment and expectations in DTV receivers would be stranded. Consumers spent an estimated $25 billion in HDTV receivers in 2009 alone. Millions of other Americans invested time, effort and funds on converter boxes, and the U.S. government spent $2 billion to help them with this. The broadcasters spent an additional $10 billion to make the transition.

For years, consumers have been promised that the digital upgrade would usher in a new era of high-quality television with new and more diverse programming, more channels and a host of new services all for free and over the air. If, as some advocate, that this all be done away with, consumers would realize none of these benefits. Through the DTV transition, broadcasters gave back 108 megahertz of spectrum. Broadcast television is the first wireless service to ever substantially reduce its spectrum use while providing an increase in services.

Then there is mobile DTV. This year, the television industry adopted a new mobile digital television standard, turning on the green light for manufacturing and implementation, and the results are nothing short of stunning. Members of the committee, this is a mobile TV. Right now it is playing a program from NBC. There are seven channels in the Washington, D.C., metropolitan area that are doing this. It is also a cell phone. And this combination of technologies is, I believe, the future of mobile wireless communications. It is not an exaggeration to say that you will soon be able to receive broadcast television signals on almost any device. This is an example. Soon your BlackBerry will be a TV. Your iPhone could be a TV. You name it, we are on the cusp of it, and to short-circuit it now it seems to me would be very unwise.

Broadcasting's ability—and this is very important to understand. Broadcasting's ability to serve one to many in small-bandwidth seg-

ments is unique among all services. At moments of national significance or tragedy when millions of Americans are seeking information, broadcasting is the most efficient delivery system. With each new viewers, broadcasters' use of spectrum becomes more efficient without any additional burden on spectrum. By contrast, with wireless broadband, each stream of content to every individual places an additional strain on the wireless network, clogging up the bandwidth, and there is more. For example, a company called Sesmi is working with broadcasters to provide a blended broadcast/broadband system. If you haven't seen this, Members, I urge you to do it. That system is more affordable, high quality and an alternative, a more affordable alternative to cable and satellite.

A comprehensive objective examination of spectrum allocation and usage is a worthwhile endeavor. Such an analysis if done forthrightly and without bias will demonstrate that broadcasters continue to be the effective custodians of our Nation's airwaves.

Many broadcast services have not been and cannot be efficiently replicated by broadband services. Broadcasters, for example, help to save lives through timely coverage of natural disasters and other emergencies, and by coordinating with local law enforcement officials via Amber Alerts, broadcasters have participated in the recovery of 492 abducted children.

Mr. BOUCHER. Mr. Smith, if you could wrap up, you are a bit beyond your time here.

Mr. SMITH. Let us not forget the concerns we all shared during the DTV transition. We spent a lot of time to get it right and we did it so that economically disadvantaged, the elderly, rural and ethnic minorities are not left out with access to critical news and information.

And finally, Mr. Chairman, if my statement is in the record, I think it is important that when you consider highest and best use and you put all of these public values in, the value of broadcasting is self-evident. Thank you, sir.

[The prepared statement of Mr. Smith follows:]

Hearing on H.R. 3125, the "Radio Spectrum Inventory Act," and

H.R. 3019, the "Spectrum Relocation Improvement Act of 2009"

United States House of Representatives

Subcommittee on Communications, Technology and the Internet

December 15, 2009

Statement of Senator Gordon H. Smith

President and Chief Executive Officer

National Association of Broadcasters

Good morning, Chairman Boucher, Ranking Member Stearns and members of the committee, and thank you for inviting me to testify today. My name is Gordon Smith, and I am President and CEO of the National Association of Broadcasters ("NAB"). NAB is a nonprofit trade association that advocates on behalf of thousands of local radio and television stations and broadcast networks before Congress, the Federal Communications Commission ("FCC") and other federal agencies, and the Courts.

I am grateful for the opportunity to speak with you today as you consider legislation that would require an inventory of radio spectrum bands managed by the National Telecommunications and Information Administration ("NTIA") and the FCC. NAB believes that a comprehensive inventory – including spectrum allocated for Federal government use – would serve the public interest. It would facilitate efforts to foster the longstanding policy goal of maximizing spectrum efficiency.

A complete inventory and analysis of spectrum usage also would inform the current debate over spectrum needs, and help policymakers to determine whether steps towards fostering greater spectrum efficiency – such as tightening service deployment deadlines for wireless licensees, or streamlining wireless licensing processes to get services to the public faster – are appropriate at this time. Additionally, this inventory will demonstrate the high efficiency and unparalleled public benefits of the use of spectrum for free, over-the-air broadcasting. Broadcast services are a critical part of a national communications infrastructure that includes wired and wireless broadband services, wired and wireless voice services, and non-broadcast audio and video services. Free, over-the-air television and radio broadcast stations provide valuable services to the American people. Our national priorities and public policies should

continue to recognize the value that both free, over-the-air broadcasting *and* broadband can bring to every American.

I. Introduction

The ultimate beneficiaries of sound spectrum management are consumers who rely upon services delivered over the spectrum resource. For more than eight decades, radio and television broadcasters have provided a free, over-the-air service to virtually every household in America, keeping local communities –your constituencies – informed and connected. Local broadcast stations provide a wealth of local news and public affairs programming, political information, vital emergency information and entertainment. Broadcasters provide unique community service (including billions of dollars annually of free air time for public service announcements and monies raised for charities, other local organizations and causes, and needy individuals). Broadcasting is synonymous with the public interest.

The recent transition to digital television ("DTV") highlights the benefits of sound spectrum management. Multi-billion dollar investments by broadcast television stations, equipment manufacturers, the government, and consumers have enabled the intensive use of each television station's 6 MHz channel to deliver a variety of high definition ("HD") and multicast programming, mobile DTV, and other ancillary and supplemental services — all while freeing up more than 100 MHz of spectrum for wireless broadband and other new commercial and public safety uses.

NAB recognizes that universal broadband also has the potential to generate substantial public interest benefits as a part of the communications ecosystem. Broadcasting and broadband are both valuable services that will continue to provide

significant benefits to the American people if appropriate principles guide public policy decisions. Broadcasting and universal broadband do not represent opposite choices or an "either-or" proposition for policymakers and the public.

II. Public Policy Should Promote the Availability of Both Broadband *and* Broadcast Services

In assessing the efficiency and value of a current use of spectrum, a premium should be placed on public policy goals that are served by that use. Broadcast television promotes core public interest goals though local journalism, timely and reliable provision of emergency information, educational programming and other valued local programming. Broadcast stations also generate significant economic activity in their local communities by, inter alia, hiring employees from the community (who then spend their wages and salaries in the community), by purchasing all manner of equipment, supplies and materials from local businesses, and by providing an outlet on which other local and regional businesses advertise in order to increase their own sales, profits and, ultimately, employment. Those who would assign arbitrary financial value to a reallocation (either in terms of the revenue that may be obtained at auction or the revenue that a new licensee may earn through sale of services over that spectrum) are asking policymakers to ignore the significant public interest value that free, over-the-air broadcast service provides. Such an approach is inconsistent with the statutory requirement that allocation decisions be dictated by public interest considerations.[1]

[1] *See* 47 U.S.C. § 303(c) (requiring that allocation decisions be based upon findings of "public interest, convenience, or necessity"). Moreover, the FCC is prohibited from considering amounts that may be raised at auction in making public interest findings about allocations. *See* 47 U.S.C. § 309(j)(7)(A) ("In making a decision ... to assign a band of frequencies to a use for which licenses or permits will be issued ... the Commission may not base a finding of public interest, convenience, and necessity on the expectation of Federal revenues from the use of a system of competitive bidding under this subsection.").

A. Innovation and Efficiency Drive Broadcast Operations

Over the past several decades, the nation's television broadcast service has made substantial advances in spectrum efficiency, all while continuing to provide a free, universal service that uniquely serves the local interests of the public. In the past, each television station delivered a single, analog programming stream over a 6 MHz channel. Today, broadcasters use the same 6 MHz channels to deliver multiple streams of programming, including in HD format. Broadcast television has gone from standard quality video and stereo sound to the highest quality widescreen theater quality pictures and multi-channel Dolby surround sound. The transmission standard for digital television provides wide-area coverage at a data rate of almost 20 Mbps within a 6 MHz channel, making it one of the most efficient transmission systems available for disseminating high bit-rate content to a wide audience. Broadcasters generate tremendous efficiencies through their ability to serve "one-to-many" in small bandwidth segments – efficiencies that cannot otherwise be achieved. Indeed, with each additional viewer, a broadcaster's use of spectrum becomes more efficient, because increasing the number of viewers places no additional incremental burden on the spectrum. Moreover, unlike many mobile services, each television station transmits over its entire spectrum allotment during all or virtually all of the day; there are not peaks and valleys in transmissions during which spectrum is unutilized or underutilized.

While the advances in quality and quantity of programming services represent a substantial gain in efficiency of spectrum use, broadcasters are poised to do even more with their existing spectrum assignments, offering new services like mobile DTV to complement existing programming streams. In October 2009, the Advanced Television

Systems Committee ("ATSC") announced the adoption of the A/153 ATSC Mobile DTV Standard, which will enable broadcasters to deliver mobile DTV products and services. Adoption of this standard was the culmination of three years of intensive research, development and testing. As ATSC explained in announcing adoption of the standard, "the ATSC Mobile DTV Standard will enable broadcasters to provide new compelling services to consumers using a wide array of wireless receiving devices including mobile phones, small handheld DTVs, laptop computers and in-vehicle entertainment systems."[2]

Broadcasters also are working with innovators to provide even better service to the public. For example, a new company called Sezmi is introducing a service that seamlessly blends over-the-air broadcast and broadband video options. Sezmi, which is selling its high-capacity set-top box in select markets today, plans a major roll-out within the next year. In addition to using over-the-air broadcast video, Sezmi has also negotiated arrangements with some local broadcasters to lease and aggregate spectrum in local markets, using that spectrum to deliver high-demand video product – product that might otherwise overwhelm a traditional IP network – to customers so that it can be played back at any time. Importantly, these services will be provided over stations' *existing* spectrum assignments, further increasing the efficiency of the nation's over-the-air television service. In addition, the Sezmi system makes broadband services available to users via an Internet connection, delivering niche content and enhancements to the program content delivered over-the-air. As an indicator perhaps for the wave of the future, the Sezmi system demonstrates the beginnings of the

[2] Press Release, *ATSC Adopts Mobile Digital TV Standard*, Oct. 16, 2009, *at* http://www.atsc.org/communications/press/2009-10-16-ATSC_approves_mobile_dtv.php. *See* Attachment A.

profound synergy of seamlessly integrating broadcast and broadband delivery mechanisms for a an overall richer consumer media experience.

In fact, efficiency gains in television broadcasting have been accompanied by a *reduction* in the total allocation of spectrum to broadcast television, most recently through reallocation of over 25 percent of spectrum (over 108 MHz) allocated to broadcasting at the conclusion of the DTV transition. Today, television broadcasting uses approximately 60 percent of the spectrum that it used in the 1970s,[3] yet has managed to provide a four-fold improvement in the audio and video quality of its service. With the conclusion of the DTV transition, broadcast television is the first wireless service ever to substantially reduce its spectrum use while providing additional services.

The efficiencies realized by broadcasting should be considered and acknowledged by policies governing spectrum management. Moreover, spectrum management policy should continue to recognize the value of new, innovative services being developed by broadcasters, and should not deprive the public of these services and/or force them to pay for similar services that may one day be offered by the wireless, satellite or cable industries.

B. Public Service Is Part of What Makes Broadcasting Unique Among Communications Services

[3] Spectrum accommodations in which broadcasters have participated include vacating of television channel 1, then of television channels 70 through 83, and most recently of television channels 52-69 and the ensuing repacking of digital channels into the core television spectrum below channel 52. In addition, broadcasters are vacating 35 MHz of spectrum in the 2 GHz band through digital conversion of Broadcast Auxiliary Service equipment. These and other steps have accommodated commercial wireless 4G networks, mobile satellite services, land mobile communications, broadband public safety networks, and low power television services, among others.

As local broadcasters have demonstrated on many occasions, stations serve the public interest by airing local and national news and public affairs programming and a variety of other programming that serves the needs and interests of their audiences, including sports, religious and other community-oriented programming. In addition to providing a mix of news, information and entertainment programming relevant to their local communities, television and radio broadcast stations also must meet a variety of other public interest obligations.[4] Through participation in the Emergency Alert System ("EAS") and additional coverage of natural disasters and other emergencies, broadcasters help save lives with extensive, timely emergency information. Coordination with local law enforcement via Amber Alerts has led to the recovery of 467 abducted children. No other communications service provides this tremendous level of service to communities across the country.

Unlike many commercial wireless services, in the television broadcast service, licensees already operate under a host of regulations to ensure that their use of the spectrum is fully utilized to maximize its total value. In the broadcasting context, the "total value" is not a strict financial measure, but rather is one that encompasses the broader public policy objectives such as universal service, local journalism and public safety. The rules designed to ensure maximization of the "value" of broadcast spectrum range from technical matters such as signal coverage requirements to substantive programming obligations, such as the requirement to air programming meeting the

[4] *See, e.g.*, 47 U.S.C. § 315(a) (requiring a station to offer equal opportunity to all candidates for a public office to present views, if station affords an opportunity to one such candidate); 47 C.F.R. § 73.1211 (regulating stations' broadcast of lottery information/advertisements); *id.* § 73.1212 (requiring identification of program sponsors); *id.* § 73.1216 (providing disclosure requirements for contests conducted by a station); *id.* § 73.3526(a) (requiring maintenance of a file available for public inspection); *id.* § 73.3526(e)(11)-(12) (requiring a quarterly report listing the station's programs providing significant treatment of community issues); *id.* § 73.671 (children's television programming requirements).

educational and information needs of children. Compliance with these requirements is taken into account at license renewal. Thus, in contrast to commercial wireless services,[5] the regulatory structure for broadcast television already is designed to maximize value of the spectrum resource.

Evaluation of the "value" of a given use of spectrum must also take into account investment in equipment and services provided over the band. In the context of television broadcasting, a significant amount of this value is in the form of investment by ordinary consumers. Consumers in 2009 have spent over $25 billion in HDTV receivers.[6] Additionally, consumers, with the support of a government subsidy, have spent billions of dollars converting their television equipment to digital, redeeming nearly than 35 million coupons for digital-to-analog converter boxes. Assuming an average price of $60 per converter box, this represents an investment of more than $2 billion in converter boxes alone — premised on the notion that consumers with these converter

[5] While some commercial wireless services are subject to construction deadlines or similar mandates intended to foster efficient use of spectrum, these obligations are considerably less stringent than those applied in the broadcast context. For example, in most wireless services, the buildout requirement is to provide one of the following within 5-10 years of the date of licensing: (i) substantial service (defined as "service that is sound, favorable, and substantially above a level of mediocre service that would barely warrant renewal"); *or* (ii) service to a specified percentage of the population in the licensee's geographic coverage area. A wireless licensee that does not expect to meet the applicable deadline may request an extension, 47 C.F.R. § 1.946(e), and/or seek a waiver of the buildout requirements, 47 C.F.R. § 1.925. Multi-year extensions affecting nearly all of the licensees in certain wireless services have been approved. *See Consolidated Request of the WCS Coalition for Limited Waiver of Construction Deadline for 132 WCS Licenses; Request of WCS Wireless, LLC for Limited Waiver of Construction Deadline for 16 WCS Licenses*, 21 FCC Rcd 14134 (2006) (extending construction deadlines by three years, until 2010); *Wireless Telecommunications Bureau Seeks Comment on Applications Filed by Licensees in the Local Multipoint Distribution Service (LMDS) Seeking Waivers Of Section 101.1011 of the Commission's Rules and Extensions of Time to Construct and Demonstrate Substantial Service*, 23 FCC Rcd 5894 (2008) (extending the LMDS construction deadline until 2012). By contrast, broadcast licensees must construct and be prepared to operate their stations and comply with applicable signal coverage obligations within a three-year window. 47 C.F.R. § 73.3598(a). Tolling of the construction period will not be approved unless the broadcaster can meet a heightened waiver standard (i.e., by demonstrating that an "act of God," pending litigation, or pending international coordination prevented completion of construction). 47 C.F.R. § 73.3598(b).

[6] *See, e.g.*, David Goetzl, *Big Picture: HDTV Sales on Upswing*, MEDIAPOST NEWS, Sept. 29, 2009, *available at*: http://www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=114483 (citing estimates of SNL Kagan).

boxes would continue to receive free, over-the-air television, including new multicast services. These investments by consumers are in addition to the many billions of dollars spent by local television stations in connection with the transition to digital television. Public policy should reject spectrum reallocation proposals that would strand substantial investments by consumers in receiving equipment and/or leave consumers without access to free broadcast service upon which they regularly rely.

III. To Promote Universal Broadband Availability and Adoption, Public Policy Should Encourage Efficient, Productive Use of Spectrum Already Allocated for Wireless Broadband and Also Should Promote Wired Alternatives

NAB has acknowledged the importance of broadband in a variety of contexts. We believe that broadcast operations and the expansion of broadband availability and adoption are by no means mutually exclusive. To the contrary, we have previously identified three key points policymakers should keep in mind when trying to promote broadband access while still preserving for the public the benefits of free, over-the-air broadcasting: (i) considering *all* frequencies that may be suitable for wireless broadband in developing an accurate assessment of spectrum suitable for broadband; (ii) prioritizing the efficient use of spectrum already allocated and suitable for wireless broadband; and (iii) maintaining an awareness of the limitations of wireless solutions as compared to wired solutions.[7]

As we explained in comments filed with the FCC, any bias in favor of using frequencies below 3.7 GHz for broadband will fail to generate an accurate assessment

[7] *See* Comments of the Association of Maximum Service Television and the National Association of Broadcasters in response to NBP Public Notice #6, GN Docket Nos. 09-47, 09-51, 09-137, DA 09-2100 (filed Oct. 23, 2009).

of available spectrum for broadband.[8] Indeed, the FCC has allocated spectrum for a variety of wireless services, including broadband applications, on frequencies above 3.7 GHz (*e.g.*, the unlicensed allocation in the 5.7 GHz band). Policymakers seeking solutions should consider *all* frequencies that may be suitable for wireless broadband based on their technical characteristics and other relevant factors. The spectrum inventory contemplated by the proposed legislation will facilitate these solutions.

Second, those seeking to promote universal broadband should seek to ensure the efficient use of spectrum already allocated and suitable for wireless broadband. In recent years, a significant amount of exclusively licensed spectrum has been repurposed in anticipation of the spectrum needs of the commercial wireless industry. Owing to a host of variables, many of these bands have only just begun to be put into use. Significant spectrum for broadband is available even if one were to accept the incorrect notion that wireless broadband deployment depends upon access to spectrum below 3.7 GHz. The following exclusively licensed spectrum bands below 3.7 GHz will provide for significant, new wireless broadband deployment by commercial providers in the coming years: (i) the lower 700 MHz band (48 MHz); (ii) the upper 700 MHz band (34 MHz); (iii) spectrum in the L-band (46 MHz), Big Leo (19 MHz) and 2 GHz (40 MHz) bands allocated for mobile satellite service ("MSS")/ancillary terrestrial component

[8] *See, FCC, Comment Sought on Spectrum for Broadband*, NBP Public Notice #6, GN Docket Nos. 09-47, 09-51, 09-137, DA 09-2100 (rel. Sept. 23, 2009) ("Notice"). In the Notice, the FCC characterized spectrum below 3.7 GHz as "prime spectrum bands." As discussed herein and in comments filed with the FCC, other spectrum also is appropriate for wireless broadband services and should be considered as part of efforts to enhance broadband deployment and adoption.

("ATC"); and (iv) the Advanced Wireless Service ("AWS") bands—AWS-1, 2, and 3 (130 MHz).[9]

Thus, a total of *more than 500 MHz of spectrum* already is allocated for wireless broadband services. Notably, this spectrum is in addition to the substantial amount of unlicensed and "licensed-lite" spectrum that has been made available for broadband. For example, in 2005 the FCC adopted rules to make nationwide licenses for wireless broadband available on a non-exclusive basis in the 3650-3700 MHz band.[10] That band, however, has yet to be put into intensive use for wireless broadband. An additional 109.5 MHz of spectrum that is suitable for wireless broadband is currently allocated for unlicensed use in bands below 3.7 GHz. In the nearby 5.7 GHz band, another 125 MHz of unlicensed spectrum is allocated and suitable for wireless broadband. Altogether, these unlicensed spectrum allocations provide 284 MHz of spectrum suitable for wireless broadband.[11] This is a total of *784 MHz* of licensed and unlicensed spectrum allocations suitable for wireless broadband. Moreover, this total does not include the spectrum that may become available as a result of the FCC's decision to allow the use of unlicensed devices in the television broadcast bands.[12] It also does not include another 30 MHz of spectrum licensed more than a decade ago in

[9] A chart describing some of the available spectrum for wireless broadband below 3.7 GHz is attached hereto. *See* Attachment B.

[10] *See Wireless Operations in the 3650-3700 MHz Band,* Report and Order and Memorandum Opinion and Order, 20 FCC Rcd 6502 (2005).

[11] The following bands are currently allocated for unlicensed or "licensed lite" operation: 902-928 MHz, 2400-2483.5 MHz, 3650-3700 MHz and 5700-5825 MHz.

[12] *See Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807 (2008).

the 2.3 GHz band, the Wireless Communications Service ("WCS"), which also is suitable for wireless broadband services.[13]

In addition to making use of spectrum that has recently been made available for wireless broadband, wireless licensees can add capacity for broadband by improving the technology, architecture and system design currently deployed over their legacy spectrum bands. History has shown that the deployment of more efficient technology has the potential to provide a meaningful increase in the capacity per unit of spectrum available to a wireless licensee. According to AT&T Inc., although having had until recently "only a fraction of spectrum available in other industrialized countries," commercial wireless providers in the U.S. "serve more customers and carry vastly more traffic" than providers in other countries.[14]

Despite the gains that the commercial wireless industry has made in spectrum efficiency over the years, it is clear that additional and substantial gains are possible.[15] A 2004 study sponsored by the National Science Foundation found that less than 20 percent of the frequency bands below 3 GHz were in use over the course of a business

[13] Licenses for WCS band (2305-2320 and 2345-2360 MHz) were awarded in 1997. *See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service*, Report and Order, 12 FCC Rcd 10785 (1997). Citing concerns about regulatory uncertainty over the operation of satellite digital audio radio service terrestrial repeaters in adjacent bands, several WCS licensees requested and obtained a three-year extension of the deadline to comply with the substantial service requirement. *See Consolidated Request of the WCS Coalition for Limited Waiver of Construction Deadline for 132 WCS Licenses; Request of WCS Wireless, LLC for Limited Waiver of Construction Deadline for 16 WCS Licenses*, 21 FCC Rcd 14134 (2006) (extending construction deadlines by three years, until 2010). Thus, the public has yet to realize any benefit from the licensing of this spectrum.

[14] *See, e.g.*, Comments of AT&T Inc., GN Docket Nos. 09-51, 09-157, at 78-79 (Sept. 30, 2009).

[15] The closed-architecture nature of most commercial wireless systems, in which the licensee has control both over the transmission and reception equipment, facilitates equipment-based gains in efficiency. In contrast, in open-architecture systems, such as broadcast television, the licensee (i.e., television station) has no control over the reception equipment (i.e., digital television receivers, digital-to-analog converter boxes) used by consumers.

day.[16] In addition to peaks and valleys in spectrum use throughout the day, wireless licensees in some cases do not serve the entire area covered by their licenses; this situation is especially prevalent in rural areas. Such practices may need to change to ensure that wireless licensees are making full use of the public's spectrum resource. In any event, given these efficiency concerns, it would be premature at best to increase the allocation of spectrum to commercial wireless uses by 300 percent over the current allocation, as some parties have recently suggested.[17] Targeting instead a 300 percent increase in efficiency of existing wireless spectrum use – which broadcasters already have achieved – would be a more appropriate exercise.[18]

Fixed wireless broadband access can be provided efficiently over higher-frequency spectrum, such as that widely available in the 5 GHz band and as high as the 70/80/90 GHz band. Because of their shorter propagation characteristics, these higher-frequency bands may be less desirable for some mobile applications or other services (like broadcasting) for which the location of receiving equipment is unknown and subject to change. Yet in the case of a fixed service, the location of both the transmitting antenna and the receiving antenna is known to the broadband provider — making it possible at all times to achieve line of sight between the two antennas. Moreover, these

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[16] *See* Comments of the New America Foundation et al., GN Docket No. 09-51, at i (June 8, 2009). Notably, broadcast television stations transmit across their entire 6 MHz channel allotments on a continuous basis; thus, broadcasters' spectrum assignments are not subject to the peaks and valleys that leave spectrum assigned to many wireless services underutilized at points in the day.

[17] *See, e.g.*, Comments of CTIA - The Wireless Association, GN Docket Nos. 09-175, 09-51, at 73 (Sept. 30, 2009) (asserting that, in addition to the approximately 450 MHz of spectrum already allocated to terrestrial wireless services, the U.S. government should "launch an effort to identify and allocate at least 800 MHz of additional spectrum for licensed commercial wireless use within the next six years").

[18] The recently-concluded transition to digital television also highlights the benefits of investing in spectral efficiency. Through the multi-billion dollar transition to digital television, broadcasters increased throughput over each television station's 6 MHz channel by 400 or 500 percent. These gains in efficiency have enabled broadcasters to launch, among other new services, a new mobile DTV service. At the same time, broadcasters decreased by 25 percent their use of spectrum.

shorter propagation characteristics allow for more efficient cell sites and spectrum re-use.

Finally, while wireless platforms clearly have a role in the national broadband plan, they should not be viewed as the sole – or even the primary – platforms for providing broadband throughout the nation. Wireline methods of delivering broadband access, such as fiber to the home, are not subject to the throughput limitations that will naturally affect wireless broadband systems. In evaluating the best possible means to increase broadband availability and adoption, policymakers should also utilize wireline service.

IV. Spectrum in the Broadcast Band Can Foster Rural Broadband Deployment

As NAB has repeatedly advocated, use of "white spaces" spectrum between television channels for fixed licensed broadband in rural areas is a way to improve broadband access.[19] If engineered properly, the white spaces presumably could have a role as well for backhaul in these areas. Because the broadcast bands are used less intensively in rural markets, with appropriate technical protections fixed broadband services can operate in this spectrum without undermining consumers' access to free, over-the-air digital television or new mobile DTV services.[20] Other parties that have addressed white-space use in connection with the FCC's National Broadband Plan have

[19] *See, e.g.*, Joint Reply Comments of MSTV and NAB, ET Docket Nos. 04-186 and 02-380, at 5 (March 2, 2007) (supporting the introduction of fixed devices into the TV white spaces to "provide new broadband services, especially to rural and underserved areas of the United States"); Letter from David Donovan, MSTV and Jane Mago, NAB, GN Docket No. 09-51 (July 21, 2009).

[20] These protections include a prohibition on operation in the channels immediately adjacent to an occupied television channel (the "first adjacent channels"). *See Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd 16807, 16812 ¶ 10 (2008).

noted its utility in rural areas.[21] The Canadian government has likewise authorized licensed use of television spectrum for broadband in "rural and remote" areas. That decision similarly reflects the fact that, unlike in urban and suburban areas, in rural areas there is typically sufficient white-space spectrum for fixed broadband use, including for backhaul purposes.[22]

Aside from the many technical advantages of authorizing licensed use of television spectrum for broadband in rural/remote areas, there is also a practical advantage in that it can bring a solution to market very quickly. Proposals involving reallocation or repacking of broadcast and/or other spectrum could involve years of administrative rulemaking activity to determine exactly how specific bands should be used, the establishment of service rules for various bands, adoption of relocation rules and procedures and eventually an auction. Completion of an auction is only the beginning of yet a new set of administrative processes including FCC review of "long form" applications to evaluate the qualifications of winning bidders, collection of payments and then license grant. This final step only means that Americans may receive new or expanded services several years down the road, because FCC rules generally only require wireless licensees to offer services to portions of their coverage areas within five or ten years of license grant.[23] Accordingly, if a near-term solution to

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[21] *See, e.g.*, Comments of Public Knowledge, Media Access Project, the New America Foundation, and U.S. PIRG, GN Docket No. 09-51, at 32 (June 8, 2009) ("Rural areas would have more white spaces compared to urban regions due to presence of fewer broadcasting channels there"); Comments of Wireless Communications Association International, GN Docket No. 09-51, at 47 (June 8, 2009).

[22] *See* Interim Technical Guidelines for Remote Rural Broadband Systems Operating in the Band 512-698 MHz (TV Channels 21-51), Industry Canada (rel. March 2007).

[23] *See, e.g.*, 47 C.F.R. § 22.503 (within five years of license grant, paging licensees must construct and operate facilities covering two-thirds of the population in their geographic service areas or demonstrate substantial service); 47 C.F.R. § 24.103 (within 10 years of license grant, nationwide narrowband PCS licensees must construct base stations covering a specified geographic area, serve 75 percent of the U.S.

the lack of broadband services in rural areas is desired, policymakers should pursue solutions that can and will be implemented in a timely manner.

V. Conclusion

Congress is appropriately interested in ensuring efficiency in the way that the nation's public airwaves are allocated, licensed and utilized. A comprehensive, objective examination of spectrum allocation and usage is a worthwhile endeavor that could go a long way towards promoting the efficient use of spectrum. Such an analysis will demonstrate that broadcasters continue to be efficient custodians of a segment of our nation's airwaves. Public policies should reflect that the unique, locally-oriented services provided by broadcasters are a critical component of our nation's communications infrastructure. Broadcasters are continually innovating and expanding the kinds of programming and services available to viewers. The value that broadcasting has brought to the American people for decades should continue to complement other spectrum-based offerings, including broadband. Spectrum management policies should encourage wireless licensees to make efficient and productive use of spectrum already allocated and assigned.

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population, or demonstrate substantial service); 47 C.F.R. § 24.203 (within 10 years of license grant, broadband PCS licensees holding 30 MHz blocks must operate with a signal level sufficient to provide adequate service to at least two-thirds of the population in their licensed area or demonstrate substantial service); 47 C.F.R. § 101.1011 (within 10 years of license grant, local multipoint distribution service licensees must demonstrate substantial service). If an extension of the construction period is not granted and construction deadlines are not met by a licensee, FCC rules provide that the licensee's authorization automatically terminates. *See, e.g.,* 47 C.F.R. § 1.946(c).

ATTACHMENT A

a t s c

Advanced Television Systems Committee

FOR IMMEDIATE RELEASE

ATSC ADOPTS MOBILE DIGITAL TV STANDARD

WASHINGTON, Oct. 16, 2009 – The Advanced Television Systems Committee (ATSC) is pleased to announce the approval of *A/153 ATSC Mobile DTV Standard*. The ballot, tallied at midnight Oct. 15, was approved with overwhelming support by the full ATSC membership.

The ATSC Mobile DTV Standard defines the technical specifications necessary for broadcasters to provide new services to mobile and handheld devices using their digital television (DTV) transmissions. The new services for mobile and handheld devices are carried along with current DTV services without any adverse impact on legacy receiving equipment. ATSC Mobile DTV was developed to support a variety of services including free (advertiser-supported) television and interactive services delivered in real-time, subscription-based TV, and file-based content download for playback at a later time. The standard can also be used for transmission of new data broadcasting services.

"Development and adoption of the ATSC Mobile DTV Standard is a major milestone in the ongoing evolution of digital television," said ATSC President Mark Richer. "We have been fortunate to have strong and active industry support, including thousands of person-hours of technical volunteers, for this work which enabled us to develop the standard in an efficient manner."

The ATSC Mobile DTV Standard will enable broadcasters to provide new compelling services to consumers utilizing a wide array of wireless receiving devices including mobile phones, small handheld DTVs, laptop computers and in-vehicle entertainment systems.

Gary Shapiro, President and CEO of the Consumer Electronics Association, said, "As a founding ATSC member, CEA congratulates ATSC on achieving this new standard, which will help chipmakers and equipment manufacturers proceed with product development and deployment. With the successful digital television transition now behind us, the ATSC Mobile DTV standard gives broadcasters an opportunity to provide consumers with the next generation of compelling over-the-air content."

"This milestone ushers in the new era of digital television broadcasting, giving local TV stations and networks new opportunities to reach viewers on the go," said Paul Karpowicz, NAB Television Board Chairman and President of Meredith Broadcast Group. "This will introduce the power of local broadcasting to a new generation of viewers and provide all-important emergency alert, local news and other programming to consumers across the nation."

ATSC Chairman Glenn Reitmeier added: "On behalf of the ATSC Board of Directors, I would like to congratulate all of the ATSC member companies that contributed to this major achievement. The ATSC Mobile DTV standard is flexible and robust, enabling a range of services business models that create new opportunities for broadcasters, device makers and consumers. It is particularly noteworthy that ATSC Mobile utilizes Internet Protocol (IP), which will enable broadcast services to be easily integrated with wireless broadband consumer devices and applications, further reinforcing the significant role of terrestrial television broadcasting in the media landscape for decades to come."

ATSC Mobile DTV is built around a highly robust transmission system based on Vestigial Side Band (VSB) modulation, with enhanced error correction and other techniques to improve robustness and reduce power consumption in portable receivers, coupled with a flexible and extensible Internet Protocol (IP) based transport system, efficient MPEG AVC (ISO/IEC 14496-10 or ITU H.264) video, and HE AAC v2 audio (ISO/IEC 14496-3) coding. ATSC Mobile DTV services

are carried in existing digital broadcast channels along with current DTV services without any adverse impact on legacy receiving equipment.

In addition to live television, the new ATSC Mobile DTV standard provides a flexible *application framework* to enable new receiver capabilities. Receivers that make use of an optional Internet connection will enable new interactive television services, ranging from audience measurement and simple viewer voting to the integration of Internet-based applications and transactions with television content.

Formal development of the ATSC Mobile DTV system began in May 2007 with the issuance of a request for Proposals (RFP). The new standard document will be available online at http://www.atsc.org/standards/

The Advanced Television Systems Committee *is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries. ATSC creates and fosters implementation of voluntary Standards and Recommended Practices to advance terrestrial digital television broadcasting, and to facilitate interoperability with other media.*

– END –

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ATTACHMENT B

The following chart depicts the exclusively licensed spectrum bands below 3.7 GHz that will provide for significant, new wireless broadband deployment by commercial providers in the coming years.

Band (MHz)	Amount (MHz)	Description
698-746	48	Lower 700 MHz band made available by completion of DTV transition on June 12, 2009
746-763, 776-793, 805-806	34	Upper 700 MHz band made available by completion of DTV transition on June 12, 2009
1525-1544, 1545-1559 / 1626.5-1645.5, 1646.5-1660.5	46	L-band allocated for MSS/ATC
1610-1617 / 2483.5-2495	19	Big LEO band allocated for MSS/ATC
1710-1755 / 2210-2165	90	AWS-1 band being made available by relocation of federal government licensees
1915-1920/1995-2000 2020-2025/2175-2180	20	AWS-2 band, being made available in part by relocation of broadcast auxiliary service
2000-2020 / 2180-2200	40	2 GHz band allocated for MSS/ATC, being made available in part by relocation of broadcast auxiliary service
2155-2175	20	AWS-3 band awaiting service rules and auction
2500-2690	190	BRS/EBS band made available by repurposing of ITFS/MMDS service[1]
TOTAL	**507**	

[1] Clearwire Corp. has initiated service in this band, but roll-out has been limited thus far to approximately two dozen markets.

Mr. BOUCHER. Thank you very much, Mr. Smith.
Dr. Johnson.

STATEMENT OF RAY O. JOHNSON

Mr. JOHNSON. Chairman Boucher, Ranking Member Stearns and members of this subcommittee, good morning and thank you for inviting Lockheed Martin Corporation to participate in today's hearing on the Radio Spectrum Inventory Act. My name is Dr. Ray Johnson and I serve as Lockheed Martin's senior vice president and chief technology officer. My role in the corporation provides me with a broad perspective of important spectrum issues relevant to the discussion today. I appreciate the opportunity to contribute and I am honored to offer input that may help inform your consideration of these important policy matters.

Lockheed Martin is a global security company that employees approximately 140,000 people in all 50 States. We are principally engaged in the research, design, development, manufacturing, integration and sustainment of advanced technology systems, products and services and most of these systems and solutions depend on access to the spectrum that we are discussing. Our customers include a broad array of agencies both military and civil for whom we support diverse critical security missions both at home and abroad. At any given time, Lockheed Martin Corporation holds approximately 400 FCC authorizations for a variety of uses including experimental licenses that enable the testing of new technologies as well as new applications being applied to existing technologies.

As a general matter, spectrum scarcity is not a problem that is unique to FCC licensees. Based on our understanding, federal government users are experiencing the same pressure as they are required to meet increasing demands of their critical roles and missions. Therefore, it is an important balance that H.R. 3125 achieves by requiring an inventory of both federal and non-federal spectrum resources to be conducted by the FCC and the NTIA. Although through our own activities in developing advanced systems and solutions to meet many federal government needs, we see growth in requirements in terms of access to bandwidth-intensive applications whether that is video streaming from an unmanned vehicle or surveillance from a high-altitude airship.

Lockheed Martin endorses the enactment of H.R. 3125, the Radio Spectrum Inventory Act. We do, however, have some concerns with the bill as it was introduced and respectfully suggest that the bill be modified to reflect the following issues.

First, I note that the stated purpose of H.R. 3125 is to promote spectrum efficiency. While the bill does not explicitly require that NTIA and FCC conduct an efficiency analysis of spectral usage, the proposed section 119(a)(1)(E) as added by the bill steers the agencies in that direction. However, there is no single metric that spans all communications and non-communications uses of the spectrum, which can be used for point of comparison. The intensity-of-use metric is not correlated with effectiveness or efficiency for many spectral users. Moreover, efficiency improvements should not be equated to the reduction in bandwidth utilized. Measuring spectrum efficiency using as a proxy the price entities are willing to pay for a license is also inappropriate. Many critical spectrum

users deliver tremendous value to our country most importantly to our national and homeland security but do not directly generate revenues.

Second, we are concerned that the bill would inadvertently require FCC and the NTIA to disclose sensitive information that should not be disclosed. This disclosure does not only impact the federal government but also impacts some FCC licensees like Lockheed Martin. We agree with the Administration's stated concern and note that from any inventory security perspective, it is very important to recognize that the release of individual unclassified data points can result in sensitive information being improperly disclosed when viewed more as an aggregate.

Third, I would like to raise a concern to the subcommittee regarding the possible misinterpretation of the legislation in two ways. One is the potential inadvertent message that it sends to our allies in the international community given the scope of the frequencies being inventoried and the provision requiring recommendations for relocation. The Department of Defense and the defense industry have worked hard to achieve an international spectrum harmonization to support allied interoperability. The other concern is the requirement for annual review of spectrum. This review can create an impression of volatility and instability in spectrum allocations, thus impacting long-term research and development, acquisition and the deployment of new systems and solutions. Suggestions of instability in spectrum access could result in a chilling effect in the long-term technology investments.

Finally, we have identified a few technical issues with the drafting of the bill that we will submit separately to the staff.

While I am here today to address H.R. 3125, I would like to note that we do have some concerns with H.R. 3019 as well and we would be happy to offer a follow-up discussion with the subcommittee.

Mr. Chairman, I appreciate having the opportunity to testify. H.R. 3125 is a good start and Lockheed Martin commends you and the other cosponsors for identifying the need for spectrum inventory and for taking the initiative to draft legislation to address this issue. We hope that you will agree with our suggestions to improve the bill and we look forward to working with you and the committee staff throughout the legislation process. I am happy to answer any questions that you may have.

[The prepared statement of Mr. Johnson follows:]

Testimony of Dr. Ray O. Johnson
Senior Vice President and Chief Technology Officer
Lockheed Martin Corporation

December 15, 2009

Chairman Boucher, Ranking Member Stearns, and members of this subcommittee, good morning and thank you for inviting Lockheed Martin Corporation to participate in today's hearing on the Radio Spectrum Inventory Act. My name is Dr. Ray Johnson, and I serve as Lockheed Martin's Senior Vice President and Chief Technology Officer. My role in the corporation provides me with a broad perspective of important spectrum issues relevant to the discussion today. I appreciate the opportunity to contribute, and I am honored to offer input that may help inform your consideration of these important policy matters.

Lockheed Martin is a global security company that employs approximately 140,000 people, and is principally engaged in the research, design, development, manufacture, integration, and sustaining of advanced technology systems, products, and services. Most of these systems and solutions depend on access to the spectrum. Our customers include a broad array of agencies, both military and civil, for whom we support diverse critical security missions, both at home and abroad. At any given time, Lockheed Martin holds approximately 400 FCC authorizations for a variety of uses, including experimental licenses that enable the testing of new technologies, as well as new applications for existing technologies.

As a general matter, spectrum scarcity is not a problem that is unique to FCC licensees. Based on our understanding, some Federal Government users are experiencing the same pressure as they are required to meet the increasing demands of their critical roles and missions, and to accommodate the technologies needed to fulfill these demands. Therefore, it is an important balance that H.R. 3125 achieves by requiring an inventory across both federal and non-federal spectrum resources to be conducted by the individual agencies, FCC, and NTIA.

Through our own activities in developing advanced systems and solutions to meet many Federal Government needs, we see a growth in requirements in terms of access to bandwidth-intensive applications – whether video streaming from an unmanned vehicle or surveillance from a high altitude airship. With respect to unmanned aerial systems (UAS) alone, there has been a 25-fold increase in their use since 2001; the full motion video feeds from these UAS are greatly increasing bandwidth demand for both live operations and training conducted from and within the Continental United States (CONUS). As the Subcommittee members may know, many of the large UAS currently in operation in Afghanistan and Iraq are being operated and controlled from CENTCOM in Florida.

Lockheed Martin is also in the process of conducting a communication needs analysis for 2010 operations in Afghanistan. The upcoming "surge" of U.S. forces alone will demand additional resources, which we believe will require both additional US Department of Defense spectrum resources and more intelligent management of all resources though use of such techniques such as Frequency and/or Time Division multiplexing of users at central hubs. As the requirements expand, it is critical that our soldiers are able to train as

they are expected to fight, and fight as they were trained – with access to the full complement of equipment, networks, and other tools necessary for them to succeed in their mission. Again, these are drivers for the Department of Defense to continue to seek solutions that allow it to meet its operational requirements within existing spectrum resources.

In an effort to develop ways to meet the need for these bandwidth-intensive applications, DOD and industry are working on tools and techniques to address spectrum access challenges by allowing more dynamic, flexible, and autonomous spectrum access. These capabilities will enable wireless devices to dynamically adapt their spectrum access according to criteria such as policy constraints, spectrum availability, propagation environment, and application performance requirements. New techniques that may enhance opportunities for sharing between federal and non-federal users, such as "dynamic spectrum access", are still maturing, and they will require the development of a new spectrum governance process to ensure that all authorized users of the shared spectrum are protected, as agreed. In terms of tools to address this issue, the Coalition Joint Spectrum Management Planning Tool (CJSMPT) is just one facet of DOD's efforts to improve its spectrum management capabilities, precisely to gain better efficiency and effectiveness in the use of this critical resource. CJSMPT, which Lockheed Martin developed with Department of Defense funding, is in response to the increasing operational congestion and limitations faced by our warfighters today, while simultaneously improving our ability to deconflict Electronic Warfare and communications spectrum requirements. CJSMPT is Increment 1 of GEMSIS (Global Electromagnetic Spectrum Information System), a DISA program of record for providing

end-to-end spectrum management capabilities and services supporting the needs of the Department of Defense and the warfighter.

Lockheed Martin is also developing new global communications analysis and ISR (Intelligence, Surveillance, and Reconnaissance) tools enveloping the C4ISR mission environment. This toolset will soon be capable of rapidly diagnosing mission needs and of identifying optimal configurations. Such analyses are not only important to the successes in current overseas missions, but may also educate policy makers and enable them to avoid inadvertently limiting critical spectrum access for both training within, and operational activities from, CONUS.

In terms of technologies, Lockheed Martin is the prime contractor on a DOD satellite system, Mobile User Objective System ("MUOS"), that will implement this type of technology in the UHF band (225-400 MHz band, which is the primary band used for military tactical communications today) by using radios capable of detecting the presence of other users, and consequently transmitting in a manner that mitigates interference with other uses as well as suppressing the impact of interference from those users. Assuming success is demonstrated in this broader innovation, this capability could result in increased access to spectrum in near-real time between and among federal users, thus improving the utilization of spectrum, including perhaps the commercial spectrum.

Lockheed Martin also suggests that the Federal Government's investment in spectrum-based technologies and applications has produced a series of the most important wireless innovations in our nation's history, pioneering many of the innovations that now serve as the foundation of the commercial wireless industry, including spread spectrum communications, satellite video and data, RFID, and the GPS applications industry.

Moreover, cutting edge DOD research & development has not only had a positive impact on the downstream U.S. commercial industry, it also enables continued American leadership in global defense exports. According to the Aerospace Industries Association, the aerospace and defense sector was the largest net positive contributor to the US balance of trade, logging a $57 Billion surplus in 2008, with U.S. military aircraft representing a $54.7 Billon export market; and, in 2007, U.S. defense exports alone constituted a $25 billion market. This segment reflected the gradual rise in aircraft research and development, aftermarket labor and materials, and UAV production and support. For aircraft production, fighter planes are responsible for the largest share of revenues, followed by helicopters and military transports. C4ISR networks and systems to enhance allied interoperability are predicted to be the most in demand. Retaining this leadership position is vital to both our economic and national security - it translates into retaining highly skilled jobs at home and ensuring that the US and Allies have the best tools at their disposal to confront today's global security challenges at home and abroad. Thus, it is in our national interest to ensure that the increasing needs of ALL users of spectrum – both federal and commercial – be understood and accommodated to enable the full range of innovation, societal, and security gains.

Lockheed Martin endorses the enactment of H.R. 3125, the "Radio Spectrum Inventory Act." We do, however, have some concerns with the bill as it was introduced, and respectfully suggest that the bill be modified to reflect the following issues.

First, I note that the stated purpose of H.R. 3125 is to promote spectrum efficiency. While the bill does not explicitly require that NTIA and the FCC conduct an efficiency analysis of spectrum usage, the proposed § 119(a)(1)(E) as added by the bill steers the agencies in

that direction. However, there is no single metric that spans across all communications and non-communications uses of spectrum, which can be used as a point of comparison among all of the disparate uses of spectrum. A simple intensity-of-use measure which does not differentiate between types of uses would improperly conclude that essential wireless applications that do not involve constant or intense transmission are somehow inefficient. I would also note that efficiency improvements should not be equated to the reduction of bandwidth utilized – it can also entail the use of technologies that can more effectively share spectrum or serve as better neighbors to adjacent spectrum users. On this general point, it is also critical to recognize and reflect that a highly effective spectrum-dependent system may not transmit at all, or only infrequently. An intensity-of-use metric is not correlated with effectiveness or efficiency for many spectrum uses. Such a metric is inappropriate for public safety communications systems, which require a guarantee of availability and reliability that often can only be achieved through dedicating spectrum resources even if those resources are not constantly in use. Measuring spectrum efficiency using as a proxy the price entities are willing to pay for a license is also inappropriate. Many critical spectrum users deliver tremendous value to our country – most importantly our national and homeland security – but do not directly generate revenues. There are also internal business applications that do not generate revenue, but rather decrease production or distribution costs, or provide for employees' safety and security.

Second, we are concerned that the bill would inadvertently require FCC and the NTIA to disclose sensitive information that should not be disclosed. This disclosure does not only impact the Federal Government, but it also impacts some FCC licensees. For example,

Lockheed Martin holds experimental authorizations for specific testing in certain frequency bands which are classified. Maintaining the integrity of the classified license is critical. We note that the Administration has expressed to the Subcommittee its own concerns regarding the protection of sensitive information as well. We agree with the stated concern, and note that from an information security management perspective, it is very important to recognize that the release of individual unclassified data points can result in sensitive information being improperly disclosed when viewed in the aggregate.

Third, I would like to raise a concern to the Subcommittee regarding the possible misinterpretation of the legislation in two ways. One is the potential inadvertent message to our allies in the international community, given the scope of the frequencies being inventoried and the provision requiring recommendations for reallocation. The Department of Defense and the defense industry have worked hard to promote, achieve, and maintain international spectrum harmonization to support allied interoperability of equipment, technologies, and capabilities. For example, the 225-400 MHz band is defined by NTIA as a "critical military radio communications band that has been preserved for military operations by the North Atlantic Treaty Organization (NATO), within individual NATO member countries", and outside NATO among allied nations in the European Cooperation Partner nations and the Partners for Peace nations. The other concern is the requirement for an annual review of spectrum – this review may create an impression of volatility and instability in spectrum allocations, thus impacting long-term research and development, acquisition, and deployment of new systems and solutions. Advanced technology projects require significant lead-times for research, development, testing, and deployment. Moreover, analogous with the level of investment required for

these systems, the expected operational lifetimes of these systems are measured in decades, not years. Therefore, suggestions of instability in spectrum access could result in a chilling effect on long term technology investments that many U.S. industries, as well government agencies, rely on.

Finally, we have identified a few technical issues with the drafting of the bill which we will submit separately to the staff.

Mr. Chairman, I appreciate having this opportunity to testify. H.R. 3125 is a good start, and Lockheed Martin commends you and the other co-sponsors for identifying the need for a spectrum inventory and for taking the initiative to draft legislation to address the issue. We hope that you will agree that our suggestions will improve the bill, and we look forward to working with you and the Committee staff throughout the legislative process.

I will be happy to answer any questions that you may have.

Mr. BOUCHER. Thank you very much, Dr. Johnson.
Mr. Stroup.

STATEMENT OF THOMAS STROUP

Mr. STROUP. Good morning, Mr. Chairman and members of the subcommittee. Thank you for this opportunity to testify on the pending spectrum inventory and relocation bills. My testimony this morning will focus on two main points.

First, to determine how and if spectrum resources are being used efficiently, a spectrum inventory and spectrum database must include data on actual spectrum utilization. Second, until a database is compiled and analyzed, we caution against jumping to any conclusions as to what is next for particular frequency bands because new technology presents spectrum access alternatives that have not existed until now.

I have been involved in the wireless industry for over 25 years. In the early 1990s, I was president of the Personal Communications Industry Association, which helped the nascent wireless industry win the reallocation of fixed microwave spectrum for new personal communications services which were the source of competition and innovation that were referenced by Congressman Markey. Then I founded and ran a company called Columbia Spectrum Management to facilitate and negotiate the relocation of fixed microwave incumbents in FCS bands for the auction winners.

Since March of this year, I have been the CEO of Shared Spectrum Company. Shared Spectrum is a small technology company located in Vienna, Virginia. Since the founding of the company in 2000, Dr. Mark McHenry has been conducting spectrum occupancy studies to document the untapped potential of many unused frequency bands. Attached to my written testimony is a list of our public studies to date. The video monitors in the room are also displaying some sample results of our measurements. These studies include measurements from New York City, Chicago and Washington, D.C., during periods of anticipated high radio traffic. They indicate that less than a third of the allocated radio spectrum was being used at any given time.

To take advantage of this empty spectrum capacity, SSC pioneered dynamic spectrum access, or DSA, technology. DSA takes advantage of the empty spectrum capacity by adapting to the spectral environment and changing transmission or reception parameters. This allows for more-efficient wireless communications without interfering or requiring the dislocation of legacy systems using the same bands. The company developed DSA over the past 9 years for several military projects, and this technology is now being implemented in several military radio systems. We are also exploring several commercial applications including new cost-effective rural wireless broadband systems that can access preferred lower frequencies.

As has been pointed out throughout the hearing, the demand for spectrum across all sectors and markets is substantially increasing. We agree that the necessary first step in confronting the spectrum dilemma is to conduct a comprehensive study of the Nation's spectrum resources. We are therefore pleased to support the Radio Spectrum Inventory Act. The bill would provide guidance to the

FCC and NTIA to work together to create a database of spectrum allocations and assignments. However, it is also important to supplement this data with information regarding the actual use of the airwaves. Virtually every service to which spectrum is allocated can show a legitimate need for the spectrum, and most incumbents will argue that they make effective use of their allocations. Thus, compiling a database of spectrum assignments will be interesting but that alone will fail to show how much or even if the spectrum is actually being utilized.

Until such a database is compiled and available, we caution against any presupposition as to what is next for a particular radio band. To assume that the next step following the initial inventory would be a traditional reallocation proceeding would amount to a plan for years and years of fighting among entrenched interests that have no notion or incentive to have their existing spectrum rights diminished no matter how little they are utilized. This is based on my personal experience where it took 6 years for the PCS spectrum to be reallocated and that looked like the fast track compared to more reallocation efforts that typically have dragged for more than 10 years.

As the subcommittee moves forward, we believe that it is also important to recognize that new technologies like DSA enable more-efficient use of existing spectrum allocations and can create new opportunities for sharing spectrum with the existing services in underutilized bands. The interest in finding additional spectrum for wireless broadband services is more likely to be accommodated in a timely manner if a flexible access framework is established that includes DSA-enabled sharing with government and non-government incumbents. Such a framework would focus on multipurposing legacy bands with flexible overlay rights and responsibilities. Approaches that involve repurposing certain bands and relocating incumbents would be too difficult, too costly, too time consuming, and in light of new technology, unnecessary.

Instead, a better policy would build upon the approach taken when the PCS bands were made available in 1995. The licenses that were auctioned were subject to a non-interference requirement with the existing microwave incumbents. While most of those licensees ultimately were relocated to new systems on other frequencies, the advances made in DSA and cognitive radio technology now provide the ability to coexist with legacy systems that was not available at that time.

Thank you again for this opportunity to testify. I look forward to your questions.

[The prepared statement of Mr. Stroup follows:]

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Testimony of Thomas Stroup
Chief Executive Officer, Shared Spectrum Company
before the
House Energy and Commerce
Subcommittee on Communications, Technology and the Internet

December 15, 2009

Good morning, Chairman Boucher, Ranking Member Sterns, and members of the Subcommittee. Thank you for this opportunity to testify on the pending spectrum inventory and spectrum relocation bills. My testimony this morning will focus on two main points: First, in order to gain better knowledge of how and if valuable spectrum resources are being used effectively and efficiently, regulatory and legislative efforts to develop a comprehensive inventory and spectrum database must include data on actual spectrum utilization or occupancy. Second, until such a database is compiled, publicly available and fully analyzed, we caution against jumping to any conclusions as to what's next for particular frequency bands – whether such next steps would be the potential reallocation for broadband services, designating more bands for unlicensed devices or some other regulatory actions – because ongoing technological developments present spectrum access alternatives that have not existed until now.

Before getting into the heart of my testimony this morning, I would first like to provide the subcommittee some information about my background and a brief introduction to Shared Spectrum Company. I have been involved in the wireless industry for over 25 years, going back to the days when cellular telephone licenses were subject to comparative hearings at the FCC. In the early 90s, I was President of the Personal Communications Industry Association (PCIA) which helped the nascent wireless industry win the reallocation of fixed microwave spectrum for

new Personal Communications Services (PCS). Then, I founded and ran a company called Columbia Spectrum Management to facilitate and negotiate the relocation of microwave incumbents in the PCS bands on behalf of the new auction winners. I am also a co-Founder and the CEO of CSM Wireless, which holds mobile wireless licenses in six markets, and served on the board of the Virginia Center for Innovative Technology. Since March of this year, I have been the CEO of Shared Spectrum Company or "SSC".

SSC is a small technology company located in Vienna, Virginia and founded by Dr. Mark McHenry in 2000. After leaving the Defense Advanced Research Agency (DARPA), Dr. McHenry began conducting spectrum occupancy studies in order to document the untapped potential of many unused frequency bands. These studies indicated that less than a third of the allocated radio spectrum was being used at any given time. While the studies showed that the utilization of each band varies, Dr. McHenry discovered that a significant amount of wireless spectrum should be available for more robust wireless applications and secondary users; that is if technology and regulations allowed such users to safely access the vacant bandwidth. So, Dr. McHenry and SSC pioneered innovative dynamic spectrum access (DSA) technology, which takes advantage of the empty spectrum capacity by dynamically adapting to the spectral environment and changing transmission or reception parameters on the fly. This allows for more efficient wireless communications for new commercial and non-commercial wireless systems without causing harmful interference to or requiring the dislocation of legacy systems using the same bands.

The company developed DSA over the past nine years for several military projects – building prototype devices, developing software and conducting field tests. This technology is now being deployed in several military radio systems and we are exploring several commercial

applications including new, cost-effective rural wireless broadband systems that can access preferred, lower frequencies.

At the same time DSA was being developed and tested, the regulatory environment at the FCC was evolving favorably to support DSA-enabled "smart" or "cognitive" radios through flexible service rules, secondary market policies and lower entry barriers in many licensed and unlicensed bands, including the so-called TV "white spaces." Similarly, the federal frequency management regulations of the National Telecommunications and Information Administration (NTIA) now enable systems using cognitive radio or software defined radio technologies in any radiocommunications service so long as they operate in accordance with the applicable restrictions governing those services. NTIA's 2008 Federal Strategic Spectrum Plan also acknowledged that Federal spectrum requirements necessitate a new, evolutionary model for spectrum management that will provide the means to meet the increasing demand of Federal users through dynamic spectrum access to bandwidth – wherever required, whenever required. More recently, NTIA Director Larry Strickling told a Department of Defense Spectrum Symposium that NTIA has "high hopes for dynamic spectrum access and related innovations to make spectrum use as efficient as possible and to solve the challenges presented when different users and different devices are trying to operate in the same frequency band."[1] Finally, we are also very pleased to see the Obama Administration's commitment "to supporting research that will foster the next wave of innovation in information and communications technologies such as 'cognitive radio' that allows for the efficient sharing of spectrum . . .."[2]

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[1] Remarks of Asst. Sec'y of Commerce, Lawrence Strickling, at the 2009 DOD Spectrum Symposium (Arlington, VA, Oct. 14, 2009) (As Prepared for Delivery).

[2] Executive Office of the President, National Economic Council and Office of Science and Technology Policy, "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs" (Sept. 2009).

* * * * *

As has been pointed out already throughout the hearing, the demand for spectrum across all sectors and markets is substantially increasing. The existing supply, to the extent it is even known, is constrained by outmoded access restrictions, inflexibility and artificial barriers. SSC agrees that the necessary first step in confronting the spectrum dilemma, as recognized by the foresight of the sponsors and co-sponsors of H.R. 3125, is to conduct a comprehensive survey of the nation's spectrum resources. We are, therefore, pleased to support, and encourage expedited enactment of, the Radio Spectrum Inventory Act.

The spectrum inventory bill would provide expanded authority and guidance to the FCC and NTIA to work together to create and maintain an accurate, comprehensive database of spectrum allocations, assignments and utilization. Consolidating the available allocation and assignment data from the various NTIA and Commission repositories into a single, unified portal or database will go a long way toward a better understanding of spectrum. As recognized in the bill, it is also important to supplement this allocation and assignment data with information regarding the actual use of the airwaves. Virtually every service to which spectrum is allocated can show a legitimate need for the spectrum, and most incumbents will argue that they make "efficient" or "effective" use of those allocations. Thus, compiling a database of spectrum assignments will be interesting, but that alone will fail to show how much, or even if, the spectrum is actually being utilized.

As I mentioned previously, Dr. McHenry and SSC have been conducting spectrum utilization studies for several years. Attached to my testimony are exhibits that list SSC's public studies to date, most of which were funded by the National Science Foundation, and some sample results of measurements taken from SSC's rooftop spectrum observatory in Northern

Virginia during the Presidential inauguration activities in January 2009. Allow me highlight some of the results from this data.

The plots from the analysis of the inauguration data, as a general matter, show the relative intensity of use over several days across several public safety bands. While there are parts of the 800 MHz band containing public safety and other land mobile users that are used intensively (Exhibit B, Figures 1 and 2), other band segments show little or no use (Exhibit B, Figures 3-10).

Similar observations can be made from spectrum occupancy measurements taken from a rooftop overlooking New York City as it was hosting the Republican National Convention in September 2004. During an event where larger than normal levels of radio traffic would be expected, the measured occupancy levels varied from less than one percent in the 1240-1300 MHz Aeronautical RADAR band to 77 percent in some of the TV bands. The average spectrum usage based on these measurements was only 13 percent.

Another NSF-funded study in an area of presumed high level of spectrum use was conducted in Chicago in November 2005 at the Illinois Institute of Technology. The spectrum occupancy was similar to that identified in New York, where only the TV, cellular and PCS bands showed use in excess of 40 percent and the average use appeared to be a little more than 17 percent. These measurements were taken during a normal work week where a high level of activity was expected.

These reports have been available for public scrutiny for years and continue to be cited by various organizations to highlight the dramatic underutilization of this important resource. SSC has conducted similar studies in less populated areas, and none show anywhere close to the level of occupancy shown in these urban studies. Thus, to summarize Dr. McHenry's earlier

findings, in densely populated areas, on average, less than 20 percent of the spectrum is being used.

The FCC's Enforcement Bureau, NTIA's Boulder Lab and NSF-supported academic institutions have conducted similar spectrum measurement studies over the years with interesting results. This data could be incorporated into the spectrum inventory immediately. Based on SSC's unique experience in conducting spectrum occupancy studies, we offer the following additional suggestions.

For purposes of supplementing the consolidated spectrum database, SSC suggests that the Commission and NTIA could – in faithfully implementing the Radio Spectrum Inventory Act or under their existing authority – sponsor or conduct an initial series of spectrum occupancy studies at a diverse set of 10 to 20 fixed locations, augmented by mobile data collections, in urban and rural areas over several days or weeks. Depending on available agency and other financial resources, some or all of this effort could be contracted out to independent third parties or conducted through NSF or the National Academy of Sciences. These studies would assess the full range of spectral, temporal, spatial, and related issues and variables. Bands with low occupancy and large spectrum holes (time and frequency) can be checked against the consolidated assignment database (including the predicted transmission patterns for known fixed transmitters) to determine if the signals should have been detectable if they were present.

Long-term spectrum observatories could also be set up by the Commission, NTIA, universities and other parties at a variety of locations around the country to provide a steady source of usage data that will validate earlier results, observe trends in spectral usage over longer periods (years), identify usage patterns and anomalies, and confirm the positions of spectral holes in time and space. Like air pollution monitoring stations that feed data to the EPA's Air

Quality System repository of ambient air quality data or various river and stream monitoring facilities across the country that track water flow and pollutant information, spectrum observatories could be a useful spectrum resource management tool.

We also believe that the analysis of the inventory information along with any data on the actual use of spectrum must take into account the purpose for which a spectrum band in question has been originally allocated and the manner in which the particular spectrum band is expected to be used. For example, in some bands, it may be appropriate to look at average spectrum utilization over a given period of time or over a certain geographic area. For other bands, utilization could be based on peak usage levels, especially during times of emergency. However, based on SSC's experience, up to 85 percent of the spectrum (or more) will likely be found to be totally unoccupied with both a peak and average utilization near or at zero.

* * * * *

The incredible value of a comprehensive spectrum inventory and database has been well articulated by the other witnesses today, many commenters in the FCC's broadband and wireless innovation proceedings[3] as well as highly credible academics and think tanks.[4] However, until such a database is compiled and available, SSC cautions against any presupposition as to what's next for a particular band, whether it be potential reallocation for broadband services, designating more bands for unlicensed devices or some other regulatory actions. Once this information is made more easily accessible to the public, incumbents and entrepreneurs, a wide range of eager spectrum-constrained innovators can identify potentially available spectrum and

[3] *See* Record in GN Docket Nos. 09-51 and 09-157, *In the Matter of National Broadband Plan and Fostering Innovation and Investment in the Wireless Communications Market.*

[4] *See* Simon Wilkie, *ICT: The 21st Century Transitional Initiative, Aspen Institute Communications and Society Program*, Jan. 7, 2009, at 6-8 & 36; Philip J. Weiser, *The Untapped Promise of Wireless Spectrum*, Brookings Institution Discussion Paper 2008-08, July 2008, at 12-18.

deploy new approaches to sharing spectrum or partnering with existing licensees. On the other hand, to assume that the next step following the initial inventory would be a traditional reallocation proceeding would amount to a plan for years and years of fighting among entrenched interests that have no notion or incentive to have their existing spectrum rights diminished, no matter how well those rights are exercised or utilized. This is based on my personal experience where it took six years for the spectrum to be reallocated, and that looked like the "fast track" compared to most reallocation efforts that typically have dragged on for ten years or more.

As the Subcommittee considers both of the pieces of legislation that are the subject of this hearing, we believe that it is also important to recognize that new technologies such as dynamic spectrum access, cognitive radios and smart antennas enable more efficient use of existing spectrum allocations and can create new opportunities for sharing spectrum with existing services in underutilized bands. Another potential positive result of a reliable spectrum inventory, and without the need for further regulatory action, would be the use of the spectrum data to facilitate more vibrant secondary market leasing activity. For example, to promote the development of broadband service in rural markets, spectrum holders may be more encouraged to post to the database or through a spectrum broker the terms under which they would make spectrum available for lease.

Accordingly, SSC suggests that the overwhelming interest in finding additional spectrum for wireless broadband services is more likely to be accommodated in a timely manner if a flexible spectrum access framework is established that includes DSA-enabled sharing with government and non-government incumbents. Such a framework would focus on "multi-purposing" legacy bands with flexible overlay rights (and responsibilities) because traditional

"repurposing" or "reclaiming" bands that involve relocating incumbents would be too difficult, too costly, too time consuming and, in light of new technology, unnecessary. Indeed, this is similar to what occurred when the PCS bands were made available in 1995. The licenses that were auctioned were subject to a non-interference requirement with the existing microwave incumbents. While most of those old licensees ultimately were relocated to new systems on other frequencies, the advances made in DSA and cognitive radio technology now provide the ability to co-exist with legacy systems that was not available at that time.

* * * * *

Thank you, again, for this opportunity to testify today. I look forward to addressing your questions and concerns.

Exhibit A

Shared Spectrum Company Spectrum Occupancy Reports

Spectrum Occupancy Measurements: Loring Commerce Centre, Limestone, Maine, September 18-20, 2007, Shared Spectrum Company Report (2007), available online at http://www.sharedspectrum.com/measurements/download/Loring_Spectrum_Occupancy_Measurements_v2_3.pdf.

Spectrum Occupancy Measurements: Dublin, Ireland, Collected On April 16-18, 2007, Shared Spectrum Company Report (2007), available online at http://www.sharedspectrum.com/measurements/download/Ireland_Spectrum_Occupancy_Measurements_v2.pdf.

Spectrum Occupancy Measurements: Chicago, Illinois, November 16-18, 2005, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/download/NSF_Chicago_2005-11_measurements_v12.pdf.

Spectrum Occupancy Measurements, Location 1 of 6: Riverbend Park, Great Falls, Virginia, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

Spectrum Occupancy Measurements, Location 2 of 6: Tyson's Square Center, Vienna, Virginia, April 9, 2004, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

Spectrum Occupancy Measurements, Location 3 of 6: National Science Foundation Building Roof, April 16, 2004, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

Spectrum Occupancy Measurements, Location 4 of 6: Republican National Convention, New York City, New York, August 30, 2004 - September 3, 2004, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

Spectrum Occupancy Measurements, Location 5 of 6: National Radio Astronomy Observatory (NRAO), Green Bank, West Virginia, October 10 -11, 2004, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

Spectrum Occupancy Measurements, Location 6 of 6: Shared Spectrum Building Roof, Vienna, Virginia, December 15-16, 2004, Shared Spectrum Company Report (2005), available online at http://www.sharedspectrum.com/measurements/.

The bar graphs below provide the average of the occupancy in each band (Figure 1) and at each of the 6 locations (Figure 2).

Figure 1: Spectrum occupancy in each band averaged over six locations

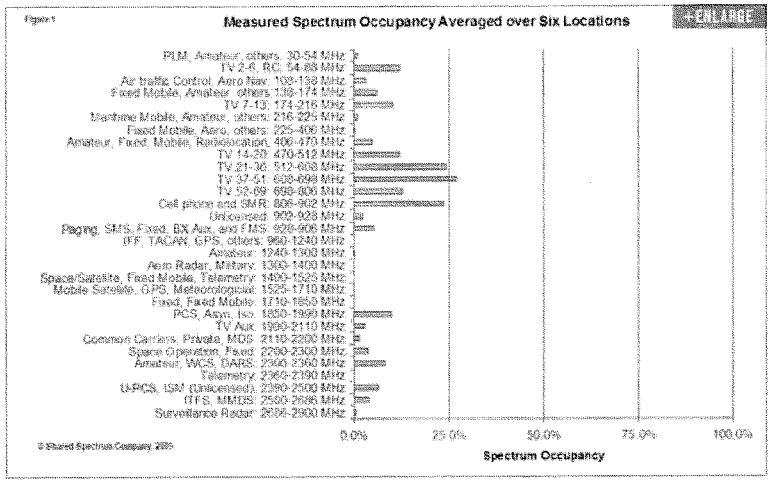
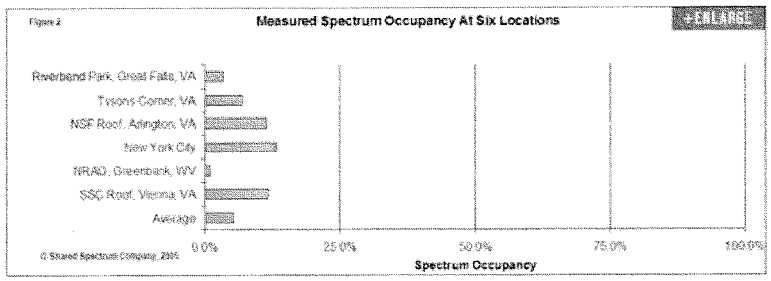


Figure 2: Spectrum occupancy at each location



Other Publications

M. McHenry, P. Tenhula, D. McCloskey, D. Roberson, and C. Hood, *Chicago Spectrum Occupancy Measurements & Analysis and a Long-term Studies Proposal*, in *Proc. of Workshop on Technology and Policy for Accessing Spectrum (TAPAS)*, Boston, USA, August 2006, available online at www.wtapas.org/final-papers/ChicagoSpectrum-McHenry-Session-I-1.pdf.

M. McHenry and D. McCloskey, Multiband, Multilocation Spectrum Occupancy Measurements, in *Proc. of Intl. Symposium on Advanced Radio Tech (ISART).*, Boulder, CO, March 2006, pp. 167-175, available online at http://www.its.bldrdoc.gov/pub/ntia-rpt/06-438/.

Exhibit B

Inauguration Week Public Safety Bands Spectrum Occupancy Measurements

Figure 1: 851-861 MHz – Higher Spectrum Occupancy

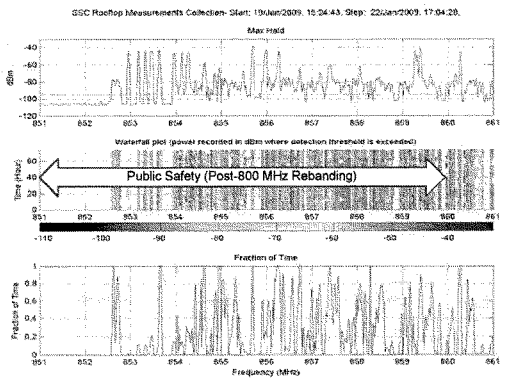


Figure 2: 861-869 MHz – Higher Spectrum Occupancy

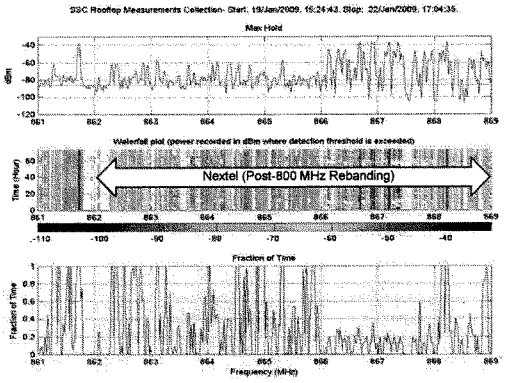


Figure 3: 406 – 420 MHz

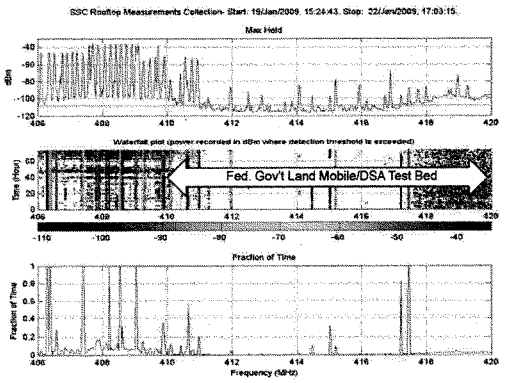


Figure 4: 450 – 463 MHz

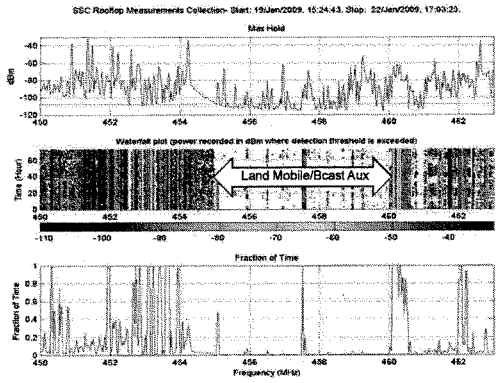


Figure 5: 463 – 476 MHz

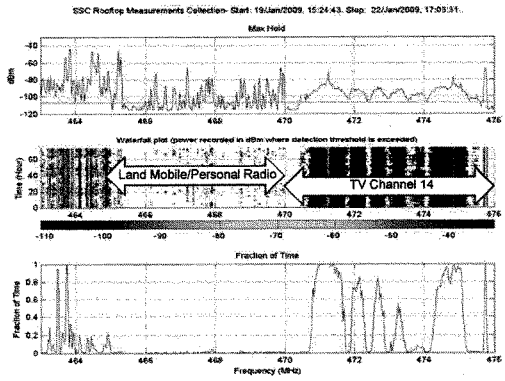


Figure 6: 476 – 489 MHz

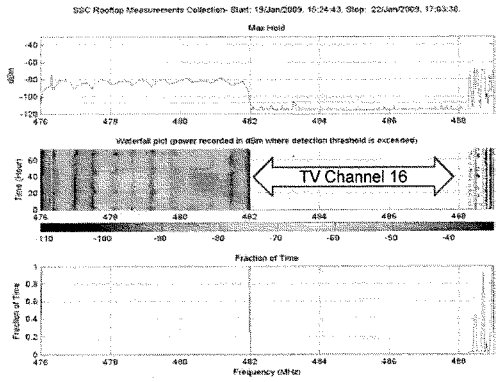


Figure 7: 489 – 502 MHz

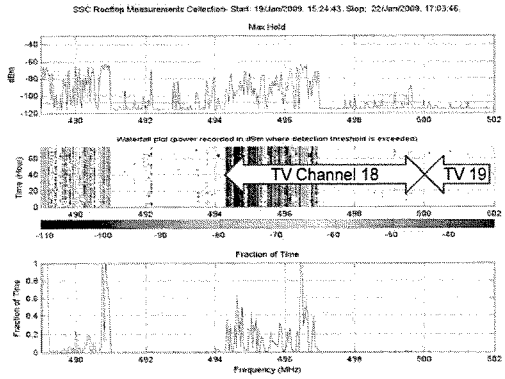


Figure 8: 502 – 512 MHz

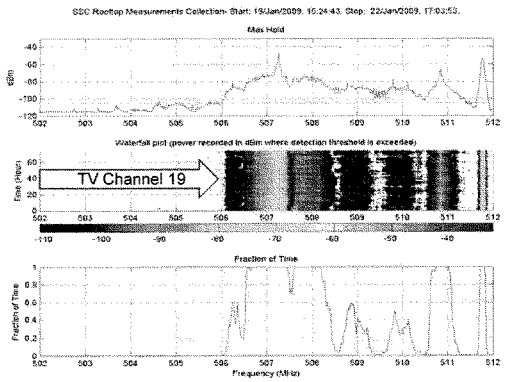


Figure 9: 763 – 776 MHz

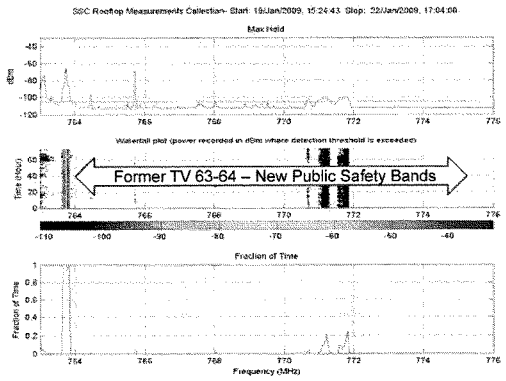
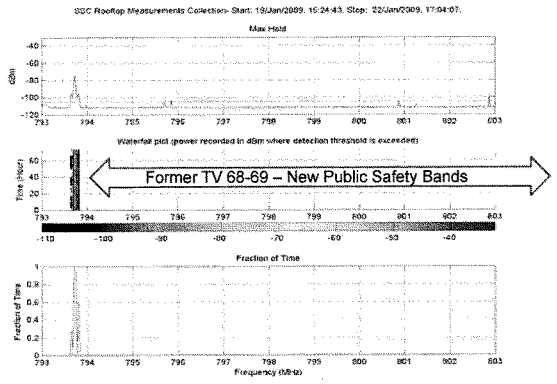


Figure 10: 793 – 803 MHz



Technical Notes:

Shared Spectrum Company's (SSC) spectrum observatory system has been implemented in connection with a project funded by a National Science Foundation award (CNS 0722003) to the Illinois Institute of Technology (IIT), to which SSC is a subcontractor. One observatory system was stood up at IIT in Chicago, IL, during the first quarter of 2008 and another one is implemented on the rooftop of SSC's office building in Vienna, VA (in the Washington, DC metropolitan area).

The spectrum observatory consists of two discone antennas installed on the mechanical room penthouse on SSC's office building. These antennas cover 25 MHz – 3000 MHz. The spectrum measuring system uses a pre-selector along with a spectrum analyzer and customized software for the gathering and analysis of spectrum data.

The figures above are representative plots of the spectrum measurements made across the specified bands during the Presidential Inauguration events in January 2009. Data collection started on January 19, 2009 and continued non-stop for approximately 74 hours.

Three types of plots were generated at the end of data analysis:

- The first subplot represents the maximum power value versus frequency measured during the period. The time shown on the plot is the measurement start time.
- The second subplot is a waterfall-type of plot showing occupancy versus time and frequency. Occupancy is determined when the power level exceeds a threshold. The threshold value was selected for each run, and is shown as a dotted line on the upper subplot.
- The third subplot is the fraction of time the signal was detected, versus the frequency measured during the period. If the fraction of time is '1', it means that the signal was detected during the entire period of measurement collection.

The resolution bandwidth was set to 10 kHz for this set of measurements. Various detection threshold values from -120 to -90 dBm were used to analyze spectrum holes. The plotted spectrum data was calibrated to the power level at the antenna input using the following procedure:

- The recorded power levels measured by the spectrum analyzer are provided in dBm relative to the analyzer input.
- The difference between the power level at the analyzer input and the power level at the antenna input is due to the losses and gain of the RF cables, filters, and amplifiers associated with the preselector.
- To correct for this difference, the preselector loss was measured using a network analyzer in each spectrum band at the conclusion of the measurements.
- The preselector loss versus frequency data values (in dB) where then added to the measured values (via an interpolation process) when plotting the spectrum data.

Mr. BOUCHER. Well, thank you, Mr. Stroup, and thanks to all of our witnesses for your informative remarks here this morning. I particularly appreciate the broad consensus that is evident from your testimony about the need to move forward with both of the bills that are the subject of our legislative hearing this morning, particularly the need for an inventory of spectrum that could be reallocated for commercial purposes. A number of you, most recently Mr. Stroup, just mentioned the potential of spectrum sharing as a way to accommodate new commercial services within our spectrum constraints. Could you talk a little bit about the state of the technology with regard to spectrum sharing and what potential really does it hold and what limitations does it face? And who would like to begin? Mr. Hatfield.

Mr. HATFIELD. Yes. Thank you. I think that sharing, you can look at it in two ways. It is important to look at it in two ways. We have always shared a lot of the existing spectrum and we call that static sharing. For example, an antenna pointed at a satellite and antennas pointing on the ground are pointing in different directions and that provides sufficient isolation that a satellite system can share with a terrestrial system, and that static sort of sharing has been with us for quite some time and used effectively. I think the key here is combining the concepts that Tom talked about is that a lot of spectrum is not being used all the time today and look at more dynamic forms of sharing. In other words, for example, here in town today in D.C., a particular channel might not be used by some private microwave, something like that, and that spectrum could be shared on a dynamic basis. So I think the key going forward——

Mr. BOUCHER. So you are not talking about technology in that example that would use the same spectrum simultaneously by various users but simply with a phased use of a spectrum by various users, each using it fully within that allotted time?

Mr. HATFIELD. Yes, where they are using it but not all the time, or as we can say, there may be directionality or something that can be employed that would allow dynamic sharing.

Mr. BOUCHER. Given that opportunity, talk a little bit if you would about the state of technology development for actual simultaneous sharing of the same spectrum.

Mr. HATFIELD. I am not——

Mr. STROUP. I will be more than happy to field that one.

Mr. BOUCHER. All right, Mr. Stroup.

Mr. STROUP. We have tested this on multiple occasions with members of the military and members of the public present. We are currently porting it over to several different radio systems. Our expectation is that those radios are going to be ready for testing next year and deployed into the field no later than the year 2012.

Mr. BOUCHER. So there is nothing commercially available today that would enable simultaneous use of the spectrum by multiple users but you are saying this technology is under development and ready for testing essentially next year?

Mr. STROUP. I would suggest that it is beyond the level of testing and is now being deployed into radio systems or being developed into radio systems. Within the commercial sector, we have initial licensing agreements with two different companies to use it within

the TV white spaces. Our expectation is that upon conclusion of that rulemaking proceeding, the development of those rules, that sometime within the next 18 months that it will be deployed.

Mr. BOUCHER. Any other comments, Mr. Calabrese?

Mr. CALABRESE. Yes. You know, as you have heard from three of us, there seems to be a far greater opportunity in terms of quantities of spectrum to open it up on a shared or opportunistic basis, and there are a couple of important precedents at least to build upon. You know, one, I think you are aware is of course the military already allows shared use of certain radar bands so, you know, thanks in part to the jump-start broadband act that was over on the Senate side some years ago, the military agreed to open up the 5 gigahertz band based on the technology that uses, you know, dynamic frequency selection. In other words, the devices sense before they transmit, and if they don't detect anything like radar, then they operate there and they keep checking, checking, checking and they can get off real quick. The other even more important technological I think precedent here to build on is the order last year from the FCC on opening the TV white space for unlicensed sharing because what the Commission has required is a geolocation database so the smart devices will need to have GPS and Internet access. They look up and they get a list of available channels with conditions attached. And so we can build on that database that the Commission is about to create and add a lot of other frequencies over time that would have conditions attached to them.

Mr. BOUCHER. That is very encouraging to hear. I would just note that the first commercial application of the white space technology is now occurring in my Congressional district.

Mr. CALABRESE. Right.

Mr. BOUCHER. One other question, my time is expired, but I will ask if you have any brief comments about this. Are there shortcomings at the present time in the licensing and spectrum management processes that are employed by both NTIA and the FCC, and if you detect that there are any, do you have recommendations for how those processes could be improved? Anyone want to answer? Mr. Largent.

Mr. LARGENT. I would just repeat some of the problems that have taken place in the AWS spectrum with some of our members as being a shortcoming that I think are addressed in both of these bills and I think are a definite step in the right direction.

Mr. BOUCHER. All right. Thank you very much. Anyone else want to briefly comment on that? Mr. Hatfield.

Mr. HATFIELD. I would add that the Commission has done things in the past to encourage a secondary market so that—one of the problems with the existing system, it is centrally controlled and therefore there are a lot of rigidities built into it. The Commission to its credit has gone to the use of secondary markets where companies and so forth can lease spectrum, and that has not worked out quite as well as some of us would have hoped, so I think there is possibilities to continue to encourage the secondary market to reduce some of the rigidities associated with trying to centrally manage the resources.

Mr. BOUCHER. Thank you, Mr. Hatfield.

My time is expired. The gentleman from Florida, Mr. Stearns, is recognized for 5 minutes.

Mr. STEARNS. Thank you, Mr. Chairman.

Mr. Largent, one of my questions for us is, when we had the auction and the DTV transition and we raised about $19 billion, the bill that Mr. Barton sponsored and I was cosponsor, I think it became the backbone of the fourth-generation wireless service. Now, that was one approach. Now, the other approach appears to be the stimulus package. They put in $7 billion to provide grants, and I guess the question would be, the auctioning of the spectrum it appears to be would be a more efficient way to do it than just giving out the stimulus package. You might comment on the two approaches here and which one you think is more advisable.

Mr. LARGENT. Well, let me just say this. The bottom line is, we need to have additional spectrum in the wireless space in order to meet not only the demands but the promise, the hope of the broadband world and so however you get to that point, that is subject to debate and can even become partisan, but the bottom line is, more spectrum is needed and sooner rather than later. The fact is, the last two tranches of spectrum that were allocated for wireless use, the AWS auction, 700 megahertz auction, both of those auctions took over 10 years to come to fruition. One was about 12 years, the other was 16 years to get it to come to fruition, and our thought is, is this is really a process that we are in the process of developing today that should have begun years ago if it still going to take somewhere between 12 and 16 years. So I guess the bottom line is, is that there is different ways to get to the bottom line but the important thing is to get to the bottom line and that is additional spectrum for the wireless industry.

Mr. STEARNS. The members of your association, are they going to benefit from this $7 billion in the stimulus package? I mean, I understand it is going to all go to develop the wirelines but do your companies see it as a positive?

Mr. LARGENT. I would say that the majority of the money that has been allocated is not going to the companies that are in our association.

Mr. STEARNS. You mentioned just briefly, the chairman talked about T Mobile and then the spectrum reallocation you sort of indicated the problem in the transition, and I mentioned in my opening statement. I would think if we want other commercial carriers to compete and get involved, this would be a flag to them that if it is going to take too long they have got this investment I think of over $4 billion. I mean, how long can they continue to deal with that procrastination? So I mean, you might give us some ideas on what can be done to improve this reallocation timeframe and perhaps what we in Congress should be aware of.

Mr. LARGENT. Well, actually, the second bill that we are talking about today, 3019, actually goes to that subject, that once the spectrum is identified, the spectrum is auctioned, then getting the people that are on the spectrum off the spectrum more expeditiously is really helped by this particular bill that we are talking about today. So, you know, my hat is off to you. I think Congress has——

Mr. STEARNS. So you think that will do it?

Mr. LARGENT [continuing]. Gone forward, made mistakes, recognized those mistakes and is now trying to correct them, and that is a real positive movement.

Mr. STEARNS. And you feel pretty comfortable that will solve the problem?

Mr. LARGENT. No, I am not positive it solves all the problems that are involved but it solves the problems that we know of with the auction process that took place 2 years ago.

Mr. STEARNS. Mr. Hatfield, what steps can be taken to make more efficient use of commercial and government spectrum that is already deployed?

Mr. HATFIELD. In my written statement, I go through the list of sort of five techniques that can be used, and the two probably that haven't been talked about as much here is, one, more technical efficiency. It is like getting more miles per gallon on your car. I mean, there are sort of two ways we can improve our transportation efficiency. One is by more miles per gallon or by carpooling, for example, and sharing that we have talked about here is the carpool analogy but we also need to look at ways of more efficiently using the spectrum, getting more bits per second per hertz, as I would say in technical terms. And there are a couple ways of doing that. One is through compression, reducing the number of bits that have to be sent. The other is using more efficient modulation techniques. What scares me as an engineer is those techniques only look like they can provide us with incremental improvements, and I am not saying we shouldn't do it, we absolutely should because it is crucial, and they are happening, but the difficulty is, they are probably not going to be adequate. So that leads us then to the need for more sharing or reallocation.

The other way, just to complete the thought, is through more intense reuse of the spectrum. For example, with your cell phone, the tower may be 2 miles away and therefore you are taking up an area with a 2-mile radius. If you shrink the cell down, then you can reuse that same channel more and more times in a city like D.C., so you can use the same channel several hundred times. And so you can see the cellular carriers have made enormous investments in more cell towers. That helps a lot. As you can keep getting the cell smaller, of course, then you have to get that information in the cell tower back to some central location and that is where I believe your broadband policy of getting fiber out there intersects with the wireless industry because the wireless industry needs to get the wireless data back to their central point and that requires broadband facilities. So I think there is a real link here between what is being done in the broadband policy and the wireless industry.

Mr. STEARNS. Mr. Chairman, I don't have any further questions but I thought Dr. Johnson might want to comment if he wanted to on the same question.

Mr. JOHNSON. The commercial receiver standards, the military already has these standards for radars but none of those standards exist for commercial systems so there may be opportunities to take advantage of some of those standards that have been developed.

Mr. BOUCHER. Thank you very much, Mr. Stearns.

The gentleman from Michigan, Chairman Dingell, is recognized for 5 minutes.

Mr. DINGELL. Mr. Chairman, thank you.

I would like to welcome our panel, particularly Mr. Largent, our former colleague and friend. Welcome back.

I have some questions. Since there are so many, I have to do all this with yes or no's. Mr. Largent, yes or no, has CTIA or anyone else conducted usage studies which measure actual traffic to see if the spectrum is being used?

Mr. LARGENT. Are you talking about the spectrum that has been allocated for commercial mobile wireless?

Mr. DINGELL. Just have spectrum studies been completed to tell us whether the spectrum is being used.

Mr. LARGENT. I am not sure I understand the question, sir.

Mr. DINGELL. Has anybody made any studies to find out if the spectrum is properly being used? CITE, FCC, anybody?

Mr. LARGENT. Well, what I can tell you is, that the commercial mobile wireless spectrum that we have available to this industry today is used more efficiently than any other country of the world.

Mr. DINGELL. I am going to take that as a no and I thank you for that. Now, do all CTIA carriers operate at full capacity on their allotted spectrum today?

Mr. LARGENT. No, sir.

Mr. DINGELL. Has FCC conducted any usage studies which examine whether the spectrum either by your members or anybody else is being properly and adequately used with regard to that spectrum which is assigned to them?

Mr. LARGENT. I am not aware of any.

Mr. DINGELL. So the argument seems to be here I think that you have enough spectrum for now but will need it 10 years from now or at some future time. Is that correct?

Mr. LARGENT. We have enough spectrum for right now but we will need spectrum before 10 years.

Mr. DINGELL. And I thoroughly agree with you. Our problem here is to see how we are going to get that spectrum efficiently allocated, because as you will remember from your time on this committee, we had a serious problem with regard to the fact that the spectrum was just thrown out by the FCC and by the government to be sold for budgetary reasons as opposed to addressing the proper use of the spectrum.

Now, to all witnesses starting on your right and my left, how do you view H.R. 3125 and H.R. 3019? Do you view it as complementary to the FCC's work to develop a national broadband plan, yes or no? Starting on your far right, if you please, sir.

Mr. HATFIELD. A simple yes or no answer? Yes.

Mr. DINGELL. Mr. Largent?

Mr. LARGENT. Yes.

Mr. DINGELL. Sir?

Mr. CALABRESE. Yes, very much.

Mr. DINGELL. Sir?

Mr. SMITH. The answer is yes but I believe it could be expanded.

Mr. DINGELL. Next witness, please, sir.

Mr. JOHNSON. No.

Mr. DINGELL. No? And the last witness?

Mr. STROUP. Yes.

Mr. DINGELL. Now, if the completion of national broadband should be delayed pending enactment of H.R. 3125 and H.R. 3019, how long should such delay be, starting again on your far right and my far left. How long could or should that delay be?

Mr. HATFIELD. I think the requirement is so great that we do not want to wait pending taking some of these steps pending the inventory.

Mr. DINGELL. Mr. Largent.

Mr. LARGENT. And I would agree with that. The sooner the better.

Mr. DINGELL. Next witness, please.

Mr. CALABRESE. Yes. Likewise, there are bands and things——

Mr. DINGELL. How long should the delay be while we wait for those studies to be completed, next witness.

Mr. SMITH. Chairman Dingell, the answer is, delay is not good but delay is frankly better if you don't have the right information, so if you need the right information, delay may be necessary.

Mr. DINGELL. Yes, I am no special pleader for delay. My concern is that if we do this, we do it well, and I am not satisfied that up until this time we have been doing these things well and I am very much troubled that we will expand that bad history by again doing things poorly——

Mr. JOHNSON. We agree with that.

Mr. DINGELL [continuing]. And winding up with a mess on our hands because we have built upon a faulty edifice. Next witness, sir.

Mr. STROUP. We would recommend moving forward with the spectrum inventory including the actual measurements, which will help identify bands that are particularly useful for spectrum sharing.

Mr. DINGELL. All right. Mr. Chairman, I note I am 4 seconds over my time and I yield back with thanks to you.

Mr. BOUCHER. Thank you very much, Chairman Dingell.

The gentleman from Oregon, Mr. Walden, is recognized for 5 minutes.

Mr. WALDEN. Thank you very much, Mr. Chairman. Again, thank you for this hearing. I want to thank the witnesses for your testimony as well, all of you, and especially Dr. Johnson. I appreciated your technical counsel on the legislation as well.

Senator Smith, I want to go to you regarding this notion put forth by the distinguished scholar in residence at the FCC for First Amendment and spectrum, Dr. Benjamin. In his paper, and this is just from May of this year, he writes, "The most obvious desirable regulations are probably those that are pure dead weight loss, regulations that cost broadcasters significant amounts of money but have no impact on their behavior. This category would include onerous record-keeping requirements, ascertainment requirements, et cetera. These are unlikely to have any impact on programming and thus will likely be pure cost." His thesis is in this paper which I will ask unanimous consent to put in the record called "Roasting the Pig to Burn Down the House: A Modest Proposal," is to make it so costly on broadcasters that they surrender their spectrum, and I find it an abomination, I find it offensive. I don't quite under-

stand why he is now in this position at the FCC, and I will follow up on that. But given the fact that we just went through a $2 billion DTV conversion and you are on the cusp of a digital television technology that is mobile and you make the argument in your statement about how every new subscriber to that free over-the-air digital mobile service makes that even more efficient because you are not adding to the stream. If we follow Professor Benjamin's counsel or the FCC does, aren't we just throwing that $2 billion into a paper shredder?

Mr. SMITH. Congressman, yes, you are throwing $2 billion of U.S. taxpayer money away. You are throwing away potentially untold billions that the U.S. citizens have spent in detrimental reliance upon the Congressional urging of the digital transition. Suffice it to say, my phone has been ringing off the hook ever since this gentleman's work has been revealed. That said, I think what he does is simply try to monetize highest and best use in pure dollar terms, disregarding all the other public values that are served through localism, local news, local sports, local weather. These are things that I think, you know, particularly when it comes to emergency information, Amber Alerts, how do you monetize that? And I am hesitant to say it, but when it comes to broadcasting and the broadcast airwaves, they have always been a public option to make sure that everybody gets served, and he seems to be suggesting that that maybe should be yesterday.

Mr. WALDEN. Dr. Johnson, I raised the issue in my opening statement about the amateur radio broadcast service, and I failed to disclose that Mr. Ross and I are the two licensed amateur radio operators which gives us license to be real hams and politicians, and I am just curious as you look at the spectrum from a technical perspective, what should amateur radio licensees be concerned about and what threats and value do you see in that spectrum?

Mr. JOHNSON. I won't be able to give you a full detailed answer because I have not looked at that particular issue in detail. I would support, however—and I also am a ham radio operator.

Mr. WALDEN. Oh, very good.

Mr. JOHNSON. I would support, however, your thesis that the ham bands have been an important backup system for the Nation's security and I think they are also a valuable resource for citizens who have an interest in that kind of technology, and although there are other avenues to address those same issues now outside of the ham bands, I think they are still important and we would be happy to look at the technical details of the challenges to that particular band.

Mr. WALDEN. Mr. Hatfield, do you have any comment on the amateur radio band? And tell me you are a ham radio operator too, would you?

Mr. HATFIELD. You know, I think my license just expired but the way I got into this business was starting as a ham. I think I was 13 or 14 years old, something like that. I think the problem that the amateur radio community has is that they do provide a very, very vital final sort of backup communication network that is just absolutely—it is totally decentralized so there is nothing central that can fail, and that is really critical. The problem is, if you tune across the band, so often they are idle, and if somebody was really

clever, maybe we could figure out ways that we could do a little bit of sharing there that would not diminish the amateur opportunity at all for use in emergencies but in non-emergency times might be used for some other vital public interest purposes as well.

Mr. WALDEN. Mr. Chairman, I know my time is expired and I am going to excuse myself. Mr. Buyer is going to take over for our side. We have a classified briefing with the Secretary of State and Secretary of Defense on Afghanistan and Pakistan that I am going to go to. So again, I thank you for your testimony and look forward to working with all of you and others on this issue as we move forward in a thoughtful and constructive way on appropriate use of spectrum. Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Walden.

The gentleman from Indiana, Mr. Buyer, is recognized for 7 minutes. Oh, I am sorry, Mr. Buyer, if you can withhold, I need to go in order here. The gentleman from California, Mr. McNerney, is recognized for 5 minutes.

Mr. MCNERNEY. Thank you, Mr. Chairman. I will try to be brief here.

First of all, I want to thank the panel. I found the testimony very informative, and I didn't hear anyone say well, no, I don't like this legislation. I think Dr. Johnson had a little reservation about some of the definitions so I appreciate that, and I am going to ask you in a minute to expand on that. But first I want to say, expanding the range to 10 gigahertz, there would seem to be a disagreement between Mr. Calabrese and Mr. Hatfield on that, and I am not sure exactly why you would think that going up to 10 gigahertz isn't that useful, Mr. Hatfield. Is it Dr. Hatfield or Mr. Hatfield?

Mr. HATFIELD. My doctor is honorary, so——

Mr. MCNERNEY. OK. Well, that is good enough for me. Dr. Hatfield.

Mr. HATFIELD. I think the answer is, there may be some confusion. It is the range up to roughly 3 gigahertz that is really critical to people like the cellular industry, so that is the most critical. On the other hand, if some of the services we might want to relocate could go higher, it would still work OK if they went higher in frequency so therefore I think you can make an argument that we ought to look all the way up to 10 to see if there are any opportunities, for example, that some could be reallocated from below.

Mr. MCNERNEY. So there are physical limitations after 3, say, line of sight and so on?

Mr. HATFIELD. Yes, that is correct for mobile applications. Now, for certain radar applications, for example, being up there where you have line of sight, it might work perfectly fine. So that is what I think is perhaps the basis for the difference. I would support going up higher for that purpose but we mustn't kid ourselves. There are technical limitations that would prevent it from being used for certain applications.

Mr. MCNERNEY. Thank you.

Dr. Johnson, you did mention the idea that there is no single metric for efficiency. Is there anyone out there that you are aware of or that would be useful or sort of a set of definitions?

Mr. JOHNSON. We think that a single definition like intensity of use is not appropriate. We propose using a variety of metrics that

correspond to the critical parameters related to the particular system and application that is being used. For example, metrics for communications systems would be different than those for radar systems.

Mr. MCNERNEY. So are you going to supply the committee with that information?

Mr. JOHNSON. We would be pleased to work with the committee to develop those metrics, absolutely.

Mr. MCNERNEY. I will be interested to work with the committee on examining that metric definition.

The last thing I have is the notion that the paper inventory isn't going to be adequate, and I didn't quite appreciate that. You know, I come from a technical background and I was a test engineer and a field tester, but when Mr. Stroup showed the graphs with all those blank spaces, people that own spectrum are going to say well, jeez, we use all of it, we don't need to reallocate and so we are going to need to actually do quite a bit of testing to validate, and it seems to me like a fairly—just on the basis of what was spoken here this morning, a fairly big task to really judge how much spectrum is available out there. Could you comment on that?

Mr. STROUP. Yes, Congressman. We submitted some suggestions in our written testimony as to some short-term approaches as well as longer-term approaches. We would recommend approximately 10 to 20 stations supplemented by mobile testing and an overall longer period of time and a larger number perhaps in conjunction with universities and other organizations to be able to compile an ongoing inventory of how the spectrum is actually being used.

Mr. MCNERNEY. That is going to take a lot of resources, a lot of time and a lot of money. Even what you have called a shortcut seems like a fairly big undertaking.

Mr. STROUP. I believe that the NTIA and other organizations, the National Science Foundation are already compiling this information so some of it is there. Our studies or many of our studies are already available publicly and can be integrated into this database, so it is not as large an undertaking as it may seem but I do agree that overall long term there is a great deal of data that will be compiled. The Illinois Institute of Technology is actually conducting ongoing studies in Chicago. They have over 2 terabytes of information that has already been collected from that location.

Mr. MCNERNEY. Mr. Calabrese.

Mr. CALABRESE. I mentioned in my written statement that the costs are really coming down for doing this so, for example, Offcom, which is, you know, the British telecom regulator, recently completed a nationwide drive test of their airwaves. They mount measuring devices just on the rooftop of a national vehicle fleet, which we could do with the Postal Service or whatever, and then, you know, that gets downloaded over wi-fi. There are also very inexpensive devices now to have a monitoring network. That is being field tested in the D.C. area fairly soon by a company. We are hoping to have one on the roof of our building downtown.

Mr. MCNERNEY. My time is expired. Mr. Hatfield, do you have a very quick response?

Mr. HATFIELD. Just as I say in my written testimony, I said one of the things we can do is focus on those bands which look the most

promising, so do the measurement first on the most promising. Second—well, why don't I just stop there.

Mr. MCNERNEY. I guess it comes down to one of our favorite Presidents saying "trust and verify." Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. McNerney.

The gentleman from Indiana, Mr. Buyer, is recognized for 7 minutes.

Mr. BUYER. Thank you.

Mr. Largent, are you familiar with this latest GAO report that came out titled "FCC Needs to Improve Oversight of Wireless Phone Service"?

Mr. LARGENT. I have not read the entire thing but I am aware of it.

Mr. BUYER. Are you aware of the recommendations of GAO? GAO recommended that the FCC, number one, improve its outreach to consumers about its complaint process, related performance goals and measures and monitoring complaints; number two, develop guidance on federal and State oversight roles; and three, develop policies for communicating with States. Are you familiar with the three recommendations?

Mr. LARGENT. Well, I am more familiar with the facts that they uncovered first that was in that report that showed that 84 percent of——

Mr. BUYER. That is where I am going. You are getting ahead of me.

Mr. LARGENT. Oh, sorry.

Mr. BUYER. Let us just go right there. I mean, what I am asking is, they have these recommendations based on, and so I want to ask you to comment about what they are based on. I mean, my gosh, when we look at all the choices that consumers have here going into the Christmas shopping season and the levels of satisfaction, would you please comment on the basis and the facts that they relied on for these recommendations?

Mr. LARGENT. Well, I think it is not the way I would have written the report based upon the statistics that they found in the study. Knowing this industry as I have for the last 6 years and seeing the consumer complaints decline every year and the consumer satisfaction go up every year, we feel like that that is a movement in the right direction. Eighty-four percent approval by our consumers is not good enough for us. We continue to want to raise that even more but it is a heck of a positive mark for the industry and I hope to be able to sit before you in a year or two and be able to talk about how we are no longer 84 percent, we are even higher today. But, you know, I think that the report did highlight some things that the FCC can be about that would improve their service but the bottom line is, is that I think it is a star for the wireless industry to show the improvement of our service for our customers.

Mr. BUYER. Regarding your member companies when they make strategic judgments in competition, wouldn't consumer satisfaction be one of those important elements?

Mr. LARGENT. Absolutely. It is the key statistic that they look at all the time.

Mr. BUYER. You know, I get excited when I listen to my good friend Mr. Markey share his excitement about competition in the

marketplace, and so I would share with my good friend Mr. Markey, when you rejoice in competition in the marketplace and what it is bringing consumers relative to choice, do not be so eager to get more government control if in fact the marketplace is driving consumer satisfaction.

The other point I would like to, if I had a little latitude, Mr. Chairman, because I am also cosponsor of this legislation, I would like to kind of shift gears and turn to Mr. Smith and ask a particular question, and matter of fact, it may drive, Mr. Chairman. I think we should take a really good look here at Comcast and NBC. So I am going to ask a question about Comcast and NBC, Mr. Smith. I have got some concerns about your member companies out there. I have got concerns about consolidation in the marketplace. I have got concerns about what type of new business model does this bring, what is its impact and how does it drive a new model for advertising. You held up your phone and you talked about this as a multimedia platform. As we have a marketplace as you try to judge into the future, it is all about individualizing of advertising, and I can almost see if we are going to permit the marketplace to begin to mine and profile people that pretty soon even advertising how it is even driven not only upon a web, you could almost have individualized advertising occurring upon TV. So as I try to think about in the future and how a vertical integration is this kind of deal when you have this many eyes of Comcast and being able to control content, it almost turns our present business model inside out, upside down. I welcome your comments on mine.

Mr. SMITH. Congressman, some of my members are for it, some of them are very concerned about it, and I am with my friends.

Mr. BUYER. Very good, Senator.

Mr. SMITH. The NAB has not taken a position on this at this juncture. We are simply going to watch and see what kind of conditions develop but we are very attuned to the issue and the problems that you just cited.

Mr. BUYER. You know, the Supreme Court long ago talked about the importance of having diversity out there among our media, and that was back in the 1940s, with regard to ideas. I mean, if I were one of your member companies and I am a small company and I have a couple of NBC affiliates and maybe a CBS affiliate, can't you relate to their concerns even about retransmission rights and fees and what impact is that going to have or upon others whereby is there going to be cost shifting because of this vertical integration?

Mr. SMITH. Well, obviously I am more than interested. I answer their phone calls because, yes, they are concerned with the very issues that you identify, but I assume that the FTC, the FCC and the Department of Justice will look at all of these things and propose conditions if this is to go forward at all. And at this juncture, it is the feeling of the association that we should allow the process to work.

Mr. BUYER. One of the concerns I have, Mr. Chairman, and why I would encourage you to place your eyes and considerations on this issue is defined by the silence. When there is silence in the marketplace because of this type of deal, that tells me that there is great concern in the marketplace and fear that if in fact a com-

pany were to come out and come against this type of merger, what type of repercussions in the marketplace would in fact occur. So the fact that there is silence out there is beginning to bother me, Mr. Smith, that a lot of your member companies while they may confide in that phone call with you that there is a reason that they are not coming out publicly because they don't want to get jammed in their negotiations. Am I close here?

Mr. SMITH. Well, I think they are very interested observers of this process and they share the concerns you have expressed. Again, we have networks, we have affiliates. They are have most issues in common but this is one where there needs to be an accommodation, an understanding and a legal structure put in place that allows both to survive.

Mr. BUYER. Mr. Chairman, I would just encourage us to put our eyes to have a better understanding so that we can try to see over the horizon the impact that this type of merger is going to have on a multimedia platform and advertising model.

Mr. BOUCHER. Thank you very much, Mr. Buyer. Let me assure the gentleman that our subcommittee will conduct at least one hearing on the Comcast NBC acquisition at the appropriate time next year. That announcement has already been made, and the gentleman is quite right in expressing the need for us to focus on this very carefully. It is certainly our intent to do so.

The gentleman from Michigan, Mr. Stupak, is recognized for 5 minutes.

Mr. STUPAK. Thank you, Mr. Chairman. I apologize to our witnesses for not being able to hear their testimony. I was in with constituents and had to take a couple of other meetings.

Mr. Largent, I have a question for you. Recognizing the challenges that Congress and the FCC will face in trying to relocate as much spectrum as possible, are companies within the CTIA exploring the possibility that a dynamic spectrum access that Mr. Hatfield suggested as a possible solution?

Mr. LARGENT. I would say our companies are at a point where they are exploring every opportunity, every option that is available to them including how to utilize their own spectrum that they currently have, use it more efficiently and look at every other avenue that is available to them in the years ahead to access more spectrum.

Mr. STUPAK. Are any of the companies within your organization using the dynamic spectrum access? I mean, are any of them trying to borrow, if you will, during a peak time surrounding system? Is that going on now?

Mr. LARGENT. I am sure they are looking, as I said, at every option that is available to them.

Mr. STUPAK. Mr. Smith, good to see you and thanks for being here. Let me ask you this one. I think it is important that we look for or search for a solution to the spectrum crisis that preserves free over-the-air broadcasting while fostering wireless broadband deployment. In your testimony, you cite how the use of white space spectrum in rural America is a way to support both of these public interest goals. Is this solution workable in urban centers as well?

Mr. SMITH. It may well be. However, we do have a concern about interference and want to make sure that we don't degrade other signals.

Mr. STUPAK. Let me ask you this. Has NAB conducted any studies that show how much spectrum is needed to fulfill future business plans of mobile TV, multicasting and HD television? Have you done some studies?

Mr. SMITH. We are doing a study right now on that very question because we understand the importance of this issue and want to have the best information possible.

Mr. STUPAK. Any idea when that study may be done?

Mr. SMITH. I don't have a date but I will get that to you, Congressman.

Mr. STUPAK. OK. Thanks.

Mr. Hatfield, we talked a little bit about the spectrum crisis. Do we only have to worry about that for the high population centers or is this a national issue? I mean, in my rural area, we have a lot of places where we don't have anything, so——

Mr. HATFIELD. Exactly. It is primarily a large urban area issue, and even within that urban area there are some real hotspots. An example would be a football stadium on Sunday afternoon. Having said that, I think I tend to divide the problem into two parts, and that is the urban problem and the more rural problem, and we need these more dynamic ways to be able to use the spectrum in the rural areas that is not needed because of the lack of population density.

Mr. STUPAK. Well, let me ask you this. Is more access to spectrum the only issue the FCC and this committee should be focused on or are there other efficiency gains that can be explored with next-generation smart phones?

Mr. HATFIELD. As I indicated in my written testimony, I don't hold out an awful lot of hope for some of the traditional solutions for the major urban areas, but there are certainly the examples that I gave like compression and so forth that we should be pursuing. I don't think those technical solutions solve the problem completely.

Mr. STUPAK. Well, if we start using these smart phones, wouldn't the manufacturers sort of help alleviate some of these problems we are going to see with trying to free up more spectrum? Can that be a solution? Can we find it more in manufacturing as opposed to the FCC and government?

Mr. HATFIELD. I don't see how the handsets by themselves can do an awful lot to improve with the exception of the sort of dynamic spectrum access where the handset is smart enough that is looking around to see what other spectrum might be available and moving to it so we can use the intelligence in the handset to find additional spectrum. I am not sure how intelligence in a handset will improve the efficiency of existing spectrum use beyond sort of incremental improvements.

Mr. STUPAK. Mr. Calabrese, did you want to add something on that?

Mr. CALABRESE. Yes. You know, I talk in my written statement about the importance of encouraging hybrid networks because, you know, as Dale said, we are reaching the limits, the technical effi-

ciency limits. We are also reaching limits in terms of how close the carriers can bring cell sites and backhaul to the consumer so you need to shrink the cell size, get more refuse, and one way to do that is, right now we have, you know, pending at the FCC are rules to extend the cutter phone device choice to wireless, and when consumers have the choice of any device, the devices increasingly will be of a type that they will decide on the fly what is my most economical path, and in most cases that will be, like in a place like this, at home, in offices and public spaces, it will be over unlicensed spectrum into local backhaul, into consumer-provided backhaul, and that will offload a lot of traffic from carriers.

Mr. STUPAK. Thank you, and thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Stupak.

The gentleman from Massachusetts, Mr. Markey, is recognized for 5 minutes.

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

Mr. Hatfield, you are talking here about capacity for dynamic sharing of a spectrum so that we can make more efficient use of currently allocated spectrum. What percentage of our spectrum needs do you think can be satisfied just by use of dynamic sharing?

Mr. HATFIELD. I have not looked at it, candidly, in that sort of quantitative way but I think—well, I am not going to answer you very satisfactorily. But I think it is sufficient enough that it would be a significant help. I don't think it gets us all the way there.

Mr. MARKEY. So what you are talking about here is something which is supplemental to what the needs are going to be in the future but not a substitute for transfer of spectrum in order to deal with the issue. Is that right?

Mr. HATFIELD. I guess I would put it slightly different. I think we are probably going to need to use all of these different techniques.

Mr. MARKEY. Well, yes. I use polysyllabic words and you put it in very simple English. We will have to use everything.

Do you agree with that, Mr. Largent? This reminds me a little bit of a discussion of CAFE standards, you know, improvement of efficiency of vehicles or appliance efficiency where we are saying can we use new technology here to get better efficiency out of these automobiles or out of the appliances which we use but at the same time you also want to do the research on all new technologies, you know, all electric vehicles, whatever to move out of the old technologies, and that is kind of what of we are talking about here: how do we get the additional spectrum but also squeeze out the maximum efficiency out of the old technology. So how do you view it, Mr. Largent?

Mr. LARGENT. Well, I would say I have a chart here that I will submit for the record and give to you if you would like to look at it but it basically talks about how efficient different countries utilize the spectrum available to them, and in the United States we have 270 million consumers and we use per megahertz 660,000 consumers per megahertz of spectrum used, and that is the most efficient by a factor of at least two of any other country save Mexico actually. They have 79 million users there. But we absolutely are using our spectrum available to us in the most efficient way possible and sometimes by a magnitude of two.

Mr. MARKEY. Mr. Smith.

Mr. SMITH. Your question to us about——

Mr. MARKEY. About this balance between squeezing efficiencies out of the old technology as opposed to moving over a spectrum to augment what we now have allocated so that we can maximize the wealth-generating opportunities.

Mr. SMITH. I think it is one of the miracles we have before us is how much more efficiently we are using the spectrum now and certainly broadcasting has invested billions to achieve that efficiency. I do believe because we have seen the explosion you spoke of at the beginning of the hearing, Congressman, that there are going to be compression technologies that will provide some of the answer here so that we can preserve the broadband and the broadcast values that the committee seeks to serve.

Mr. MARKEY. Thank you.

Dr. Johnson.

Mr. JOHNSON. Yes, Congressman, I would like to make a couple comments. First of all, the Department of Defense, one of our principal customers, is driven toward increasing efficiency. We mentioned briefly in my testimony the use of unmanned aerial systems and streaming video and the intelligence, surveillance and reconnaissance needs in Iraq and Afghanistan that are driving that efficiency as they are with the commercial market. Lockheed Martin has developed spectrum management tools that are being used by our customers to increase that efficiency but I would also like to point out that in the federal, non-federal kind of binary view of things, it is really not that. It is not a binary view at all because it is important to realize the Department is a major consumer of commercial equipment and using commercial systems both terrestrial and space so they have to balance that accommodation between commercial and federal needs.

Mr. MARKEY. Mr. Stroup.

Mr. STROUP. Yes, I would emphasize that the military is deploying dynamic spectrum access. It is being built into several military radio systems.

Going back to the question about utilization, emphasizing the point that you made regarding the PCS allocation proceeding, that spectrum was encumbered by over 1,500 microwave apps which ultimately the PCS licensees received that via auction with the understanding that they could not interfere with them and we are recommending building on that model, being able to utilize the technologies available today where they may not actually have to be relocated but actually could share the spectrum.

Mr. MARKEY. Yes, I think we have to be inflexible in terms of the goal which we are trying to reach here but flexible in terms of what the final combination looks like, but I think it will involve obviously substantial portions of both, increased efficiency and more spectrum as well, and we have to ensure that we encourage both to be maximized so that we do make ourselves as competitive as a Nation as we can looking over our shoulders at number two and three in the world, as you said, Steve, so we maintain this lead. So we thank you all very much.

I thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Markey.

The gentleman from Pennsylvania, Mr. Doyle, is recognized for 7 minutes.

Mr. DOYLE. Thank you, Mr. Chairman.

I just want to start by thanking all the witnesses but especially I want to thank Dale Hatfield for his years of dedicated public service and his assistance to policymakers and helping people across the country to better understand the technologies behind these issues. I never had a chance to tell him that personally and he is here and I want him to know that, so thank you, Mr. Hatfield.

Mr. Largent, Mr. Smith, you both talk a lot about mobile video broadcasting, and I am curious, do you think people want to watch a limited number of channels at a set schedule on a device about this big or do you think they want to watch their choice of programs when they want to watch them, and should that consumer preference drive spectrum decisions?

Mr. LARGENT. Well, I would say that from my personal experience, the older I get, the harder it is to watch television on a handset, but, you know, we are serving closer probably now 280 million customers in this country will probably be the statistic at the end of this year and I would say that there probably is consumer uptake of that particular service as it becomes available and it is available now.

Mr. DOYLE. Mr. Smith.

Mr. SMITH. Congressman Doyle, I don't believe they should be regarded as exclusive. I think we can do both. And I know young people are highly interested in mobile TV and I suspect many who don't have to wear these are as well. That said, I think it is very important that these new inventions like Hulu coming along are using broadcast content, it won't be many years until your laptop will have a broadcast signal too, and so it is not either/or. It is both.

Mr. DOYLE. But it seems to me—and I agree, I think it is young people because I couldn't watch TV on this either. But it seems to me those same people are the ones that don't want a set schedule. They want to watch their show when they want to want their show, and that being the case, you know, as we talk about where is the best place to allocate spectrum, it just—I just saw a note here, "I want to watch the Steelers beat the Seahawks in real time." Right now the Steelers aren't beating anyone. Eddie, were you responsible for that?

Mr. SMITH. And Congressman, to that point, I hear your point but I also hear Congressman Markey's point. I hear people say no, I want to watch it when it is really happening and it is just part of being the American tradition, particularly when it comes to sports. People are very anxious to see it live in real time.

Mr. DOYLE. Mr. Hatfield.

Mr. HATFIELD. First of all, I want to thank you for your kind remarks earlier but I think as an academic stepping back from this, you have asked a very, very fundamental question. If people want to watch content simultaneously, than that old broadcast model is a very efficient way of doing it. If people want to watch individual things, then the more cellularized approach is more efficient. So here your decision or our decision is how that balance should be

made, and of course on the broadcast side we probably have this additional public interest benefit that may sway the decision but I think from an engineering standpoint, that is the fundamental question, how much of it is individual choice and what time you want to watch it and how much of it do you want to watch simultaneously with other people in the country.

Mr. DOYLE. Does anyone else want to chime in on that? OK.

I just have one other question. Mr. Smith, in the Pittsburgh area, roughly about 8 percent of the people in my region get their broadcast with rabbit ears, you know, over-the-air broadcasting, and I was just curious if you have any numbers on how many people—yes, 8 percent watch with rabbit ears. How many people—do you have any numbers on how many people watch HDTV over the air with, you know, the rabbit ears versus relying on standard def? Is there any kind of figures like that?

Mr. SMITH. I have heard the range from 8 percent to 20 percent but I think there are a couple of other factors that are important depending on your Congressional district. For example, Mr. Barton's district, it may go as high as 40 percent, and over the air tends to be about people who are rural, who are poor, who are elderly, who have also invested in the digital transition.

Mr. DOYLE. Do you think they have HDTVs?

Mr. SMITH. I believe the figure of $25 billion, which is an estimate of what people have spent in the digital transition, I think many of them do now and they really like high definition and they don't want to see it degraded and they are beginning to really value the multicasting so that they get a religious channel, a weather channel, a Hispanic channel, a Korean channel. This is the miracle that is now made possible because we all did this and it is a very exciting future that I hate to see clouded by ill-considered ideas that pit broadband against broadcast. I do think in the fullness of time there will be technologies that will provide for both.

Mr. DOYLE. Thank you.

Mr. Chairman, I have no more questions. I will yield back.

Mr. BOUCHER. Thank you very much, Mr. Doyle.

The gentleman from Washington State, Mr. Inslee, is recognized for 5 minutes.

Mr. INSLEE. Thank you.

Mr. Largent, we know Americans are going to be looking at their cell phone much more frequently and on an hourly basis. I just wonder what suggestion you could give us on things we could do here or FCC to promote investment in the networks that are really going to be necessary. Just give your general thoughts about that.

Mr. LARGENT. Well, number one, I would applaud what the FCC did in November by approving the tower siting initiative. We have been fighting this battle for a long time, giving local jurisdiction, States the ability to object to tower siting proposals but doing it in a timely fashion, and that goes a long way to helping this industry provide more service to this country, so I really applaud the FCC for their action on the tower siting. The two bills that we are looking at today are kind of the beginning of the process, the end of the process. The spectrum inventory bill looks at the possible spectrum that is out there, how it is being used and what spectrum could be identified for higher and better use perhaps. And then

your bill comes in at the end of the process and says here is a more orderly fashion to move the current spectrum holders to their new spectrum and do it in a more efficient, effective way and do it faster, so both of these bills are good bills and go a long way to improving a process of acquiring additional spectrum which the wireless industry is sorely going to need in the years to come.

Mr. INSLEE. I want to make sure I didn't miss anyone. I didn't hear any good or even not-so-good constructive criticism of our bill, and I want to make sure I hadn't missed any. Does anyone have any suggestions on the bill I am working with Mr. Upton on that you would suggest to improve the product? We are always looking for good suggestions. This might be the first hearing in American history where there isn't any constructive criticism, so this is quite an achievement.

Mr. Calabrese, you have suggested broadening the purpose of the spectrum relocation fund to support modernizing federal systems and allowing for a greater degree of band sharing. Could you give us any sense what you would be suggestive of as far as cost and what type of approach?

Mr. CALABRESE. It is very difficult to know the exact cost. In fact, I would assume probably, you know, first of all that the agencies that would be proposing to modernize their system to free up spectrum for sharing that they would be in a sense second in line. You know, there would first from that spectrum relocation fund the priority for those agencies that needed to migrate off a band so that it could be cleared for licensing as we did with AWS, you know, the fundamental purpose of your bill. But then secondarily, you know, like now we have remaining funds and then I think they should—agencies should be able to apply to the technical panel that you propose in the bill setting up which would then recommend to OMB which of those, you know, on a competitive basis which of those would have the greatest impact in terms of freeing up spectrum for the commercial sector or for spectrum efficiency, and it is really a great benefit because it would make those agencies more effective with more modern communication while also freeing up spectrum.

Mr. INSLEE. Thank you, Mr. Chairman.

Mr. BOUCHER. Thank you very much, Mr. Inslee.

I am going to ask unanimous consent on behalf of the gentleman from Nebraska, Mr. Terry, to insert in the record a letter concerning the subject matter before us of the Electronic Warfare and Information Operations Association. Without objection, that will be made a part of the record.

[The information appears at the conclusion of the hearing.]

Mr. BOUCHER. And the gentlelady from California, Mrs. Bono Mack, is recognized for 5 minutes.

Mrs. BONO MACK. I thank the Chair.

I would like to ask a question of Dr. Johnson. In your testimony, you indicated that future government spectrum needs will be focused on high-bandwidth uses such as video for UAVs or high-altitude surveillance aircraft. Is that correct?

Mr. JOHNSON. Yes, that is correct.

Mrs. BONO MACK. Can you please provide an estimate of the percentage of the DOD's high-bandwidth video capacity used by UAVs

and other surveillance aircraft that is currently provided by commercial satellite systems using spectrum above 10 gigahertz?

Mr. JOHNSON. No, I can't provide that but we can provide that after the hearing.

Mrs. BONO MACK. Thank you. And do you believe that most of the future high-bandwidth video capacity for the UAVs also will use spectrum above 10 gigahertz?

Mr. JOHNSON. I don't know the answer to that.

Mrs. BONO MACK. OK. Thank you. If I can get the answers in writing after the hearing, that would be great.

At this point I would like to yield the balance of my time to my colleague, Steve Buyer.

Mr. BUYER. Thank you very much. The question I have—and I thank you for yielding—is about the delays in the delivery of spectrum and its impact on delivering commercial systems. So when you look back even back in 2006 when T Mobile paid a lot of money out there, $4.2 billion, for spectrum, you know, we are 5 years down range now and we still don't have systems being delivered, and so when we lay out these timelines for the delivery and they are not met, so I look at this legislation before us and I am interested in your opinions if I were to offer an amendment, and Mr. Markey talks about giving encouragement. What about if I were to offer an amendment that has a penalty clause so that if a government department or agency does not deliver the relocation at the timeline that is specified whether it is classified or unclassified, then that department or agency is to pay interest on the monies relative to where that spectrum is located? So you can figure out what the economic impact would be, so if DOD says well, it is too difficult for us to deliver the spectrum from Mobile, Pensacola, to Jacksonville because we have our classified issues. Well, deal with it then. Tell us what they are. You said you could deliver on a particular date, then deal with it. And so I am interested if I were to offer such an amendment as an incentive, because if we ask for these companies to put billions of dollars—you are asking for the next auction. We do the next auction. Government takes the money and we use the money yet aren't delivering when we said we would.

And so in the end, Mr. Smith, you talked about public values. Public values are based upon virtues. If you are going to have a deal, you can't have a deal without fidelity and fidelity requires two people, and so if government is not upholding its fidelity, then maybe we should have an encouragement clause called a penalty clause. What are your ideas, your thoughts, Mr. Largent?

Mr. LARGENT. Well, I like your thinking going into this but I would prefer—I mean, I am just thinking about this freewheeling right now so I wasn't prepared for the question, but as I think about it, I think perhaps you could build incentives for the people that are moving off the spectrum to get off so that you give them the spectrum relocation money. You would give them, you know, some amount of money if they are off in a year and you give something less than that amount if they are off in 2 years, so you give them more money to relocate the faster they are able to relocate as opposed to the same amount of money whenever they relocate.

Mr. BUYER. Well, we can incentivize and penalize, right?

Mr. LARGENT. We like incentives.

Mr. BUYER. I understand.

Mr. Smith?

Mr. SMITH. Congressman, NAB really doesn't have a dog in the fight, so to say, but having said that, I applaud the way you are thinking because I think it would have the effect of incentivizing more interest in spectrum auctions if they knew that there was a two-way street and they would be treated fairly.

Mr. BUYER. Thank you. I would like to explore this idea with not only my colleagues but with you on how we can build this into this piece of legislation. Thank you. I yield back.

Mr. STUPAK [presiding.] I would have to put a second degree amendment on your amendment and we would have to punish all Members of Congress who spend that spectrum money five times over.

Mr. BUYER. I agree with you.

Mr. STUPAK. And with that, I think we will close this happy hearing. Thank you to all of our witnesses. Have a good holiday and thank you for being here.

[Whereupon, at 12:00 p.m., the Subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

Statement of Representative Anna G. Eshoo
Subcommittee on Communications, Technology, and the Internet
House Committee on Energy and Commerce
2123 Rayburn House Office Building
December 15, 2009

Thank you, Mr. Chairman for initiating this timely discussion about spectrum allocation issues. I know that the witnesses today will provide a broad range of opinions about spectrum needs and usage, and I expect that we will hear sharp contrasts in their individual perspectives.

While I'm a member of this Subcommittee, I also chair the Permanent Select Committee on Intelligence's Subcommittee on Intelligence Community Management. So my personal view is shaped by the knowledge that commercial spectrum is crucial to our nation and we must also safeguard the channels that our intelligence, military and security agencies may need in the future. Our very lives may depend on it. We have to find the happy medium on the spectrum chart, one that will spur economic growth and development while keeping America safe in the new world community.

I'm a cosponsor of the *Radio Spectrum Inventory Act* because I believe that the FCC and the NTIA have the capacity to review our spectrum assets in a judicious manner and develop the informational resources that will guide us

into the future. We've found that while spectrum is a finite resource, it's also somewhat elastic in nature – where we once had one analog channel, we now have six digital channels. We've found flexible organizational models can allow for shared uses and new technologies.

What there isn't room for is spectrum hoarding – we don't want people holding spectrum as if they're guarding an unused parking space. We just can't afford that luxury in this economy and in the world of competitive wireless services. Use it or lose it because spectrum waits for no one. Round it up and roll it out so that all Americans benefit.

As I look out at our witnesses, I recognize a group of old pros on the telecom circuit. You must have at least 200 years of telecommunications know-how shared among you. We need their shared knowledge to help lead toward better ways to share the spectrum. I look forward to hearing from you today.

December 15, 2009
Opening Statement
Congressman Fred Upton
Subcommittee on Communications, Technology, and the Internet
Hearing on Spectrum Legislation

Mr. Chairman, thank you for calling this hearing today. I would like to extend a special welcome to our former colleague Steve Largent and to Senator Smith, who is making his first appearance before our Committee since joining NAB earlier this year.

I will focus my brief statement on H.R. 3019, The Spectrum Relocation Improvement Act of 2009, bipartisan legislation that I introduced along with my friends Mr. Inslee and Chairman Boucher.

During President Obama's Jobs and Economic Growth Forum, he said: "Broadband infrastructure investment holds great potential for job creation, both in the deployment but also the innovation it affords." I agree wholeheartedly with the President, that private sector investment in broadband infrastructure can be a great job creator. However, I have grave concerns that the FCC's proposed Net Neutrality regulations will stifle new investment. Additionally of concern are hiccups in the government's process for clearing Federal users from spectrum that has been paid for and reallocated for commercial use.

The economy is struggling. Our bill, HR 3019, encourages private investment in broadband infrastructure, one of the few sectors where we're seeing new investments, which will in turn help create jobs. This bill aims to remove impediments that could prevent or delay capital investments by companies seeking to provide wireless broadband services to consumers.

The current federal spectrum relocation process was created as a win-win opportunity. Proceeds from spectrum auctions would be used to upgrade and relocate government wireless use while simultaneously freeing the cleared spectrum for commercial use. Complexities in the relocation process, however, have effectively prevented several companies that cumulatively invested over $13 billion in spectrum bids and billions more in equipment and infrastructure

from deploying wireless broadband services. Given this fact, we need to provide real certainty for companies putting up billions of dollars and speed up the government's process. With the impediments that exist today, capital investments are being stranded and the values of future auctions are being depressed. Not to mention the potential for job creation has diminished as a consequence. The Inslee-Upton-Boucher Spectrum Relocation Improvement Act aims to do just that by streamlining the auction relocation process.

This is important legislation and I look forward to work with my Colleagues on this committee to get this bipartisan bill to the President's desk.

I yield back.

Association of Old Crows

December 14, 2009

The Honorable Henry A. Waxman
Chairman
House Energy & Commerce Committee
US House of Representatives
Washington, DC 20515

The Honorable Joe Barton
Ranking Member
House Energy & Commerce Committee
US House of Representatives
Washington, DC 20515

Dear Mr. Chairman and Mr. Barton:

On behalf of the AOC – The Electronic Warfare (EW) and Information Operations (IO) Association[1] – I write to express our concerns about H.R. 3125, the Radio Spectrum Inventory Act. The AOC is *the* professional association chartered to advocate for issues pertaining to military operations within and across the electromagnetic spectrum (EMS). The AOC believes in a strong national defense with an emphasis on the criticality of the EMS to current and future military operations. We therefore believe that H.R. 3125 will significantly and disproportionately affect the joint warfighters who rely on the EMS to train and fight in demanding environments such as Iraq and Afghanistan.

The EMS is a warfighting domain fundamental to the range of military operations (ROMO). Its availability is essential to existing and emerging technologies in EW[2], Network-Centric capabilities, communications systems, satellite resources, and multi-spectral sensors.[3] Current H.R. 3125 language threatens to undermine the growing military requirement to conduct operations within and across the EMS and raises four primary concerns that our association has regarding the bill:

1. **Spectrum Utilization**. The Department of Defense (DOD) utilizes the spectrum much differently than the commercial wireless industry. "Utilization" is a snapshot of spectrum activity; however, the bill does not clearly account for passive usage - when receivers and sensors are listening to the EM environment, but not necessarily transmitting signals. Passive spectrum usage is critical to our military's electronic intelligence (ELINT)[4] and signals intelligence (SIGINT)[5] communities, and national EW test, evaluation and enemy exploitation capabilities.

2. **Annual Inventory/Reallocation**. The annual inventory and reallocation process would hurt both DOD and defense industry's capacity to invest and develop advanced spectrum-utilizing technologies necessary for combat in the 21st Century. Defense planning and program management often has a long-

[1] The Association of Old Crows (AOC) is a not-for-profit international professional association with over 13,500 members and 150+ organizations engaged in the science and practice of EW, IO, and related disciplines. Founded in 1964, AOC has members in 47 countries with 65 chapters in 19 countries. AOC's membership includes executives, scientists, engineers, managers, operators, educators, and military personnel. For more information, visit www.crows.org.
[2] *Electronic Warfare*, Joint Publication 3-13.1, 25 February 2007, page v
[3] CJCSI 3320.1b (4.a) instructs that "[joint] military operations Military operations rely heavily on equipment using the limited resources of the electromagnetic spectrum. In joint military operations, requirements may exceed the amount of spectrum available. As a result, efficient use and control of the spectrum are critical to national security in terms of information operations (IO), combat operations and electronic warfare (EW)."
[4] *Electronic Warfare*, Joint Publication 3-13.1, 25 February 2007, GL-8
[5] *Electronic Warfare*, Joint Publication 3-13.1, 25 February 2007, GI-13

1000 North Payne Street, Alexandria, VA 22314
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term outlook to ensure proper coordination and deconfliction.[6] An annual process creates uncertainty that would dissuade investment in long-range research and development and increase acquisition costs for our nation's military. "Underutilized" today does not mean unnecessary tomorrow. DOD is experiencing the rapid growth of military spectrum requirements, which is leading to advances in spectrum-utilization technologies and spectrum management.

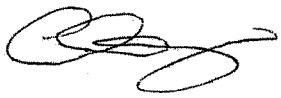
3. **National Security.** While the legislation seeks to protect against harming national security, the inventory requires the release of data on spectrum utilization that would harm warfighters. We believe that the legislation must provide DOD with greater authority to withhold data from inclusion in the inventory. Furthermore, within the framework of national security, the U.S. military focuses primarily on mission effectiveness.[7] Spectrum encroachment today is detrimental to the military's ability to train and conduct operations. Our warfighters must be able to "train like they fight" in complex, congested, and contested spectrum environments.

4. **Public Disclosure.** The legislation creates a web-based portal to make the inventory publically available. If defense spectrum activity data becomes publicly available it will be too easy for adversaries and peer competitors to learn about how the U.S. military is utilizing the spectrum and ultimately exploit weaknesses. Protecting sensitive information about spectrum utilization is challenging today and H.R. 3125, as written, will only make it more difficult – potentially putting the lives of our warfighters at risk.

The AOC fully comprehends the potential economic value of spectrum inventory and reallocation. We also recognize the important contributions of the commercial wireless industry to the advanced military capabilities our warfighters are presently using in combat. However, it is vital to mission effectiveness and for the safety of our warfighters that our military controls the electromagnetic spectrum in operations from the first day of conflict until the last. The EMS is a dynamic and ever-changing environment, and the U.S. is no longer a generation ahead of its peer competitors. We must ensure that DOD can manage military utilization of the spectrum and provide long-term strategic planning and program development.

Therefore, I appreciate your consideration of our concerns. I respectfully request the opportunity to meet with you or the appropriate Committee staff to discuss the legislation and our recommendations to protect our warfighters. Please do not hesitate to contact me if you have any questions or need additional information. I look forward to hearing from you.

Sincerely,



Mr. Christopher L. Glaze
President

[6] CJCSI 3320.1b (4.e) states that "[planning for use of the spectrum resource and assigning of spectrum management responsibilities must be fully integrated into the Joint Operation Planning and Execution System (JOPES) process. The complexity of effective joint spectrum use and management requires advance planning for scenarios of expected military operations."

[7] Electronic Warfare, Joint Publication 3-13.1, 25 February 2007, Appendix F-2

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