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SPECTRUM MANAGEMENT: IMPROVING THE MANAGEMENT OF GOVERNMENT AND COMMERCIAL SPECTRUM DOMESTICALLY AND INTERNATIONALLY

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

JUNE 11, 2002

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SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

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SPECTRUM MANAGEMENT: IMPROVING THE MANAGEMENT OF GOVERNMENT AND COMMERCIAL SPECTRUM DOMESTICALLY AND INTERNATIONALLY

TUESDAY, JUNE 11, 2002

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

The Committee met, pursuant to notice, at 9:38 a.m. in room SR–253, Russell Senate Office Building, Hon. Daniel K. Inouye, Chairman of the Subcommittee, presiding.

OPENING STATEMENT OF HON. DANIEL K. INOUYE, U.S. SENATOR FROM HAWAII

Senator INOUYE. This hearing will continue to explore the complex issues concerning spectrum management in an effort to help us move forward and develop a national spectrum management policy. Piecemeal proposals to allocate and reallocate spectrum are not in our Nation's best interests. In addition, the ongoing war against terrorism has shed new light on Government spectrum needs.

The testimony before the Committee today should provide useful information as we work to develop a legislative framework for managing spectrum. The particular issues before us today include: one, improving the process for assigning and allocating spectrum; two, reimbursing Government users for their reallocation costs if they are required to relinquish their spectrum for commercial uses; three, increasing U.S. participation in the World Radio Conference process; and four, the status of third generation wireless service.

Since 1993 the Government users have been required to turn over portions of their spectrum for use by commercial users. In order to facilitate this process, many have suggested that Government users should be reimbursed through auction proceeds for reallocation costs they incur in order to move to new spectrum blocks or consolidate their existing operations.

As we will hear today, there are also proposals to use auction proceeds for other beneficial purposes. In July of last year the Communications Subcommittee studied the need to make available spectrum for third generation wireless service. However, it seems that almost a year later we are not much closer to a resolution of this matter.

Recent postponement of spectrum auctions reinforces the need to develop a national spectrum policy, one that supports the develop-

ment for emerging technologies while meeting the needs of Government users.

Spectrum allocation is not only a domestic issue. It has become an important international issue. The U.S. must work to improve its participation in the World Radio Conference to successfully negotiate spectrum use internationally.

As we consider these issues and work to improve the Nation's management of spectrum, regulators must recognize the need to exercise leadership on and more effectively address these increasingly complex spectrum use and management issues. Spectrum management is important to both Government and commercial users. Incumbents and new entrants continue to seek additional spectrum to upgrade existing wireless technologies as well as introduce new ones.

Given the growing importance of wireless technologies to consumers and Government users, we must rise to the challenge and resolve these issues to best serve our Nation's interests. We must face these challenges head-on. In developing a new spectrum management approach, it is my hope that regulators will strive to stand in each other's shoes by viewing the issues not only from the perspective of their constituencies, but also from the perspective of those competing interests.

We must approach this issue creatively and bring forward new ideas to comprehensively address our Nation's spectrum allocation.

With that said, I welcome the witnesses and look forward to their testimony. We are most honored to have with us as our first witness——

Senator MCCAIN. Are we going to have opening statements?

Senator INOUYE. Oh, I am sorry, yes. May I call upon the Chairman of the Committee, Senator Hollings.

STATEMENT OF HON. ERNEST F. HOLLINGS, U.S. SENATOR FROM SOUTH CAROLINA

The CHAIRMAN. Thank you, Mr. Chairman. I will file my statement for the record and simply say that our Committee is indebted to you for your leadership and for your calling the hearing here on this spectrum issue. The fact is that this Committee is charged primarily with the responsibility of communications in this country of ours and yet we do not have a spectrum policy.

I serve on the Budget committee and every time we get a shortfall they say, well, let us sell some spectrum. It is used for any and everything except the advancement of communications. Yet at the same time we have got the demands, we have got the educational demands. There is an interesting initiative by our friends Mr. Larry Grossman and Newt Minow. There is the need, of course, for broadband. There is the need for the wireless.

Of course, foremost is the need of our Department of Defense. As the chairman of the Defense Appropriations Subcommittee, I know that you have got that foremost in mind. So what I would like in this hearing is to begin to determine just exactly the needs of the Defense Department. They will fight at those needs.

I was on the Budget committee when Rumsfeld was Secretary under President Ford and as chairman of a task force on defense for the budget, I found they had put 2 percent cut insurance. They

had all the budgets come through. They had gotten their submission ready to send to the Congress and then they just added 2 percent on the premise that, wait a minute, the Congress is going to cut us, so we want to get what we want and the best way to do it is to put cut insurance on there of billions of dollars.

So I know how that crowd works. We in turn have got to study it carefully and make sure they have got all they need, but begin as an industrialized nation to develop an expansion of the spectrum usage here in the United States. As an industrialized country, we probably have less spectrum allocated than any in the world.

Thank you very much.

[The prepared statement of Senator Hollings follows:]

PREPARED STATEMENT OF HON. ERNEST F. HOLLINGS,
U.S. SENATOR FROM SOUTH CAROLINA

I commend Senator Inouye for holding this hearing. I believe that we are at a cross roads in spectrum management. We are essentially faced with two choices—continue managing spectrum as we have in the past or develop an improved framework for addressing the increasingly complex spectrum issues that we face. I think it is incumbent on everyone, policy makers, regulators, commercial users, government users, new service providers, as well as manufacturers to candidly engage the difficult issues facing the nation regarding spectrum use and management, and work together to resolve those issues in a fair and creative manner.

One of the important issues that must be addressed is finding and making spectrum available for third generation wireless service. Clearly, to successfully meet this challenge, re-allocations of spectrum, in addition to upgrades in technology to make better use of the spectrum, will be required. Although this presents crucial challenges for policy makers, such steps must be taken if we are going to meet the growing market and technological needs of both government and commercial users of spectrum.

Freeing up more spectrum is not only critical for the offering of 3G service by wireless carriers, but also necessary for U.S. international competitiveness, and making new and innovative wireless services available to U.S. consumers. In fact, recent consumer data on wireless use demonstrates the need for additional wireless services. It noted that in the last 6 months of 2001 alone, U.S. consumers used more minutes than in all of 2000, and that by 2005, wireless usage is expected to equal more than 40 percent of all U.S. telecom minutes. As it stands, carriers are beginning to implement new wireless mobile data applications which will become increasingly important to consumers and how we conduct commerce.

Because of these important needs and developments, I must say that I am disappointed with the lagging pace of finding spectrum for 3G service. After spectrum bands were identified for 3G service at the last world radio conference, president Clinton, in October of 2000, directed all federal agencies to work with the FCC and the private sector to identify spectrum that could be used for 3G service domestically. Even though it's been almost two years since that charge, we have still not made much progress on the issue.

Now there is a new proposal on the table. NTIA, along with DoD, is examining whether the 1710–1770 MHz portion can be used for 3G service. At the same time, the FCC is examining whether the 2110–2170 MHz band can be reallocated for 3G service. Although this current proposal represents a start, given its potential to provide 120 MHz of spectrum, it, nevertheless, is 80 mhz short of the 200 MHz that the international telecommunications union concluded is required for 3G service.

I expect that, in addition to the other issues that this hearing will address, it will provide us with a clearer understanding of what it will take to meet the challenge of making spectrum available for 3G service. I understand that if DoD has to relinquish spectrum that it is currently using as well as to relocate or modify its operations, it will need to be reimbursed for its costs and may need additional spectrum in which to relocate its operations. I also understand that there are some existing wireless commercial users that may be affected by efforts to find spectrum for 3G services. While both of these issues are not easy ones, we are willing to work with everyone to find a solution, and clearly our national security cannot be jeopardized by this process.

Spectrum undoubtedly is an increasingly scare resource. In this environment, there are only a few ways to find more spectrum. Our choices are reallocating spec-

trum from existing users, or developing technologies that can use spectrum more efficiently or use spectrum in frequency bands that are unusable today. As we move forward, all stakeholders must be willing to explore and pursue all options. With that said, I welcome the witnesses and look forward to hearing their testimony.

Senator INOUYE. I thank you, sir.

Senator McCain.

STATEMENT OF HON. JOHN MCCAIN, U.S. SENATOR FROM ARIZONA

Senator MCCAIN. Thank you, Mr. Chairman. I want to thank you and Senator Hollings for holding this hearing. I am particularly grateful that this is a full Committee hearing, reflecting the importance of this issue for both national defense and our economy.

I would like to associate myself with the comments of Senator Hollings. Today there are even greater spectrum demands for both commercial and Government uses that make the task of managing this resource increasingly challenging and the importance of doing so effectively increasingly vital to our national interests.

There are over 130 million wireless customers in the United States today, triple the number of wireless users in 1996. We all know the promise of 3G technology and it is important that we continue to foster the growth and development of these new and innovative technologies. However, we are still in a war. Threats to the security of the United States are there. It makes more urgent the task of reorganizing our military and the people, weapons, technology, and planning necessary to ensure the success of our world leadership. Clearly spectrum plays a very vital role in that effort.

I believe it is critical, as the Chairman said, for our military forces to be properly equipped with the latest technology to keep America's edge on the twenty-first century battlefield. More importantly, our military forces must have the resources necessary to complete their mission during time of war.

That is why, Mr. Chairman, I think it is important that we get a definitive statement and assessment of needs by the military as well as public safety and transportation interests, so we can ensure that their views are heard as we strike a fine balance for finding and allocating spectrum for 3G and other future wireless services, while ensuring our military forces and other public users have enough spectrum for current and future needs.

I think there is some time sensitivity associated with this issue, Mr. Chairman, as more and more clamor for the spectrum, increased by commercial and other interests. I hope we can set the parameters and policies, which so far we have been unable to do, nor has the administration presented to my knowledge.

I thank you, Mr. Chairman.

Senator INOUYE. Thank you.

Senator Burns.

STATEMENT OF HON. CONRAD BURNS, U.S. SENATOR FROM MONTANA

Senator BURNS. Mr. Chairman, thank you very much for today's hearings. I think this is the first shot really or the first step that we have, after looking at this situation, that we find ourselves in spectrum policy and especially in offering any kind of reform.

Clearly there are many dimensions in this information age, but none more important than the use and the availability of spectrum. This issue at hand is not simply the allocation of spectrum for 3G or third generation, but also how to create a process for managing this valuable commodity in such a way to ensure national security, ensure commerce, but most of all to propel our transition into the next phase of the digital era, where information is truly available to all Americans regardless of geography.

I became convinced more than ever of the need of comprehensive spectrum reform after recently traveling to Asia over this last Memorial Day recess. During my trip in Korea and Japan, I met with top legislators, telecommunications CEOs, and was quite impressed with the products and the services available to their consumers.

Unfortunately, while consumers in Korea and Japan choose from a wide variety of third generation services, the rollout in the United States has been slow and it has been very choppy. Clearly, this is no accident as the amount of commercially available spectrum in Asia is twice that available to the industry in the United States. Making innovative wireless services available to consumers should be a national priority of every country.

Unfortunately, the situation regarding spectrum allocation is far different in the United States. Put simply, we do not manage our spectrum well. At the heart of my concerns about our allocation of spectrum is the very auction process itself. The current process has resulted in creating a win-at-all-costs mentality among bidders that often results in widely inflated bids that cripple the companies that gain access to the spectrum. I can say something about auctions.

I also remain troubled by views of spectrum as a sort of a national resource, to be exploited for maximum budgetary impact. We have seen the results of this kind of thinking both in Europe and here at home, which instead of maximizing revenue has often resulted in bankruptcies and endless hours, days, months, and years in the courtrooms.

Rather, spectrum should be viewed as a technology which is the key to the future of the new generation of services for American companies and consumers.

I have a variety of other concerns, including whether current division of spectrum authority should be between two agencies. Currently the two heads of the FCC and the NTIA are coordinating well, but from an institutional standpoint and perspective I fear the division leads to bureaucratic turf battles and inevitable delay.

I am also interested in placing greater emphasis on our preparations for our participation in the World Radio Communications Conference.

With these concerns in mind, last year I requested a comprehensive GAO report on spectrum allocation last year, along with my colleagues Senator Kerry and Senator Hollings. This report, which is unprecedented in its scope, will be completed this summer. I will use those findings as a basis to guide some of my thinking in preparing a comprehensive spectrum reform bill later on this year. This is a huge issue.

Comprehensive spectrum reform has the potential to create numerous high tech jobs, to jump start the current ailing technology sector of our United States economy. We need to create a spectrum

plan that will focus on managing spectrum in a rational way, balancing the needs of industry and Federal agencies. The emphasis of this plan must focus on developing innovative new wireless technologies.

I would also state at this point, working with my Chairman, Mr. Inouye, and the full Committee Chairman Mr. Hollings, I look forward to the challenges that we will have to face in developing a fair, balanced resolution to this issue.

I look forward to the testimony of the witnesses today. Thank you, Mr. Chairman, for this hearing, both Mr. Chairmen. I feel like it is probably one of the more vital things that we will do in this summer session.

Senator INOUYE. I thank you very much.

Senator Brownback.

STATEMENT OF HON. SAM BROWNBACK, U.S. SENATOR FROM KANSAS

Senator BROWNBACK. Thank you, Mr. Chairman. I just want to add a couple comments to what has already been said.

One is that—and I think this has been made by the Chairman and others—Congress has permitted spectrum auctions, intended as an efficient and objective means of licensing spectrum, to become a mere tool for raising revenue. On that I want to raise my voice as a part of the chorus saying that is just a wrong-headed way to go. I do not think we ought to look at this as a way to raise money. We should be looking at it as an overall policy issue.

We should consider deposits of auction revenues in the Treasury as an added bonus, not the primary goal of spectrum auctions. However, since the passage of the Balanced Budget Act of 1997 we have clearly lost sight of these principles.

The transition to digital television was intended to be a cooperative, market-driven process. Yet 2006 was set in the statute for the transition to come to a close. We made this decision in 1997, not because it was realistic, but because such a decision was required for budgetary purposes. Now, think about that. We decided in 1997 that this transition would end in 2006. Did we know that that was going to take place? Did we think that was a fully appropriate period of time? It was primarily driven by budgetary needs.

The end result is Congressional impatience with the DTV transition, even though it has probably proceeded without undue delay considering the level of investment that is required, the technological hurdles, and the policy resolutions required, too.

Also, we have been forced to address issues that, quite frankly, should never have been raised, such as the 700 megahertz debacle. Today's reliance on spectrum auctions for revenue generation and not solely for spectrum assignment cannot continue. With that, I want to again add my voice to what the Chairman and others have already said.

I want to make one other note on a nascent issue that is developing here. The notion of, at this point in time, setting aside spectrum auction revenues for non-spectrum management-related purposes is not a good concept for us to engage at this point in time. Again as I have stated, the first goal of spectrum auction revenue

should be the management of the spectrum itself, and not raising revenue for non-spectrum management-related purposes.

Issues such as reimbursement for relocation must be addressed and assisted through the use of auction revenues that have been received. We have major transition issues that are going to be involved in comprehensive spectrum management reform and I think that is the more valuable place for us to be looking to focus these resources, rather than create another driver, causing us to push constantly for the sale of spectrum for a purpose other than the management of the spectrum itself.

I think if we engage nonspectrum-management-related purposes, you are just going to get another pusher in the system to sell more spectrum, and I do not think that is wise in us looking for an overall spectrum management policy.

I appreciate the hearing. I think it is a good topic. I hope it is one that we can get aggressively engaged upon. Thank you, Mr. Chairman.

Senator INOUYE. Thank you very much.

Senator Wyden.

STATEMENT OF HON. RON WYDEN,
U.S. SENATOR FROM OREGON

Senator WYDEN. Thank you, Mr. Chairman. I too join in praising you and Senator Hollings for this hearing. I think that spectrum policy is the single most important issue in the telecommunications field. I think that when we look back 5 or 10 years from now at all the telecommunications issues that we are debating, I think we are going to say that spectrum policy issues had the most significant impact.

I am of the view that probably the best way to promote real competition is through wireless, probably the best way to get significant additional service to rural areas is through wireless. But the only way you are going to do that is to reform the system of spectrum policy in this country. It is unquestionably a Jurassic system. Virtually nothing has changed since the 1920s, when spectrum was used for radio and radio only.

I would sum it up by way of saying that inefficiency is now built into the system. So what I would like us to do as we examine this issue—and we will certainly be spurred by the GAO study this summer—is to say that the heart of a new spectrum policy should be to create new incentives to use spectrum in an innovative way, in a creative way, to share it, rather than in effect pull it close to you and hoard it.

Essentially, today's system encourages people just to hold everybody hostage and get the best ransom you can for it. I think we can do much better. As of now those incentives are lacking in the commercial area, they are lacking in the Government area, they are lacking with respect to the military. I think that is what we need to zero in on. I look forward to working with you and our colleagues to do it.

Senator INOUYE. Senator Stevens.

STATEMENT OF HON. TED STEVENS,
U.S. SENATOR FROM ALASKA

Senator STEVENS. Thank you very much, Mr. Chairman. I will be short.

I am sorry, I do not know if anyone else has mentioned this, but I do think we should congratulate Chairman Powell of the FCC for his spectrum policy task force. He is taking steps to expedite the broadcast digital conversion. I think we should take knowledge of the fact that the administration is working on a spectrum proposal to create a trust fund for spectrum proceeds to facilitate the movement of Defense and other agencies from the spectrum they currently use.

But I also would like to remind the Committee that the World Radio Conference identified the global harmonized spectrum for the third generation uses, including global roaming, and the spectrum of 1755 to 1850 is occupied by DoD. It would be my hope that you would remember to have a classified hearing for Members of this Committee so they can obtain information on that spectrum and understand the pace at which it could possibly be moved.

Senator Brownback mentioned the pace of change here. Clearly, even with the money that is contemplated by the administration's spectrum trust fund, the cost of moving that spectrum is much greater than anyone, unless they have had the classified briefings, realize. So I think, while I entirely support the concept of finding some way to move the agencies off this spectrum and meeting particularly the international needs for the third generation, I do believe we should be clear what we are doing and not rush into this.

Thank you very much.

Senator INOUYE. Thank you.

Senator Ensign.

STATEMENT OF HON. JOHN ENSIGN,
U.S. SENATOR FROM NEVADA

Senator ENSIGN. Thank you, Mr. Chairman. I want to compliment you and Senator Hollings for this hearing today. I also am pleased that the administration has recognized the need for a comprehensive spectrum policy.

A lot has been said and I just want to make two points from my observations. Third generation wireless is absolutely critical to America's future. How it is handled in expediting the spectrum clearing process is very important, especially spectrum held by the Defense Department.

Unfortunately, when we have looked at spectrum auctions, we focus on our budgetary means, not how many jobs will be created and how much revenue will come into the Federal treasury from deploying new technologies into the marketplace. It is unfortunate that current spectrum policy does not take future economic impact into account.

With regard to the 700 megahertz issue that was previously mentioned. It is a textbook example of what can go wrong when we do not have a forward-looking, comprehensive spectrum management policy. We should continue working to establish such a policy, and I look forward to working with my colleagues on the Committee to accomplish this goal. It is a mistake to go ahead with the

June 19th auction. We can do much better in managing our previous spectrum, and I am continuing to work with some of my colleagues to come up with a compromise so that the June 19, 700 megahertz auction does not go forward. I believe it would be a mistake to do so at this time, and I hope the Senate will soon act to dispose of this issue.

So I look forward to working with my colleagues on the issue of spectrum management. I think wireless issues are exciting issues. They are difficult issues for us to understand, but I also agree that we should hold a classified briefing to better understand the military aspects.

So thank you, Mr. Chairman.

Senator INOUYE. Thank you, Senator.

Now may I call upon the Honorable James M. Jeffords, Chairman of the Committee on Environment and Public Works, and the Honorable Chris Dodd, member of the United States Senate and senior member of the committee on Foreign Relations. Senator Jeffords.

STATEMENT OF HON. JAMES M. JEFFORDS, U.S. SENATOR FROM VERMONT

Senator JEFFORDS. Thank you, Mr. Chairman. I certainly appreciate the hearing. I already learned a good deal about the complexities that we are dealing with.

I commend Senator Hollings for holding the hearing to address the important issues relating to spectrum management, such as public safety and auctions. I appreciate your courtesy in allowing me to make a brief statement before attendance to another committee.

First, let me briefly say I appreciate Senator Hollings' attention to emergency personnel and first responders and their communications needs. In the Environment and Public Works Committee, we have heard about how our interoperability issues prevented first responders from communicating with each other on September 11th. I know when I arrived at the Pentagon the day after, I talked with the responders who came from all over the country and they said—I asked them: What is the one problem that you noted most? They said: We could not talk to each other. This obviously is a critical problem when people are trying to operate in those circumstances.

The EPW Committee has reported out a bill that would direct FEMA to study the steps necessary to establish a nationwide emergency communications system. I thank Senator Hollings for his interest and look forward to working with him and Senator McCain and other Members of this Committee to ensure that the responders have a first-rate system in place that really augments our Nation's preparedness.

Let me now talk about the education component and other aspects that I believe is relevant to the hearing. The American people are the owners of the spectrum and it is a national resource that has enormous value. Our citizens should see a direct and specific benefit from the use of their commonly owned property. The electromagnetic spectrum can serve a compelling national priority supporting education. There are several options. An education trust

fund established with a percentage of the proceeds from the public asset of the spectrum could and should be designed to meet these needs. Distance learning options have tremendous potential and are already utilized around the world and in this country.

Also, health care the potential for bettering our health care options are tremendous with respect to the utilization of the spectrum. The Digital Opportunity Investment Trust Fund Act authored by Senator Dodd is one approach that would help support education efforts with revenue from spectrum auctions. I am proud to join my friend from Connecticut as a co-sponsor of this provision.

While the spectrum is literally as intangible as air, it is a national public resource every bit as real as our Federal park lands. We in the Government are the only managers of this resource and must not take that responsibility lightly. The Federal Government must be responsible for maximizing utilization of the spectrum for the best public purposes.

The Congressional Research Service estimates that at least $40 billion will come into the Federal coffers from spectrum auctions, have come since the auctioning began in the early 1990's. That money has already been spent. The Congressional Broadcast Office estimates that the Federal Government will take in an additional $27 billion in proceeds from the spectrum auctions between now and the year 2007.

I ask respectfully that you keep our Nation's educational needs in mind as you consider the overall Federal management of the spectrum. Historically, Congress has stepped in to make substantial Federal investments in education innovation at critical times. A fellow Vermonter, Senator Justin Morrill, headed the concept of using a public asset for education in the mid–1800's. The Morrill Act established through a gift of public land to each State our Nation's land grant colleges. The Morrill Act resulted in unprecedented access to higher education for all, including historic black colleges.

The GI Bill put higher education within the reach of millions of veterans from World War Two and later military conflicts. The launching of Sputnik prompted passage of the National Defense Education Act. The act brought increased funding to help Americans compete with the Soviet Union in scientific and technical fields and the improvements of education, mathematics, and foreign language training.

I believe Congress has an opportunity to step in and again bolster the quality of our educational system. We have an educational emergency in our Nation. We are lagging far behind our critical competitors in math and science. The President's new testing initiative will make this very, very clear this fall.

So I look forward to working with Senators Hollings, McCain, and all of my colleagues on this Committee to link education to the spectrum for the highest public good.

[The prepared statement of Senator Jeffords follows:]

PREPARED STATEMENT OF HON. JAMES M. JEFFORDS, U.S. SENATOR FROM VERMONT

Thank you Senator Inouye, Senator Hollings, Senator McCain, and other Members of the Commerce Committee, for giving me the opportunity to testify today. I commend Senator Hollings for holding this hearing to address important issues re-

lating to spectrum management such as public safety and auctions. I appreciate your courtesy in allowing me to make a brief statement before my attendance is required at another hearing.

First, let me briefly say I appreciate Senator Hollings' attention to emergency personnel and first responders and their communications needs. In the Environment and Public Works (EPW) Committee we have heard about how interoperability issues prevented first responders from communicating with each other on September 11th. The EPW Committee has reported out a bill that would direct FEMA to study the steps necessary to establish a nationwide emergency communication system.

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Let me now talk about an education component that I believe is relevant to this hearing. The American people are the owners of the spectrum, and it is a national resource that has enormous value.

Our citizens should see a direct and specific benefit from the use of their commonly owned property. The electromagnetic spectrum can serve a compelling national priority of supporting education. An education trust fund, established with a percentage of the proceeds from the public asset of the spectrum, could and should be designed to meet these needs.

The Digital Opportunity Investment Trust Act authored by Senator Dodd is one approach that would help support educational efforts with revenue from spectrum auctions. I am proud to join my friend from Connecticut in this effort as a cosponsor.

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The Federal Government must be responsible for maximizing the utilization of the spectrum for the best public purpose.

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The GI Bill put higher education within the reach of millions of veterans from World War 2 and later military conflicts.

The launching of Sputnik prompted passage of the National Defense Education Act. This Act brought increased funding to help America compete with the Soviet Union in scientific and technical fields and the improvement of science, mathematics, and foreign language training.

I believe Congress has the opportunity to step in and again and bolster the quality of our educational system.

I look forward to working with Senator Hollings, Senator McCain, and all of my colleagues on this Committee to link education and the spectrum for the highest public good.

Senator INOUYE. Thank you very much, sir.

Now may I call upon Senator Dodd.

STATEMENT OF HON. CHRISTOPHER S. DODD, U.S. SENATOR FROM CONNECTICUT

Senator DODD. Mr. Chairman, I will just ask unanimous consent to have this very, very brief statement.

Senator INOUYE. Without objection.

Senator DODD. First of all, we appreciate immensely you giving us an opportunity to appear before you this morning. Just by the

mere presence of the many Members of this Committee, it demonstrates the interest in the subject matter, and obviously the interest goes even beyond the Committee here. This is a critically important issue. Senator Inouye, we know of your longstanding interest in it. Senator Hollings, obviously Senator McCain and others.

I have spoken with John I think a couple of years ago about the idea of some sort of a trust fund, using the Morrill Act as an example. I found that a fascinating historical reference. Here in the middle of the Civil War, Abraham Lincoln along with Justin Morrill of Vermont decided that they would sell public lands in the West and use the revenues from that to establish land grant colleges. A rather innovative and far-sighted idea, if you would, considering what the demands of the era and the time were.

The GI Bill that has been mentioned by my colleague Senator Jeffords is another example. There was an earlier example in 1787, the Northwest Ordinance Act, which I am sure Senator Wyden is familiar with, which demanded in fact that States establish some sort of public school education policy as a result of efforts there.

All we are suggesting here with this bill I think has been incorporated by a lot of what you have said already, and that is the idea of utilizing these public resources. This is sort of the land of the twenty-first century, if you will, the spectrum. Not to rush it, not to do it, auction it for the sake of auctioning it for revenues, but to see to it that we use this land, if you will, in a way that is going to contribute to the wealth and health of a Nation.

One of the ideas is obviously education. There are others. Obviously, the first responders' needs, interconnectability, is critically important; defense needs. Possibly a trust, which we are talking about here, would give us the greatest options in making determinations how best to use those resources, rather than having it just dumped into the general revenues where they can get lost in terms of some of the vital needs we are talking about.

So Larry Grossman and Newton Minow you have mentioned, Senator Hollings, already as being people I know have talked to many people here in the Senate and others over many years about the idea that Senator Jeffords and I have offered here briefly in the last couple of days as one idea. I know the Committee will consider not only our ideas but others as you talk about this legislation.

We are just grateful for the opportunity to testify here before you this morning. It is a little bit off the exact theme you have raised, but we appreciate the chance to express our views on this issue.

[The prepared statement of Senator Dodd follows:]

PREPARED STATEMENT OF CHRISTOPHER S. DODD, U.S. SENATOR FROM CONNECTICUT

Chairman Hollings, Ranking Member McCain, and Members of the Committee, I appreciate the opportunity to make some brief remarks today in support of innovative approaches to education and information technology in the 21st century. I am pleased to be joined today by my good friend and colleague, Senator Jeffords.

Today, the Committee is beginning a formal inquiry into spectrum auctions and relocation and how best to manage this critical resource for maximum benefit. This issue is complex and I do not purport to be a technical expert. However, it is my belief that the spectrum is one of our last great natural resources and should be used for the greater public good. Innovative technologies could revolutionize lifelong learning and provide educational content to those individuals that might otherwise be denied access. Simply put, the goal is to link our cultural, historical and educational heritage, without commercial regard. Technological advances and infra-

structure improvements are only as good as the depth and breadth of content available to enhance our lives.

It is estimated by CBO that more than $20 billion could be available from the sale and licensing of the spectrum. Some of these revenues could be used to build a Digital Opportunity Investment Trust to achieve this educational goal.

Yesterday, Senator Jeffords and I introduced S. 2603, the Digital Opportunity Investment Trust Act, a bill designed to lay a framework for this vision.

Throughout history, Congress has taken bold steps and invested resources to ensure that Americans were ready to overcome obstacles and face challenges head-on. Whether it be the 1787 Northwest Ordinance which set aside public lands for schools in every state, the 1862 Morrill Act which established land-grant colleges, or the 1944 GI-Bill, all of these bold initiatives expanded educational opportunities for the masses. It is again time to take a giant step forward. Now, we have the chance to build on those past initiatives and adapt and enhance educational opportunities for the 21st century.

The legislation we set forth is designed to spur debate and interest in a visionary educational proposal for the 21st century. It is a framework for discussion and by no means set in stone. I know the Committee has an ambitious agenda, but I hope that members take a look at this proposal over the coming weeks. I do not expect that you would have any comments today, but I do look forward to working with you in the future.

Senator INOUYE. Any questions?

Senator BURNS. Senator Dodd, the land grant colleges was a great idea, but they did not sell the public lands.

Senator DODD. They gave it away.

Senator BURNS. No, they did not give them away. Each section is assigned—out of each range there is a certain amount of sections that those revenues continue today to support land grant colleges. They were never sold, but the revenues derived from those resources found on those lands support land grant colleges.

Senator DODD. I stand corrected, but the concept is—you endorse the concept, though, Senator?

Senator BURNS. I fully endorse it.

Senator INOUYE. Any further questions?

[No response.]

Senator INOUYE. If not, thank you very much, Senator Jeffords and Senator Dodd.

May I now call upon a panel made up of the Director of the Physical Infrastructure Issues, U.S. General Accounting Office, Mr. Peter Guerrero; the Deputy Assistant Secretary for Spectrum, Space, Sensors, and C3, Office of the Secretary of Defense, Mr. Steven Price; the Assistant Secretary of Commerce for Communications and Information and Administration, National Telecommunications and Information Administration, U.S. Department of Commerce, Ms. Nancy J. Victory; and Chief of Wireless Telecommunications Bureau of the Federal Communications Commission, Mr. Thomas J. Sugrue.

May I first call upon Mr. Guerrero.

STATEMENT OF PETER F. GUERRERO, DIRECTOR, PHYSICAL INFRASTRUCTURE ISSUES, U.S. GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY: TERRI RUSSELL, SENIOR ANALYST, GAO

Mr. GUERRERO. Thank you, Mr. Chairman. With me today is Terri Russell, Senior Analyst working for the GAO on these important issues.

I appreciate the opportunity to testify on our ongoing work on spectrum management. As you know, managing the radio frequency spectrum has become more challenging as new technologies have developed and are used more widely. My full statement, which I will submit for the record, contains GAO's preliminary observations in this regard.

I would now like to talk about the current U.S. approach to spectrum management and some of the challenges we face. The current legal framework for domestic spectrum management emerged over a period of decades. As you know, spectrum management authority resides in two agencies, requiring close coordination and cooperation to ensure that the national interest is served. The National Telecommunications and Information Administration within the Department of Commerce is responsible for managing Federal spectrum use. The Federal Communications Commission has responsibility for managing all non–Federal spectrum use.

While this shared approach has generally served us well, some allocation decisions are becoming more difficult, resulting in lengthy negotiations. This situation exists because nearly the entire usable spectrum is currently occupied.

Short of improvements in technology that allow for more efficient use of existing spectrum, one of two things must generally happen to accommodate new demands: one, more of the available spectrum will need to be shared; or two, existing spectrum users will need to be reallocated to other frequencies to make room for others. Moving users is usually contentious and requires that comparable spectrum be found for incumbents and that resources are available for system and equipment changes. An example of this difficulty in making allocation decisions is the ongoing effort to identify spectrum to accommodate third generation wireless services.

During the course of our review, some officials we interviewed suggested establishing a third party, such as an outside panel or a commission, an office within the executive branch, or an interagency group, to arbitrate or resolve these types of differences. In some other countries such decisions are made within one agency or within interagency mechanisms that exist for resolving such matters.

Recognizing also that better planning could help address these issues, Congress itself has directed both the FCC and NTIA to conduct joint spectrum planning sessions and assess the progress towards implementing a national spectrum plan. However, top officials from both FCC and NTIA said that neither requirement has been fully implemented, but recently confirmed at a national summit on spectrum their intention to implement these directives.

Now I would like to turn to the challenges we face in preparing for international negotiations. We looked at these challenges as the U.S. prepares for the World Radiocommunication Conference coming up next year, where decisions are made on how to allocate spectrum internationally. In recent years, U.S. preparations for these conferences have become more complex as the number of conferences, participating nations, and agenda items have all increased.

For example, while only 9 nations participated in the first World Radio Communication Conference in 1903, some 148 nations par-

ticipated in the 2000 conference. With more at stake and more nations participating, the U.S. needs the votes of other nations in order to get the U.S. positions adopted by the conference. We found strong agreement among those we interviewed on the importance of developing an early U.S. negotiating position to allow sufficient lead time to meet with other nations to gain their support for our positions.

However, we heard differences of opinion about the effectiveness of the current U.S. preparatory process. Currently, both FCC and NTIA develop separate positions on conference agenda items through separate processes. With State Department coordination, the agencies then get together to develop a unified U.S. position. While ensuring stakeholder input and producing well-scrutinized proposals, this separate but parallel process can also take time, especially when agenda items are contentious.

In response to concerns about timeliness, the former U.S. ambassador to the 2000 conference recommended merging the separate processes to get an earlier start and to harmonize industry and Government positions for these negotiations.

Differing views have also been expressed on the appointment process used to choose an individual to head the U.S. delegation. Since the early 1980s, the President has appointed a temporary U.S. ambassador with a term of 6 months to head our delegation. Again, the former U.S. ambassador to the 2000 conference observed that the brief tenure of the appointment leaves little time to get up to speed on the issues, to solidify U.S. positions, to form a delegation, and to undertake the preconference meetings with heads of other delegations.

In addition, the ambassador said there is concern about the lack of continuity and leadership from one conference to the next, in contrast to other nations that are led by high level Government officials who serve longer terms and may represent their nations through multiple conferences.

Now I would like to turn to the Department of Commerce's efforts to promote efficient spectrum use by Federal agencies. We reviewed how NTIA, within the Department of Commerce, works to promote efficient spectrum use by Federal agencies. While NTIA has established several processes and undertaken a number of actions, it lacks assurance that these activities are indeed effective. There are a number of reasons for this.

First, staffing and resource limitations often prevent agencies from completing required periodic reviews intended to assure that assignments are still needed. Staffing and funding limitations have also forced NTIA to eliminate monitoring programs intended to verify that agencies are using spectrum as specified in their assignments.

Second, the adoption of more efficient technologies has proven to be challenging. Along these lines, NTIA has required Federal agencies to adopt what is called narrowband technology. This technology would considerably increase the number of channels available for land-based mobile communications. However, some agencies are currently struggling to meet this requirement due to the lack of sufficient staff and funding. Specifically 4 of the 7 agencies

we reviewed said they would not complete their upgrades before the deadline.

Finally, NTIA officials told us that existing spectrum management fees designed to recover part of the costs of NTIA's spectrum management functions provide agencies with a financial incentive to remove inactive assignments. However, it is not clear that these fees, about $50 per assignment, actually promote efficient use of spectrum. For instance, agencies can reduce the number of assignments without returning unneeded spectrum.

In conclusion, Mr. Chairman, I would like to add that we will be reporting to you in detail on all of these matters later this summer. In addition, we are conducting further work on how current rules and regulations governing spectrum allocation and use affect the rollout of new technologies and services and the level of business competition.

As a part of this work to be completed next year, we are interviewing an array of business, Government, and public safety users of spectrum. Tomorrow at GAO we will be hosting a panel of national spectrum experts. We are also collecting information from spectrum managers in a dozen countries in an effort to learn more about other spectrum management approaches.

This concludes my statement. I would be pleased to answer any questions you have.

[The prepared statement of Mr. Guerrero follows:]

PREPARED STATEMENT OF PETER F. GUERRERO, DIRECTOR, PHYSICAL INFRASTRUCTURE ISSUES, U.S. GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY TERRI RUSSELL, SENIOR ANALYST, GAO

Mr. Chairman and Members of the Committee:

I am pleased to be here to report on the preliminary observations from our work on radio spectrum management issues. The radio spectrum is the medium that makes possible wireless communications of all sorts, such as cellular and paging services, radio and television broadcasting, radar, and satellite-based services. As new technologies that depend on the radio spectrum continue to be developed and used more widely, managing the spectrum has grown increasingly challenging. The radio spectrum can become congested if too many users operate on it in an uncoordinated manner. Moreover, because spectrum has no geographical boundaries, the domestic management of spectrum is closely tied to international agreements on spectrum use. Therefore, the radio spectrum must be carefully managed, both on a national and international level, to meet the needs of a constantly increasing variety of services and users. One important task of spectrum management is the allocation of spectrum, or the apportionment of spectrum between the different types of uses and users of wireless services. As demand for spectrum has grown, this task has become more difficult, raising complex questions that cannot be easily answered.

At the request of this Committee, we have interviewed agency and industry officials and reviewed relevant documents to address the following issues: (1) the evolution of the current legal framework for domestic spectrum management; (2) how well the current U.S. spectrum management structure facilitates the allocation of spectrum; (3) what challenges the United States faces in preparing for World Radiocommunication Conferences (WRC), at which decisions are made on how to allocate spectrum internationally; and (4) how the federal government encourages efficient use of spectrum by federal agencies

Our work is ongoing and will result in a report to be issued this summer. We reviewed the legislative history and relevant agency manuals, policies, and regulations, and interviewed officials responsible for spectrum management from the Federal Communications Commission (FCC), National Telecommunications and Information Administration (NTIA), and Department of State, and key wireless industry representatives. In addition, to determine how the federal government uses and manages spectrum, we interviewed officials from the following seven agencies: the Department of Energy, the Department of the Interior, the Federal Aviation Admin-

istration, the Coast Guard, the Department of Justice, the Federal Emergency Management Administration, and the National Aeronautics and Space Administration.

In summary, our preliminary observations are as follows:

- The current legal framework for domestic spectrum management evolved as a compromise over the questions of who should determine the distribution of spectrum among competing users and what standard should be applied in making this determination. Although initially all responsibility for spectrum management was placed in the executive branch, since 1927 this responsibility has been divided between the executive branch for managing federal use (currently, the President has delegated this responsibility to the National Telecommunications and Information Administration), and an independent commission for managing non-federal spectrum use (at first the Federal Radio Commission and since 1934, its successor, the Federal Communications Commission). The standard to be applied in managing non-federal government spectrum is "the public interest." Under this divided management framework, no one entity has ultimate decision-making power over all spectrum users; the two agencies must coordinate and cooperate in order to determine how to accommodate different users competing for spectrum.
- The current shared U.S. spectrum management structure has processes for allocating spectrum for new uses and users of wireless services, but these processes have occasionally resulted in lengthy negotiations between FCC and NTIA over how to resolve some allocation issues. Since nearly all of the usable radio spectrum has been allocated already, accommodating more services and users often involves redefining spectrum allocations. One method of doing this used by FCC and NTIA is to increase the amount of shared spectrum. In shared spectrum, more than one type of service or user may utilize the frequencies in the allocation. For example, according to NTIA, 56 percent of the spectrum in the 0–3.1 GHz range is now shared between federal and non-federal users. Another method of redefining allocations, called band clearing, involves moving a service or user from one area of spectrum to another in order to make room for a new service or user. Occasionally, these methods are contentious and protracted, such as the continuing efforts to reallocate spectrum for third-generation advanced wireless services. Some government officials and nongovernmental representatives we interviewed discussed the possibility of designating a third party to arbitrate between FCC and NTIA in such circumstances and the need for better planning to help increase coordination between the two agencies in their shared management of this resource.
- The United States faces challenges in effectively preparing for World Radiocommunication Conferences, at which decisions are made regarding the allocation of spectrum internationally, to ensure that the United States can best serve the interests of domestic spectrum users. Timely preparation has become more important and challenging due to increases in the frequency of conferences, the number of participating nations (each of which has one vote), and the number of items on conference agendas that countries vote on to change the international rules for spectrum use. In addition, regional blocks have emerged, with countries pooling their votes to promote their position on agenda items. Under the current structure, FCC and NTIA develop positions on agenda items through separate processes that involve the users of the spectrum they manage. The positions reached during these two processes must be merged into a unified U.S. position. An ambassador is appointed by the President for a period not exceeding six months to facilitate the development of this unified position and lead the U.S. delegation in negotiating for the adoption of U.S. positions at the World Radiocommunication Conference. In our meetings with government officials and wireless industry representatives, we heard differing opinions about (1) the ability of the United States to develop a unified position early enough to promote that position effectively and (2) the manner in which we appoint an ambassador to head the U.S. delegation.
- NTIA has several activities to encourage efficient spectrum use by federal agencies, but it lacks assurance that these activities are effective. NTIA is required to promote efficiency in the federal spectrum it manages, which included more than 270,000 federal frequency assignments at the end of 2000. To do this, NTIA directs federal agencies to use only as much spectrum as they need. Because agencies have different mission-based needs and because there are a large number of frequency assignments that require attention, NTIA's frequency assignment and review processes place the primary responsibility for promoting efficiency in the hands of the agencies. NTIA requires that agencies justify their need for spectrum and review most spectrum assignments every 5 years. Offi-

cials from the seven federal agencies in our review told us that they attempt to use spectrum as efficiently as possible, but five of them are not completing the required five-year reviews in a timely or meaningful way because of staff shortages and other agency priorities. Moreover, although NTIA has established monitoring programs to verify how agencies are using spectrum, it said that some of these programs are inactive because of staff and funding shortages. NTIA also conducts research and technical initiatives that are designed to promote efficiency by conserving spectrum, but NTIA said some of these efforts have been difficult to implement. In addition, NTIA states that its spectrum management fees, which were designed to recover part of the costs of NTIA's spectrum management functions, provide agencies with a financial incentive to remove inactive assignments. However, it is not clear that these fees promote efficient use of spectrum because agencies can reduce the number of assignments without returning spectrum.

- In addition to these issues, the Committee requested that we review how the current rules and regulations governing spectrum holders affect the rollout of new technologies and services and the level of competition in markets that utilize spectrum. As part of this work, we will look at how other countries manage spectrum. Although our review of these issues will not be completed until early 2003, I will briefly discuss our ongoing work at the end of this statement.

Background

To a large degree, spectrum management policies flow from the technical characteristics of radio spectrum. Although the radio spectrum spans nearly 300 billion frequencies, 90 percent of its use is concentrated in the 1 percent of frequencies that are below 3.1 gigahertz.[1] The crowding in this region has occurred because these frequencies have properties that are well suited for many important wireless technologies, such as mobile phones, radio and television broadcasting, and numerous satellite communication systems.

The process known as spectrum allocation has been adopted, both domestically and internationally, as a means of apportioning frequencies among the various types of uses and users of wireless services and preventing radio congestion, which can lead to interference. Interference occurs when radio signals of two or more users interact in a manner that disrupts the transmission and reception of messages. Spectrum allocation involves segmenting the radio spectrum into bands of frequencies that are designated for use by particular types of radio services or classes of users, such as broadcast television and satellites. Over the years, the United States has designated hundreds of frequency bands for numerous types of wireless services. Within these bands, government, commercial, scientific, and amateur users receive specific frequency assignments or licenses for their wireless operations.[2] The equipment they use is designed to operate on these frequencies.

During the last 50 years, developments in wireless technology have opened up additional usable frequencies, reduced the potential for interference, and improved the efficiency of transmission through various techniques, such as reducing the amount of spectrum needed to send information. While this has helped limit congestion within the radio spectrum, competition for additional spectrum remains high. Wireless services have become critically important to federal, state, and local governments for national security, public safety, and other functions. At the same time, the consumer market for wireless services has seen extraordinary growth. For example, mobile phone service in the United States greatly exceeded the industry's original growth predications, as it jumped from 16 million subscribers in 1994 to an estimated 110 million in 2001.

Framework for Spectrum Management

The legal framework for allocating radio spectrum among federal and nonfederal users emerged from a compromise over two fundamental policy questions: (1) whether spectrum decisions should be made by a single government official, or a body of decision-makers; and (2) whether all nonfederal users should be able to operate radio services without qualification, or if a standard should be used to license these

[1] Radio waves are a form of electromagnetic radiation that propagates in space as the result of particle oscillations. The number of oscillations per second is called frequency, which is measured in units of hertz. The terms "kilohertz" refers to thousands of hertz and "gigahertz" to billions of hertz. The radio spectrum comprises a range of frequencies from 3 kilohertz to around 300 gigahertz.

[2] Part 15 of FCC rules permits the operation of authorized low-power wireless devices without a license from FCC or the need for frequency coordination. The technical standards contained in Part 15 are designed to ensure that there is a low probability that these unlicensed devices will cause harmful interference to other users of the radio spectrum. 47 C.F.R. § 15 (2001).

operators. The resulting regulatory framework—dividing spectrum management between the President and an independent regulatory body—is rooted both in the President's responsibility for national defense and in the fulfillment of federal agencies' missions, and the encouragement and recognition by the federal government of the investment made by private enterprise in radio and other communications services.

The first federal statute to establish a structure for spectrum management—the Radio Act of 1912[3]—consolidated licensing authority with the Secretary of Commerce. However, the act proved to be deficient in addressing the burgeoning growth of radio communications and ensuing interference that occurred in the late 1910s and 1920s. Specifically, the Secretary of Commerce lacked the authority to use licensing as a means of controlling radio station operations,[4] or to take actions to control interference, such as designating frequencies for uses or issuing licenses of limited duration. In recognition of such limitations, deliberations began in the 1920s to devise a new framework for radio spectrum management. Although there was general agreement that licensing should entail more than a registration process, there was debate about designation of the licensing authority and the standard that should govern the issuance of licenses.[5]

The Radio Act of 1927,[6] reflecting a compromise on a new spectrum management framework, reserved the authority to assign frequencies for all federal government radio operators to the President and created the Federal Radio Commission (FRC) to license non-federal government operators. Composed of five members from five different regions of the country, FRC could assign frequencies, establish coverage areas, and establish the power and location of transmitters under its licensing authority. Further, the act delineated that a radio operation proposed by a non-federal license applicant must meet a standard of "the public interest, convenience and necessity," and that a license conveyed no ownership in radio channels nor created any right beyond the terms of the license.[7] FRC's authorities were subsequently transferred to the Federal Communications Commission (FCC), and the FRC was abolished upon enactment of the Communications Act of 1934, which brought together the regulation of telephone, telegraph, and radio services under one independent regulatory agency. The 1934 act also retained the authority of the President to assign spectrum to and manage federal government radio operations.

The need for cooperative action in solving problems arising from the federal government's interest in radio use was recognized in 1922 with the formation of the Interdepartment Radio Advisory Committee (IRAC), comprised of representatives from the federal agencies that use the most spectrum.[8] IRAC, whose existence and actions were affirmed by the President in 1927, has continued to advise whoever has been responsible for exercising the authority of the President to assign frequencies

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[3] 37 Stat. 302 (1912). The Radio Act of 1912 was enacted, in part, to fulfill U.S. obligations incurred by the first international radio treaty. Congress had passed an earlier federal statute, the Wireless Ship Act, 36 Stat. 629 (1910), as amended, 37 Stat. 199 (1912), to address a first use of radio—safety of ships at sea. In 1904, President Roosevelt adopted a recommendation of the first known inter-agency board to address radio use by the federal government placing all government coastal radio facilities under the U.S. Navy's control.

[4] The Secretary of Commerce could not refuse to grant a license upon proper application under the Act as held by a court and two attorneys general opinions. *See* 29 Op. 579 (1912); 35 Op. 126 (1926); *Hoover v. Intercity Radio Co., Inc*; 286 Fed. 1003 (D.C. Cir., 1923). The Secretary had no power to make regulations additional to those in the act. *See United States v. Zenith Radio Corporation et al.*, 12 F. (2d) 614 (N.D. Ill., 1926); *Carmichael v. Anderson*, 14 F. 2d 166 (W.D. Mo. 1926). The 1912 act did not regulate broadcasting. *See Tribune Co. v. Oak Leaves Broad. Station, Inc., et al.*, reported in the Congressional Record on December 10, 1926 (Cong. Rec. Vol. 68, Part I, pp. 216–219).

[5] This debate went on over several years as the Department of Commerce convened four radio conferences (1922–25) attended by manufacturers, broadcasters, civilian and military government users, and other stakeholders to make recommendations addressing overcrowding of the airwaves. Designation of the Secretary of Commerce as the sole licensing authority, one of the recommendations from the conferences, was a matter of contention in congressional debate on new legislation.

[6] 44 Stat. 1162 (1927). Under the act, the FRC was granted licensing authority for one year to resolve interference problems and then was to become an appellate body to address disputes with the Secretary of Commerce who was to assume licensing duties. However, the FRC's one-year tenure was extended three times by Congress, the last for an indefinite term pending new legislation.

[7] Prior to the 1927 Radio Act, an Illinois state court issued a decision to enforce a property right to a radio frequency under the principle of "right of user." *Tribune Co. v. Oak Leaves Broad. Station, Inc., et al.*, (Cir. Ct., Cook County, Ill. 1926), reprinted in 68 Cong. Rec. 216 (1926).

[8] When originally formed in 1922, the inter-agency committee was known as the "Interdepartment Advisory Committee on Governmental Radio Broadcasting."

to the federal government.[9] In 1978, the President's authority for spectrum management of federal government users was delegated to NTIA, an agency of the Department of Commerce.[10] IRAC assists NTIA in assigning frequencies to federal agencies and developing policies, programs, procedures, and technical criteria for the allocation, management, and use of the spectrum.

Over the past 75 years, since the 1927 act formed our divided structure of spectrum management, there is historical evidence of cooperation and coordination in managing federal and non-federal users to ensure the effective use of spectrum. For example, FCC and IRAC agreed in 1940 to give each other notice of proposed actions that might cause interference or other problems for their respective constituencies. Further, FCC has always participated in IRAC meetings[11] and NTIA frequently provides comments in FCC proceedings that impact federal radio operations. And, as I will discuss later, FCC and NTIA also work together with the Department of State to formulate a unified U.S. position on issues at international meetings that coordinate spectrum use regionally and globally. However, as demand for this limited resource increases, particularly with the continuing emergence of new commercial wireless technologies, NTIA and FCC face serious challenges in trying to meet the growth in the needs of their respective incumbent users, while accommodating the needs of new users.

Facilitating Spectrum Allocations

The current shared U.S. spectrum management structure has methods for allocating spectrum for new uses and users of wireless services, but these methods have occasionally resulted in lengthy negotiations between FCC and NTIA over how to resolve some allocation issues. Since nearly all of the usable radio spectrum has been allocated already, accommodating more services and users often involves redefining spectrum allocations.

One method, spectrum "sharing," enables more than one user to transmit radio signals on the same frequency band. In a shared allocation, a distinction is made as to which user has "primary" or priority use of a frequency and which user has "secondary" status, meaning it must defer to the primary user. Users may also be designated as "co-primary" in which the first operator to obtain authority to use the spectrum has priority to use the frequency over another primary operator. In instances where spectrum is shared between federal and non-federal users—currently constituting 56 percent of the spectrum in the 0–3.1 GHz range[12]—FCC and NTIA must ensure that the status assigned to users (primary/secondary or co-primary) meet users' radio needs, and that users abide by rules applicable to their designated status.

Another method to accommodate new users and technologies is "bandclearing," or re-classifying a band of spectrum from one set of radio services and users to another, which requires moving previously authorized users to a different band. Bandclearing decisions affecting either only non-federal or only federal users are managed within FCC or NTIA respectively, albeit sometimes with difficulty. However, bandclearing decisions that involve radio services of both types of users pose a greater challenge. Specifically, they require coordination between FCC and NTIA to ensure that moving existing users to a new frequency band is feasible and not otherwise disruptive to their radio operation needs.[13] While many such band-clearing de-

[9] Under the Radio Act of 1927, the President's spectrum management authority was delegated—and IRAC reported through—first, the Secretary of Commerce, and then, beginning in 1932, the FRC (replaced by the FCC in 1934). In 1940, an inter-agency Defense Communications Board was formed to coordinate the relationship of all branches of communication to the national defense; IRAC reported directly to the Board as of 1941 until the Board was abolished in 1947. Since 1951, the President's spectrum management authority, coupled with telecommunications policy advice, has been delegated, and IRAC has reported through: the Telecommunications Advisor to the President (1951); the director of the Office of Defense Mobilization (1953); the director of the Office of Civil Defense Mobilization (1958); the director of Telecommunications Management (1962); the director of the Office of Telecommunications Policy (1970); and NTIA (1978).

[10] President Carter's Executive Order 12,046, issued in 1978, abolished the Office of Telecommunications Policy, transferred its functions to the Department of Commerce, and established an Assistant Secretary for Communications and Information. Subsequently, the Department formally established NTIA and Congress codified NTIA and its mission into law. *See* The Telecommunications Authorization Act of 1992, 106 Stat. 3533 (1992).

[11] Although FCC once served as a representative to IRAC, its role in IRAC was transformed in 1952 to that of liaison.

[12] NTIA also reported that 42 percent of the shared allocations between federal and nonfederal users in the 0 to 3.1 GHz range are shared on a "co-primary" basis.

[13] The Strom Thurmond National Defense Authorization Act for the Fiscal Year 1999, P.L. 105–251, Oct. 17, 1998, authorized federal entities to accept compensation payments when they

cisions have been made throughout radio history, these negotiations can become protracted. For example, a hotly debated issue is how to accommodate third-generation wireless services.[14] FCC also told us that the relationship between FCC and NTIA on spectrum management became more structured following the enactment of legislative provisions mandating the reallocation of spectrum from federal to non-federal government use.[15]

To address the protracted nature of some spectrum band-clearing efforts, some officials we interviewed have suggested establishing a third party—such as an outside panel or commission, an office within the Executive branch, or an inter-agency group—to arbitrate or resolve differences between FCC and NTIA. In some other countries, decisions are made within one agency or within interagency mechanisms that exist for resolving contentious band-clearing issues. For example, the United Kingdom differs from the U.S. spectrum management structure in that a formal standing committee, co-chaired by officials from the Radiocommunications Agency and the Ministry of Defense, has the authority to resolve contentious spectrum issues.

Another proposed mechanism is the preparation of a national spectrum plan to better manage the allocation process. The Omnibus Budget Reconciliation Act of 1993 required NTIA and FCC to conduct joint spectrum planning sessions.[16] The National Defense Authorization Act of 2000 included a requirement for FCC and NTIA to review and assess the progress toward implementing a national spectrum plan.[17] Top officials from FCC and NTIA said that neither requirement has been fully implemented. However, they indicated their intention to implement these directives.

Challenges in Preparing for World Radiocommunication Conferences

A central challenge for the United States in preparing for WRCs, at which international spectrum allocation decisions are made, is completing the preparatory actions to ensure that the U.S. is able to effectively negotiate for international allocations that best serve the interests of domestic federal and non-federal spectrum users. The management of our domestic spectrum is closely tied to international agreements on spectrum use at regional and global levels. Domestic spectrum allocations are generally consistent with international allocations negotiated and agreed to by members of the International Telecommunication Union (ITU).[18] The spectrum allocation decisions reached at these international conferences can affect the direction and growth of various wireless communications services and have far-reaching implications for the multi-billion dollar wireless communications industry in this country and abroad.

While the first international radio conferences were aimed at interference avoidance for early radio uses, such as maritime safety, meeting this same objective has become increasingly challenging throughout the last century with the proliferation

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relocate or modify their frequency use to accommodate non-federal users of the spectrum. The National Defense Authorization Act for Fiscal Year 2000, P.L. 106–65, Oct. 5, 1999, specified a number of conditions that have to be met if spectrum in which DoD is the primary user is surrendered. The act requires NTIA, in consultation with FCC, identify and make available to DoD for its primary use, if necessary, an alternate band(s) of frequency as replacement for the band surrendered. Further, if such band(s) of frequency are to be surrendered, the Secretaries of Defense and Commerce, and the Chairman of the Joint Chiefs of Staff must jointly certify to relevant congressional committees that such alternative band(s) provide comparable technical characteristics to restore essential military capability.

[14] For more information on spectrum use decisions for third-generation wireless services, see *Defense Spectrum Management: More Analysis Needed to Support Use Decisions for the 1755–1850 MHz Band* (GAO–01–795, August 20, 2001).

[15] Omnibus Budget Reconciliation Act, P.L. 103–66, Aug. 10, 1993, mandated that bands of frequencies not less than 200 MHz be transferred from use of the federal government to non-federal users. NTIA was directed to make a report on the identification and recommendation for reallocation of frequency bands; utilize specific criteria in making recommendations; issue a preliminary report upon which public comment on proposed reallocations would be solicited; obtain analyses and comment from FCC on reallocations; and transfer frequency bands within specified time frames. It required FCC to gradually allocate and assign frequencies over the course of ten years. The Balanced Budget Act, P.L. 105–33, Aug. 5, 1997, imposed a stricter deadline for NTIA to identify for reallocation and FCC to reallocate, auction, and assign licenses by September 2002 for an additional 20 MHz of spectrum. (Eight MHz of spectrum was subsequently reclaimed per congressional direction. See section 1062 of the National Defense Authorization Act for Fiscal Year 2000, P.L. 106–65, Oct. 5, 1999.)

[16] 47 U.S.C. § 922.

[17] P.L. 106–65, 113 Stat. 767 (1999).

[18] ITU is a United Nations specialized agency. The federal government considers the ITU the principal competent and appropriate international organization for the purpose of formulating international treaties and understandings regarding certain telecommunications matters.

of services and the number of nations adopting communications that utilize the radio frequency spectrum. For example, the emergence of new radio applications with international ramifications, such as broadcasting, radio navigation, and satellite-based services, has increased the need to reach agreements to prevent cross border signal interference and maximize the benefits of spectrum in meeting global needs, such as air traffic control. At the same time, the number of participating nations in these negotiations has risen dramatically—from 9 nations in the first conference held in 1903, to 65 nations in 1932, to 148 at the conference held in 2000—along with the frequency of conferences (now held every 2 to 3 years), and the number of agenda items negotiated at a conference (e.g., 11 in 1979; 34 in 2000). There has also been a movement toward regional cooperation at WRCs. Because decisions on WRC agenda items are made by vote of the participating countries—with one vote per country—uniform or block voting of nations in regional alignment has emerged to more effectively advance regional positions.[19]

The State Department coordinates and mediates the U.S. position for the WRC and leads the U.S. delegation to the conference through an ambassador appointed by the President. We found strong agreement among those we interviewed that it is important for the United States to develop its position in advance of the conference in order to have time to meet with other nations to gain international support for our positions. However, we heard differences of opinion about the United States' preparatory process for the conferences. U.S. positions on WRC agenda items are developed largely through separate processes by FCC and NTIA with the involvement of their respective constituencies. To obtain input from non-federal users, FCC convenes a federal advisory committee comprised of representatives of various radio interests (e.g., commercial, broadcast, private, and public safety users), and solicits comment through a public notice in the *Federal Register*. NTIA and federal government users can and do participate in the FCC process. To obtain the views of federal spectrum users, IRAC meets to provide NTIA with input on WRC agenda items. Although IRAC's WRC preparatory meetings are closed to the private sector due to national security concerns, non-federal government users may make presentations to IRAC to convey their views on WRC agenda items. Any differences of opinion between FCC and NTIA on the U.S. position must ultimately be reconciled into a unified U.S. position on each WRC agenda item. In cases where differences persist, the ambassador acts as a mediator to achieve consensus to form a position.

State Department and FCC officials told us that the work of FCC and NTIA with their respective constituencies and with each other in preparation for a conference leads to U.S. positions on WRC agenda items that are thoroughly scrutinized, well reasoned, and generally supported among federal and non-federal parties. In contrast, some non-federal officials told us that the NTIA process does not allow the private sector adequate involvement in the development of U.S. positions for the WRC. Also, some federal and non-federal officials said that since each agency develops its positions through separate processes, it takes too long to meld the two toward the end of the preparatory period. For example, to speed up our preparatory process, the former U.S. Ambassador to the 2000 WRC recommended merging the separate FCC and NTIA preparatory groups to get an earlier start at working with industry and government users to reach a consensus on U.S. positions regarding WRC agenda items.[20]

Differing views also have been expressed on how we appoint an individual to head the U.S. delegation. Since the early 1980s, the President has appointed an ambassador to head the U.S. delegation to WRCs for a time period not exceeding six months.[21] The former U.S. Ambassador to the 2000 WRC said that ambassador status is generally believed to confer a high level of support from the administration, and it is viewed as helping to achieve consensus in finalizing U.S. positions and enhancing our negotiating posture. However, the former ambassador also said that the brief tenure of the appointment leaves little time for the ambassador to get up to speed on the issues, solidify U.S. positions, form a delegation, and undertake preconference meetings with heads of other delegations to promote U.S. positions. In

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[19] One of the U.S. delegation's objectives stemming from its experience at the 2000 WRC is to work more closely with participating countries in our own region in preparing for the 2003 conference.

[20] *Recommendations to Improve United States Participation in World Radiocommunication Conferences*, Ambassador Gail S. Schoettler, U.S. Head of Delegation, World Radiocommunications Conference 2000, June 27, 2000.

[21] 22 U.S.C. § 3942. This provision of law enables the President to confer the personal rank of ambassador on an individual in connection with a special mission for the President not exceeding six months in duration. The President need only transmit to the Senate Committee on Foreign Relations a written report on the appointment; confirmation by the Senate is not needed.

addition, the ambassador said there is concern about the lack of continuity in leadership from one conference to the next, in contrast to other nations that are led by high-level government officials who serve longer terms and may represent their nations through multiple conferences. Leaders of national delegations with longer terms are perceived as being more able to develop relationships with their counterparts from other nations, helping them to negotiate and build regional and international support for their positions. On the other hand, NTIA officials expressed the view that the ambassador's negotiating skill was of equal importance to the duration of the appointment.

Encouraging Efficient Federal Spectrum Use

NTIA has several activities to encourage efficient spectrum use by the federal government, but does not have assurance that these activities are effective. NTIA is required[22] to promote the efficient and cost-effective use of the federal spectrum that it manages—over 270,000 federal frequency assignments at the end of 2000—"to the maximum extent feasible." NTIA has directed agencies to use only as much spectrum as they need.

NTIA's process for assigning and reviewing spectrum places primary responsibility for promoting efficiency in the hands of the individual agencies because the determination of agencies' spectrum needs depends on an understanding of their varied missions. Moreover, the large number of frequency assignments that require attention (NTIA processes between 7,000 and 10,000 assignment action requests—applications, modifications, or deletions—from agencies every month on average) makes it necessary to depend heavily on the agencies to justify and review their assignment needs.

NTIA authorizes federal agency use of the spectrum through its frequency assignment process. As part of this process, NTIA requires an agency to justify on its application that it will use the frequency assignment to fulfill an established mission and that other means of communication, such as commercial services, are not appropriate or available. In turn, agencies generally rely on mission staff to identify and justify the need for a frequency assignment and complete the engineering and technical specifications for the application. NTIA and IRAC review the application to ensure, among other things, that the assignment will not interfere with other users. Once NTIA has authorized spectrum use by agencies, it requires that the agencies review their frequency assignments every 5 years to determine that the assignments are still needed and meet technical specifications.[23] NTIA said that it may delete assignments that have not been reviewed for more than 10 years.

Officials from the seven federal agencies in our review told us that they attempt to use spectrum as efficiently as possible, but five of them are not completing the required five-year reviews in a timely or meaningful way. According to agency officials, this is due to shortages of staff available to complete the review or because completing the reviews are a low agency priority. For example, a spectrum manager for a major agency division has over 1,000 frequency assignments that have not been reviewed in 10 years or more. A spectrum manager in another agency said that the agency has eliminated all field staff responsible for assisting with the five-year reviews, which has impaired the timeliness and quality of the reviews. The spectrum manager for a third federal agency said that he was sure that the agency was not using all of its frequency assignments, but he added that conducting a comprehensive review would be cost prohibitive and generate limited benefits to the agency. However, we note that although the agencies may not reap benefits from conducting these reviews, if these reviews result in the release of unused or underutilized spectrum, other federal and non-federal users could benefit.

Although NTIA's rules and procedures also include NTIA monitoring programs designed to verify how spectrum is used by federal agencies, NTIA no longer conducts these programs as described. For example, at one time, the Spectrum Management Survey Program included NTIA site visits to verify if agency transmitters were being used as authorized. NTIA said that although this program helped correct frequency assignment information and educate field staff on NTIA requirements, it is not currently active due to NTIA staff shortages. In addition, the Spectrum Measurement Program made use of van-mounted monitoring equipment to verify that federal agencies were utilizing assigned frequencies in accordance with the assignment's requirements. NTIA said that although this program provided useful information, the van-mounted verification has been discontinued due to lack of resources. As a result of the limited nature of the assignment and review programs and de-

[22] 47 U.S.C. § 903(d)(1).

[23] Certain aeronautical and military frequency assignments are required to be reviewed every 10 years.

creased monitoring, NTIA lacks assurance that agencies are only using as much spectrum as they need.[24]

NTIA also seeks to promote efficiency by advocating spectrum conservation through research and technical initiatives, but some of these activities face implementation problems. Two examples illustrate the potential and the limitations of these types of efforts. First, NTIA, with the approval of IRAC, has required all federal agencies to upgrade land-based mobile radios by setting deadlines for halving the spectrum bandwidth used per channel (in essence, freeing up half of each band currently in use) for radios in certain highly congested bands—a process called narrowbanding.[25] This requirement has the potential to greatly expand the spectrum available for land mobile telecommunications, but some agencies said that they are struggling to meet the deadline due to a lack of sufficient staff and funding. Several agencies in our review said they will not complete the upgrades before the deadline. For example, the Chief Information Officer for one agency that is a member of IRAC compared the requirement to an unfunded mandate, and indicated that his office did not have the financial resources needed to upgrade the tens of thousands of radios that fall under the requirement.

A second example of a technological initiative is a NTIA-sponsored pilot program for federal agencies in six cities in the early 1990s to establish a spectrum sharing method for voice radio communications, called trunking, which conserves spectrum by putting more users on each radio channel. According to NTIA, some agencies resisted the program because it was more costly for agencies to participate in trunking than it was for them to use their own channels. In addition, some agencies said the trunking systems did not meet their mission needs.[26] NTIA added that the program was only completely successful in Washington, DC, where agency demand for frequency assignments, and therefore spectrum congestion, is extremely high. We found efforts to encourage this technology in other countries as well. In the United Kingdom, providers of emergency services are being encouraged to join a trunking system. Once the new system has proved to be capable of meeting their needs, certain public safety users will incur financial penalties if they do not use this system. Additionally, in one province in Canada, a variety of public safety users have voluntarily begun developing a trunking system in order to use their assigned spectrum more efficiently in light of the fees they must pay for this resource.

NTIA also told us that the congressionally-mandated spectrum management fees agencies must pay also help to promote the efficient use of spectrum. These fees are designed to recover part of the costs of NTIA's spectrum management function. The fees began in 1996 and amounted to about $50 per frequency assignment in 2001. NTIA decided to base the fee on the number of assignments authorized per agency instead of the amount of spectrum used per agency because the number of assignments better reflects the amount of work NTIA must do for each agency. Moreover, NTIA stated that this fee structure provides a wider distribution of cost to the agencies.[27] Although NTIA officials said that spectrum fees provide an incentive for agencies to relinquish assignments, it is not clear that this promotes efficient use of spectrum, in part because agencies may be able to reduce assignments without returning spectrum. For example, a spectrum manager for a federal agency said that the spectrum fee has caused the agency to reduce redundant assignments, but that it has not impacted the efficiency of the agency's spectrum use because the agency did not return any spectrum to NTIA as a result of reducing its assignments.

We have learned that other countries are moving toward using payment mechanisms for government spectrum users that are specifically designed to encourage government users to conserve their use of spectrum, rather than to recover the cost of managing the spectrum. Both Canada and the United Kingdom are reviewing

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[24] The issue of unused spectrum is not exclusive to federal agencies. A recent self-reported survey of some private radio bands by FCC resulted in the return of over 30,000 unused spectrum licenses.

[25] In 1992, Congress directed NTIA to adopt and implement a plan for federal agencies with existing mobile radio systems to use more spectrum-efficient technologies. 47 U.S.C. § 903(d)(3). In 1993, NTIA provided Congress with a report—*Land Mobile Spectrum Efficiency: A Plan for Federal Government Agencies to Use More Spectrum-Efficient Technologies*—that included the narrowbanding plan.

[26] In addition to cost constraints, federal agencies can choose not to use an existing land mobile system if the agency can justify that it needs its own system to meet its mission requirements. For example, GAO agreed with NTIA that the Navy was in the best position to assess whether it needed its own land mobile system to meet its mission.

[27] A bandwidth-based approach would have forced the Air Force to pay the majority of the fees because of the large amount of spectrum the radars they operate use. However, each radar transmitter requires only one assignment.

their administrative fee structures at this time with the intent of encouraging spectrum efficiency.

Additional GAO Work on Spectrum Management

We are conducting additional work on the management of the radio spectrum to determine how the current rules and regulations governing spectrum holders affect the rollout of new technologies and services and the level of competition in markets that utilize spectrum. To address these and other related issues, we are building on the information presented here today concerning U.S. rules and regulations governing spectrum management. We are interviewing an array of providers of mobile telephone, satellite, paging services, broadcasters, NTIA, other federal agencies, and public safety representatives. Tomorrow we are hosting a panel with experts from several of these sources to elicit additional input on these and other issues.

We are also collecting information from spectrum managers in approximately 12 other countries. We are interested in learning about their regulatory structure, including their assignment processes, the amount of flexibility allowed spectrum users, the existence of secondary markets, and their rules regarding interference. In addition, we are interested in determining what incentives—market-based or administrative—are employed to encourage government and non-government users to conserve spectrum. We will also seek to determine what impact these regulators think their actions are having on consumer prices, the deployment of new technology, the rollout of new services, and the level of competition. From this work, we hope to summarize alternative approaches to spectrum management used around the world and to identify similarities and differences between these approaches and those used in the United States.

Mr. Chairman, this concludes my prepared remarks. I would be pleased to answer any questions you or other Members of the Committee may have.

Senator INOUYE. Thank you very much, Mr. Guerrero.

Now may I call upon Mr. Price.

STATEMENT OF STEVEN PRICE, DEPUTY ASSISTANT SECRETARY FOR SPECTRUM, SPACE, SENSORS, AND C3, OFFICE OF THE SECRETARY, DEPARTMENT OF DEFENSE

Mr. PRICE. Thank you. Mr. Chairman and Members of the Committee: I would like to thank you for inviting me today and also thank you for your remarks earlier, most of which the Department fully agrees with. The Department of Defense appreciates that your Committee is looking at spectrum management issues.

Spectrum is the lifeblood of our military. Every ship at sea, every airplane conducting missions, every forward-deployed young man or woman, especially in hard-to-reach locations, depends on radios and spectrum to conduct their missions and to return home safely. A Special Forces team leader operating during Operation Enduring Freedom in Afghanistan recently told me: "We could go in there naked with flipflops and as long as we have good radios we could do our job."

Information clearly is one of our most important weapons. A Department of Defense spectrum requirements analysis completed prior to the September 11th and therefore likely to be an underestimate predicted Department of Defense spectrum usage growth of more than 90 percent by 2005. This did not take into account new demands in the arena of homeland defense, such as potential spectrum-related missions like military support for major events, as was the case during the Olympics in Salt Lake City, protection of critical infrastructure and emergency response.

In short, the Department of Defense spectrum needs are growing rapidly and the Department does not believe that the future needs of our transformed, network-centric military can be met without access to additional spectrum allocations.

DoD spectrum policy is guided by certain core principles. First, spectrum is critical to DoD. As I have mentioned, it is a core enabler of what we do. Therefore, we should not allow lack of sufficient spectrum to be a constraint on our war-fighters.

Second, spectrum is, as has been mentioned, a vital national resource. We understand that our needs must be balanced with other national needs. Our view is that such a balance must recognize that essential defense needs must have top priority.

The third spectrum policy is that we recognize that we must be a good and responsible spectrum user. We must, as was mentioned earlier, justify how we use our spectrum and how much spectrum we need. In fact, we do strive to be as efficient a user as we can be.

But it is important to understand that when talking about needs and efficiency our use is very different from that of commercial enterprises. The commercial sector seeks low-cost, high-revenue solutions. Therefore, busy signals are acceptable. I understand and accept that fact. In fact, when I ran a publicly traded wireless company years ago I did exactly that. But such cannot be the case for our military, because our calls must get through, whether they are guiding precision guided munitions or alerting a soldier of harm. Where lives are the stake, there is no margin for error.

Despite how critical spectrum is to DoD's mission, our access to it is under attack. This is evidenced by the current viability study for 3G services. Losing needed spectrum is like losing any other vital resource. It costs the Department both in current capability and future opportunity, both directly and through reallocation of dollars to mitigate the damage. Each time we are forced to adjust training in the United States away from operational norms to accommodate domestic frequency restraints, our training realism and effectiveness suffers.

The uncertainty caused by relocation attacks pose serious risks for our long-term planning. Will we be required to move? Will we get the money to move? Will we need to retrain? Will we retrain in time to be prepared to deploy in an emergency? Will we need to change our concepts of operations to account for degraded capabilities? Will we be able to get host nation approval to use the systems in the new frequency bands in all parts of the world we might need to do so? Will our allies who bought interoperable systems to work with us and who are now required to modify their systems because of our domestic constraints do so, and who will pay their bill? And on and on.

DoD bears the risk of cost overruns for moving. We bear the risk of overcoming technical challenges and, most importantly, we bear the risk of failure of our equipment due to hasty relocation decisions.

In the Department of Defense we have a duty to the young men and women who defend our country. We have a duty to ensure that they have the tools they need to do their job. We believe we owe them policies to ensure that lack of access to spectrum is not a constraint on their capabilities.

Thank you for your time. I look forward to working with you and the other witnesses on these important issues.

[The prepared statement of Mr. Price follows:]

PREPARED STATEMENT OF STEVEN PRICE, DEPUTY ASSISTANT SECRETARY FOR SPECTRUM, SPACE, SENSORS, AND C3, OFFICE OF THE SECRETARY, DEPARTMENT OF DEFENSE

1. Introduction

I would like to thank the Members of this Committee, and particularly Chairman Inouye, for holding this hearing on spectrum management and use. I think that our experiences in Afghanistan indicate just how important this issue is to our armed forces.

DoD's spectrum needs are increasing due to new operational concepts, including more extensive use of Unmanned Aerial Vehicles, as well as evolving strategies that require joint, dispersed forces to have greater connectivity in the "last tactical mile." One of the platforms used in Operation Enduring Freedom is the Predator. This new type of military system is an Unmanned Aerial Vehicle (UAV). Because the plane is unmanned, it must be controlled and operated remotely. That means it is entirely dependent on spectrum, both for flight control and to pass along information. Without spectrum the Predator would, in aviator parlance, "go stupid"—it could neither fly nor be able to pass on information or images, which is its core function. In Afghanistan, we used Predators to laser-designate targets for bombers, and the Air Force is even testing how well Predators can fire laser-guided missiles. Many experts see Predators and other UAVs as being in a similar developmental phase as manned aircraft were in the 1920s and 30s. This is, of course, great news because we can do so much, without risking lives, in reconnaissance, targeting and now even firing of weapons. There is, however, a cost to all of this, and that cost is in spectrum. These UAVs absolutely depend on spectrum; if they don't have it, they fall out of the sky.

The Predator example is just one indication of how spectrum is crucial for DoD's entire mission, including homeland security. Fully sufficient spectrum is essential in accomplishing national defense missions, and ensuring that the Department of Defense retains such spectrum it needs is a top national priority.

Mr. Chairman, as I will discuss in more detail in my testimony, spectrum is integral to our nation's defenses. It is critical to the success of national security policy at home and abroad. We must be able to inform you, the commercial sector and the general public of that importance as we try to balance the relative values of competing interests.

Spectrum is the lifeblood of the Department of Defense. Every ship at sea, every airplane conducting missions, every forward-deployed young man or woman—especially in hard to reach locations—depends on radios and spectrum to conduct missions and to return home safely. Captain Jason Armerine, a Special Forces Team Leader during Operation Enduring Freedom, spoke about his experience in the early days of the Afghanistan campaign: "We could go in there naked with flip-flops and as long as we have good radios, we could do our job."

This will be even truer in the future, as DoD's ongoing transformation to a network-centric military will add new demands. A DoD spectrum requirements analysis, completed prior to September 11, 2001 (and therefore likely to be an underestimate) predicted DoD spectrum usage growth of more than 90 percent by 2005. In addition, there will be new demands in the arena of homeland defense. These will likely include new spectrum related missions, such as military support for major events (such as was the case in the 2002 Winter Olympics in Salt Lake City), protection of critical infrastructure and emergency response.

Spectrum is one of our nation's most valuable natural resources. It is not uncommon for us to use land or real estate analogies to describe spectrum. We use terms like "beachfront property"—that's how valuable it is. The reason it is so valuable is that it enables so much of the technology that many people look to in order to solve many problems. The communications and information revolution has now resulted in commercially successful technologies unimagined several years ago: such as, tiny wireless phones, wireless local area networks (LANs), Internet access from virtually anywhere in the world.

But these technologies are even more important to the military because of the lack of any wired alternative in many military operations. Wireless technologies are particularly important for our military forces' operations because of their increasingly mobile and flexible nature. The ongoing revolution in military affairs/operations has made information the key component of warfare. Mass of force no longer has the power it once did because our tactics are more sophisticated, as are our warfighters and the equipment they carry. The revolution in personal communications that civilians have experienced is mirrored by a similar revolution in military communications. We can make a phone call or access the Internet on a landline, but the ship captain, bomber pilot or tank commander has no other option but wire-

less communications. And because of the way we fight, that information is more important than ever, both to the troops in the field and to the commanders—whether they are in theater or 12,000 miles away.

The pressure on government spectrum will not end. Wireless technologies will continue to proliferate. While 3G services have yet to be widely deployed, there is already industry discussion of 4G and 5G technologies, as well as widespread wireless LANs. We should resist the convenient arguments that these burgeoning technologies should be supported by reallocation of more government spectrum—we must arrive at a sound spectrum policy that allows our commercial interests to coexist with public interests.

2. DoD Use of Spectrum

Spectrum enables almost every function that DoD performs. Whenever mobile platforms—whether satellites, ships or trucks—exchange information, spectrum is involved. I would like to go through some examples of this just to give you a flavor of what we are really talking about here. Military strategists around the world—and, in fact, the American public—have seen first-hand in Afghanistan how the United States has been able to defeat an extraordinarily determined enemy in some of the world's most inaccessible terrain. We have demonstrated the advantage to our nation of asymmetric warfare, relying upon networked satellites, UAVs, air support, precision-guided weapons and Special Forces on the ground. The accuracy of precision-guided weaponry is dependent on our GPS satellite system and on UAVs that can spot the enemy very effectively. The weapons guidance systems are entirely dependant on radio spectrum. Where sky-based surveillance alone does not provide our forces and their allies with sufficient knowledge of circumstances on the ground, we have relied on radio-based communications between our ground-based forces and air-based forces, and indeed, the Central Command in Tampa, Florida. What we have is an extraordinarily complex electromagnetic ecosystem. Indeed, I would posit that it is one of the most complex electromagnetic ecosystems in the world, all functioning exceptionally well under battlefield conditions. The preparations for this Afghanistan scenario, and its enactment itself, are based in large measure on spectrum in the bands from 1755 MHz to 1770 MHz—precisely the bands that industry has targeted over the past year. Let me describe some of the critical DoD systems that operate in these bands.

The uplinks that control all DoD and intelligence satellites—more than 120 satellites representing a cumulative investment of about $100 billion—use spectrum in the 1755–1850 MHz band. These satellites perform communications, positioning and timing, surveillance and reconnaissance, weather observation, and other functions crucial to warfighting and to decision-making. The telemetry, tracking and command systems for all of these satellites resides in the critical 1755–1770 band which is still under consideration. In addition to the satellite control function, the 1755–1850 MHz band also serves as an uplink to provide processed weather data and navigation timing information to DoD satellites for down linking to DoD users on a worldwide basis.

DoD's GPS satellites have become crucial parts of the national civilian/military infrastructure, supporting global navigation and positioning requirements for air, land and sea vessels. Today in Afghanistan, GPS supports everything from precision-guided munitions to Special Forces operations. Precision targeting done by special operations forces is virtually impossible without GPS.

Battlefield radio relay systems also use the 1755–1850 MHz spectrum and form the long-haul backbone of the Army and Marine tactical Internets. They let our ground forces share situational awareness and coordinate their operations in real time across the extended battlefield, as well as with ships offshore.

In terms of training our forces, the Air Force and Navy aircrew combat training system are also heavily dependent on the 1755–1850 MHz spectrum. This system provides realistic training to our aircrews that cannot be gained in flight air combat simulators, while allowing supervisors to make critical assessments of their performance and give feedback to improve that performance. This is one of the main reasons that American pilots are the best-trained combat pilots in the world. We can ill-afford to send marginally trained aircrews into combat; on the first night of an air war there can be no learning curve. A major impact of reduction of spectrum allocated to federal uses is the effect on training and, consequently, combat readiness. The comprehensive training required to achieve and maintain combat readiness is essential for the effective deployment of our forces for both homeland defense and wartime conditions. This training includes the development of operational tactics and doctrine to ensure that our forces operate at maximum capabilities.

The following is an excerpt of a March 11, 2002 Aviation Week article on this topic, which shows how important a role bandwidth and spectrum played in our current operations:

> For example, a Rivet Joint (airplane) orbiting over Pakistan or a signals intelligence satellite in space picks up a communication indicating Al Qaeda activity in some corner of Afghanistan. That sigint "tipper" is sent to the (combined air operations center). Operators there look for the fastest intelligence platform—Joint Stars, AWACS or P–3, for example—and send it to the hot spot to begin controlling the local engagement using its wide area sensors. Meanwhile, a slower Predator (unmanned plane) is turned and starts taking its acute but narrow field-of-view sensors to the scene. . . The Predator shows up and relieves the manned aircraft, which moves off to the next problem. The UAV then provides precise target coordinates to an AC–130 gunship or a strike aircraft.

Virtually all of these systems played a key role in the Allied victory in Kosovo and are now being used in Afghanistan in the war on terror. The success of these operations would be unlikely without satellite-based communications, navigation, and reconnaissance, without well-trained combat aircrews, without precision-guided weapons, and without tactical radio relay systems.

In an era of reduced force structure and increased mission responsibilities these systems serve to enhance significantly our operational capabilities. Enhanced knowledge of the battlefield (or, situational awareness) and precise engagement capabilities obtained from these spectrum-dependent force-multiplier systems protect our forces throughout the full range of U.S. involvement, from combat to peacekeeping and humanitarian operations.

I want to say in the most unequivocal way possible that the loss or degradation of our ability to perform these crucial functions would have severe consequences for national security. It would result in mission failures and increased casualties in future operations, as well as the loss of vital intelligence information to the President and senior leaders. As Secretary Rumsfeld and then Chairman of the Joint Staff Shelton wrote to Senator Daschle on August 27, 2001, "Access to the radio frequency spectrum is essential to our success in *all* future real-world operations. Lack of adequate spectrum will jeopardize our national security."

Access to sufficient spectrum will be even more important to our military in the future. All of our transformational priorities depend on it. Spectrum supports the six goals from the Quadrennial Defense Review. Access to bandwidth and spectrum help the military:

- Protect our bases of operation and our homeland
- Deny enemies sanctuary
- Project power in denied areas
- Leverage information technology
- Enhance information operations, and
- Maintain our unhindered access to space

Just as in the civilian world, the military is seeing a quantum leap in the demand for spectrum. Transformation is driving this and will continue to drive it. Without sufficient spectrum, there is no transformation. And without transformation, our military forces may not be able to maintain the crucial edge needed to confront and defeat the nation's 21st Century enemies.

Much of DoD's spectrum use is unique. Unlike the commercial sector's drive for low cost, high revenue solutions, the DoD's core belief is that where lives are at stake, there is no margin for error—the "call" must get through. When an aircraft is guiding a precision weapon, or a commander is relaying life-saving information to troops on the ground, there cannot be "busy" signals. Some spectrum use that industry might label as "inefficient" is actually designed for anti-jam systems, low probability of intercept, and other "counter counter-measures." For the military, "efficient spectrum use" often translates into "guaranteed information delivery" and because of that, commercial standards that allow a certain percentage of built-in busy signals or dropped calls cannot be tolerated. Nor, in many cases, are commercial measures of efficiency useful.

Another example of DoD's unique use is that we often operate many different emitters in close proximity to each other. Our AWACS command and control aircraft uses 50 antennas to track other platforms, communicate and direct the battlefield. If one system on the airplane were changed it would affect all of the others. How this kind of equipment interacts with each other is really a science. The issue is complicated when talking about warships, such as aircraft carriers, that have a large number of emitters and also handle live ordnance on the decks—electromagnetic energy can in some cases cause ordnance to detonate. The Joint Spectrum

Center does a great deal of analysis in this area, mitigating interference between different pieces of equipment and ensuring that there are no harmful effects of radiating the equipment. Without their efforts radiating emitters near each other would be hazardous with the risk of interference substantial.

3. DoD Spectrum Principles

DoD spectrum policy is guided by certain core principles. First, spectrum is a vital national resource. DoD understands that its needs must be balanced with other national needs. Therefore, it supports a US spectrum policy that balances military and economic security. DoD believes that the balance of authority between the President's spectrum manager, the NTIA, and the Federal Communications Commission, as implemented at a practical level, helps to achieve the appropriate balance. That balance must recognize that the Department of Defense must have sufficient spectrum to meet the nation's defense needs. This is a longstanding principal of national spectrum management and it should continue.

Second, spectrum is critical to DoD. It is a core enabler of what we do, and it is indispensable to national security. Therefore, we should not allow lack of sufficient spectrum to be a constraint on the US warfighter or on military capabilities. DoD spectrum needs should be driven by military requirements and capabilities, not spectrum allocations.

Third, DoD recognizes that it must be a good spectrum user. DoD must strive to be as efficient a spectrum user as it can be. For example, DoD is in the process of implementing an internal reorganization to create the Defense Spectrum Office. This is a new entity, co-located with the service frequency management offices, that will among other things focus on spectrum efficient technologies and promote interservice sharing of spectrum assets.

Fourth, DoD intends to continue investing in new, spectrum-efficient technologies. It will continue to seek to use technology to alleviate DoD's and the commercial sector's long-term needs for additional spectrum. DoD has been a major contributor to the birth of proven spectrum efficient technologies, including CDMA and software defined radio, and those that show potential, such as ultra wideband. Significant research is ongoing within DoD in search of efficient technologies. This research includes extensive work on such topics as adaptive spectrum usage, frequency and bandwidth agility, phased-array antenna configurations, interference mitigation techniques, congestion control technologies and numerous networking projects. In addition, DoD continually seeks to better manage its spectrum allocations. For example, it will seek to move fixed use assignments out of lower frequency bands and into bands less suitable for mobile applications.

Fifth, DoD commits to actively supporting US policies and interests in international organizations and multinational and bilateral negotiations for spectrum allocation and use. The Department of Defense works with the State Department and other federal agencies on international negotiations regarding spectrum allocations and related matters, under the auspices of the International Telecommunication Union and regional telecommunication and related international organizations and with other countries on bilateral matters. The cycle of preparations is a permanent, ongoing process leading up to World Radiocommunication Conferences, which are held about every three years.

4. Spectrum Management Process

DoD is a user—a large user—of frequency spectrum. We understand that our role is not that of a regulatory body, and we believe that the FCC and NTIA are the proper bodies to address national spectrum policy. Nonetheless, we welcome participating in the discussion and in formulating a national spectrum strategy. We believe that the current spectrum management process creates imbalances and asymmetric risks for the incumbent uses. These must be set straight through effective use of a rational, long-term spectrum management policy that mirrors national priorities. In developing those priorities, DoD believes it is important to have a spectrum management system that recognizes national defense as a top priority in spectrum allocation, that DoD needs long-term certainty and reliability of access to spectrum, and that, in those cases in which spectrum is reallocated from defense use to commercial use, DoD should not bear all the costs and risks associated with the reallocation.

There's another element involved in these allocation decisions as well. The risks to the incumbents are entirely asymmetric: this is true whether DoD is being asked to move, as with 3G, or to accommodate a new, potentially disruptive technology, as with UWB. When the incumbents are asked to move, they bear the risks that the new allocation will not be free of interference, that the costs will be greater than

predicted, and that the technical characteristics will not be as beneficial to the use. The party asking for the incumbent to relocate bears none of these risks and costs.

The uncertainties caused by the constant threat of relocation poses serious issues for our long-term planning. Will we be required to move? When will we get the money to move? Will we need to retrain? Will we retrain in time to be prepared to deploy in an emergency? Will we need to change concepts of operations to account for degraded capability? Will we be able to get host nation approval, when needed, to use systems in the new frequency band in all parts of the world where we might need to do so? Will our allies who bought inter-operable systems now also be required to modify their equipment? And if so, who pays their bills? Will the new spectrum be free of interference? And on and on.

The issue is not simply one of increased money to pay costs of moving; the Department of Defense bears the risk of overcoming these and any technical and regulatory challenges. And most importantly, we bear the risk of potential failure of our equipment caused by hasty relocation decisions. Due to the nature of our responsibilities in keeping this country free and safe and protecting the lives of the young men and women who serve in our military, a relocation that compromises our essential capability is unacceptable.

5. Third Generation Wireless

In October 2001, NTIA, FCC, DoD and other Executive Branch agencies developed a plan to assess spectrum for advanced wireless services. DoD has been supporting this viability effort and it is still ongoing. A few points must be understood in this context. First, the process is a viability assessment that is examining current uses of the bands and feasibility of sharing or relocating certain users. The goal is to reach solutions that best serve the national interest—balancing commercial goals with national security and public safety interests. Second, the Viability Assessment's Terms of Reference require that the parties take into account changing DoD needs following the September 11 attacks. Since that tragic date, DoD has accelerated its move to a transformed, mobile, networked and flexible military. In addition, it has a new mission for homeland defense, as evidenced by the creation of Northern Command, a new combatant commander for the continental United States. Spectrum needs associated with NorthCom currently are being examined. These new homeland missions may include protection of critical infrastructure and support for major events. I note that last week the President asked the Congress to work with him to create a Cabinet-level agency for homeland defense. In short, DoD's potential need for access to additional spectrum—not to mention its need to maintain existing allocations—must be considered in the viability assessment. Third, I'd like to commend the staffs of the FCC and NTIA for their tireless and skilled work throughout this viability assessment.

The 1755–1770 band has superior features that make it a vital resource for military applications. The band's characteristics uniquely enable small antennas, sufficient antenna beam widths for simple reliable link establishment and sustainment, low power transmissions that support extended communications ranges and high data-rate channels. No other spectrum band presently available to the Government and not overcrowded possesses all of these attributes.

In addition, the US employs the same military systems as many of our allies and coalition partners around the world—in fact many of them procured systems specifically to interoperate with ours. Any decision to modify equipment or change the band-operating capabilities would be detrimental to our allies. Requiring them to pay for new equipment merely because of a US domestic spectrum allocation decision would be problematic.

All major DoD systems in the band have received, or are in the process of receiving, host nation coordination, where needed. These are negotiated on a bilateral basis and allow DoD to operate our systems in the national territories of our allies and coalition partners. In one case, it took the US Central Command six years to get host nation approval to operate our tactical radios in a specific, important country. Were we required to move out of 1755–1770, that clock would start anew and—who knows for how long—those radios would be unusable in that theater and in other key countries.

Some of the systems that use spectrum in the 1755–1770 MHz band are: space operations; Tactical Radio Network Systems; Air Combat Training Systems; and Precision Guided Munitions. Space operations are particularly difficult, expensive and time-consuming to relocate because some of the satellites using the band are not due to be replaced until 2017 and once launched, satellites cannot simply be "retuned." So they either must have access to the band until then, or the new licensee must pay for new satellites well ahead of the end of their scheduled service life, at great additional and unnecessary cost. Air Combat Training Systems are

used to train pilots and are critical for use in training aircrews before deployments to combat zones—all deploying aircrew use these systems for realistic training. Precision Guided Munitions (PGMs) make modern air warfare possible. As the name implies, they allow for precision targeting that enables pilots to accurately deliver their weapons from farther outside the range of the enemy threat. They also increase the effectiveness and lethality of airpower, making operations like Enduring Freedom in Afghanistan and Allied Force in Kosovo possible. And they greatly reduce the risk of collateral damage caused by a weapon veering off-course. In short, PGMs have revolutionized air power.

Our aircrews must "train like they fight." They must be allowed to drop live ordnance on training ranges in the United States, and they must have unimpeded access to the spectrum required to do so. I would also note that DoD retains access to the 1710–1755 MHz band at 16 protected sites. One important function that takes place at these 16 sites is Aeronautical Telemetry which takes place at 10 of the 16 sites and is most commonly associated with testing of airborne equipment. The telemetry downlinks can be from manned or unmanned aircraft, missiles or other ordnance devices. Aircraft operations are expensive and often not easily replicated, therefore the signals are robust to prevent loss of data resulting in a wide area of potential interference. Access to the spectrum at all of these sites is essential and shows how some of the impacts from previous reallocations have been mitigated.

DoD believes that the burden must be on the proponent of any new spectrum allocation to prove that they really need that spectrum. In the 3G debate, it is not clear how much new spectrum is really necessary. Some companies have begun to deploy 3G services without additional spectrum allocation. Many argue that the FCC's lifting of spectrum caps, and steps allowing wireless carriers to share spectrum, have mitigated the requirement for new spectrum allocations.

DoD understands the importance of a vibrant industrial base, including the wireless sector. However, especially in uncertain times, policy makers must protect our national security and ensure that spectrum limitations are not a constraint on our warfighters.

DoD is open to finding solutions, provided DoD's interests and requirements are met. Such solutions must include identification of comparable spectrum for displaced DoD functions, full compensation for costs incurred and the requisite time to transition. These are not new requirements, and we believe they are reasonable.

Third-Generation wireless is by no means the only spectrum-dependent technology for which spectrum needs must be balanced with those of national security. One of the newest spectrum-dependent technologies competing for spectrum access is Ultra Wideband. Unlike traditional wireless technologies, UWB consists of radio pulses that emanate, at low-power levels, across a wide range of spectrum bands. Thus, as a result of the FCC's April 2002 Report and Order, UWB will operate, on a non-licensed basis, across many different spectrum bands, in which hundreds of government and commercial users are licensed to provide hundreds of vital and needed wireless services—including vital military and public safety systems. Never before have the FCC and the NTIA authorized unlicensed use of a horizontal slice of spectrum, including certain so-called restricted bands. The effect on DoD and other incumbent users will be evaluated as UWB services are deployed.

6. Comparable Spectrum and Cost Reimbursement

Section 1062(b) of the National Defense Authorization Act for Fiscal Year 2000 (47 U.S.C. 921 note), provides that "[if], in order to make available for other use a band of frequencies of which it is a primary user, the Department of Defense is required to surrender use of such band of frequencies, the Department shall not surrender use of such band" until several conditions are met. First, the FCC and the NTIA must make available to DoD "for its primary use, if necessary, an alternative band or bands of frequencies as a replacement for the band to be so surrendered." Second, the Secretaries of Defense and Commerce, and the Chairman of the Joint Chiefs of Staff, must jointly certify to the congressional armed services and commerce committees that "such alternative band or bands provides comparable technical characteristics to restore essential military capability that will be lost as a result of the band of frequencies to be so surrendered."

DoD's certification takes into account whether the replacement spectrum for different DoD systems has suitable technical characteristics and similar regulatory status so that the displaced function can be performed with no degradation in capability. In considering spectrum replacement issues, it is important to emphasize that spectrum is not fungible. Different parts of the spectrum have different physical characteristics. For example, some bands allow for propagation through foliage, and others through buildings. DoD has often chosen the particular bands of spectrum

that DoD currently occupies for the particular physical characteristics of that band. The reallocation process should provide the DoD systems with the same regulatory status as the systems had in the spectrum replaced. And unless DoD keeps the same priority as well as the comparable technical characteristics, a move from a band where DoD is primary user to a band where DoD is not the primary user would not preserve DoD's essential operational capabilities with respect to that spectrum.

With respect to the costs to DoD—that is, the cost to American taxpayers—when DoD yields spectrum to commercial users and moves to replacement spectrum, the law (47 U.S.C. 923) provides that the commercial users will pay DoD in advance for the costs of relocating operations to the replacement spectrum, including the costs of any modification, replacement or reissuance of equipment, facilities, operating manuals, or regulations. NTIA's Final Rules to implement these statutory requirements will be published in the *Federal Register*. I commend the NTIA and other IRAC agencies' personnel for their hard work over two and one-half years in developing a workable set of Rules.

In addition, the Administration is considering submitting a proposal to Congress s to revise the current cost reimbursement statutory provisions in order to streamline the cost reimbursement process and ensure full cost reimbursement to effected government agencies. It is currently developing legislation to implement this proposal. We are working with OMB, NTIA and other Executive Branch agencies in such efforts.

Cost reimbursement is a critical issue—but DoD's concern over relocation is not merely a cost issue. To some extent, that risk is quantifiable and therefore not as troubling as the potential risk to our operations, which I outlined earlier, including the risk that our systems won't operate, or will operate improperly. These are tough issues and issues that take a tremendous amount of time and effort—effort that could be channeled into serving our warfighters.

7. Conclusion

In closing, we must keep in mind that spectrum is vital to our national security. It is also the critical resource required for transformation of our military forces to meet the challenges of the 21st century and beyond. Spectrum is the very medium through which our military defends our security. I am sure that you will agree that this is its highest purpose.

In the Department of Defense, we have a duty to the young men and women who defend our country. We have a duty to ensure that they have the tools, including spectrum, that they need to do their job. We owe them policies to ensure that lack of access to spectrum is not a constraint on their war fighting capability.

I look forward to working with you, our colleagues in other parts of the government, and members of the private sector to develop a national spectrum policy that preserves spectrum access for national security while balancing commercial interests. We must continue to ensure that our military has ample spectrum to defend our nation and our ideals.

Senator INOUYE. Thank you, Mr. Price.

May I call on Ms. Victory, please.

STATEMENT OF NANCY J. VICTORY, ASSISTANT SECRETARY OF COMMERCE FOR COMMUNICATIONS AND INFORMATION AND ADMINISTRATION, NATIONAL TECHNICAL INFORMATION ADMINISTRATION, DEPARTMENT OF COMMERCE

Ms. VICTORY. Thank you, Mr. Chairman and Members of the Committee, for inviting me here to testify on the important topic of spectrum management.

Spectrum is an invisible but indispensable building block for America's future. It is a natural resource that can fuel economic growth. It is a key to our Nation's digital defense and our citizenry's safety. It is a wireless link that can enable anyone anywhere to access the marvels of the World Wide Web.

But spectrum management is under stress and strain from concurrent challenges. There is the challenge of constantly evolving

technological capabilities. There is the challenge of threats to security and safety. There is the challenge of static processes and legacy regulations in a dynamic field. Finally, there is the challenge of the finite nature of the radio spectrum.

As reflected by the interest of this Committee, spectrum management is one area where we have to get it right and keep getting it right. Too much of our country's future is riding on it to do anything less.

In early April, I convened a 2-day spectrum summit at the Department of Commerce with experts from Government, industry, academia. The purpose of the summit was to explore new and innovative ideas for spectrum policy and management approaches. I was particularly pleased with the extensive participation of the Federal Communications Commission, including Chairman Michael Powell and Commissioners Kathleen Abernathy and Kevin Martin. David Gross, the lead State Department official for international telecommunications policy, also participated.

The results of the summit were very revealing. Among the major problems with spectrum management identified were gaps in governmental coordination, the length and complexity of the allocation process, inefficient uses of spectrum in the absence of efficiency-stimulating incentives, challenges in making room for new services and technologies, and lack of clarity about spectrum rights and the Federal spectrum management process.

From the spectrum summit I believe several basic spectrum management goals emerged. First, the U.S. Government agencies involved in spectrum management—NTIA, the FCC, and the State Department—must work collaboratively as one spectrum team to serve our Nation's collective interests. Chairman Powell and I have taken first steps to improve our inter-agency communications and to take a more forward-looking approach to accommodate advances in technology within our domestic spectrum.

Chairman Powell, Deputy Assistant Secretary Gross and I have also been discussing how we can better coordinate to improve our international outreach as we prepare for international fora like the World Radio Communications Conferences held every 3 years.

Second, we should be developing policies that encourage spectrum efficiency. NTIA has long advocated and required the use of spectrum-efficient technologies by Federal agencies. For example, NTIA has developed and the Federal agencies are now implementing a transition to narrowband technology to relieve the congestion in the land-mobile radio bands used by the Government. NTIA and the Federal public safety agencies have also developed technical standards for receivers to minimize interference and increase overall spectrum efficiency. We are also exploring innovative new technologies, including those that will permit radios to select their operating frequencies, decrease power, and adjust coverage based on sensing the operating environment and dynamically selecting unused channels.

Third, we must establish forward-looking policies that enable technological advances and eliminate legacy regulations that stand in the way of innovation. One such promising reform in this area is the FCC's proceeding to create secondary markets that would permit parties to lease their spectrum to others, to put otherwise

unused spectrum to its most efficient use. Another is the accommodation of frequency-flexible wireless systems, such as those under the 802.11 standard, on an unlicensed basis.

Taking steps to make room for new technologies is key, including through migration or relocation to higher frequency bands. NTIA is currently finalizing rules for Federal agencies to be reimbursed by the private sector for relocation costs, as well as working on a legislative proposal referenced in the President's 2003 budget to create a reimbursement fund from spectrum auction proceeds.

Fourth, we must have policies that ensure the deployment of robust wireless networks that are prepared for the worst crises and able to deliver the very best of services to the American people. The events of September 11th demonstrated how critically important communications capabilities are for our Nation's first responders. Interoperability among these agencies is essential to their ultimate success.

NTIA is attempting to assist in achieving this goal through research at our Boulder, Colorado, lab and through education and outreach. At this very moment, NTIA and the Public Safety Wireless Network Program are co-hosting a summit here in Washington to focus on current and emerging solutions for achieving interoperability.

While we wrestle with building a sound spectrum management framework for the future, the demands of the present increase unabated. NTIA is currently working with the FCC, the Department of Defense, and other Federal agencies to accommodate the demand for spectrum for third generation or 3G wireless services. A viability assessment on making the 1710 through 1770 and 2110 to 2170 megahertz bands available for 3G is scheduled for release later this month.

At the same time, DoD has predicted that its spectrum usage will grow by more than 90 percent by 2005. Wireless systems are critical to our national defense, not only as DoD deploys our troops abroad, but also as it conducts critical training operations here in the United States. These requirements need to be recognized and addressed as we move forward in encouraging innovation and efficiencies in the public sector.

We also need to resolve issues in the 700 megahertz band in a manner that makes clear when and how these frequencies will become available for new wireless services. An equitable and efficient solution for relocating incumbents in these bands is possible, and the administration looks forward to working with the FCC and Congress to ensure such policies are developed in a timely fashion.

Finally, we need to address our spectrum allocation and licensing policies to address the special needs and challenges of the Nation's rural areas.

Mr. Chairman and Members of the Committee, the radio spectrum is vital to our national security and to our economic security. I look forward to working with Congress in developing the best possible spectrum management policies for the future. Thank you again for inviting me to testify and I would be happy to answer any questions you may have for me.

[The prepared statement of Ms. Victory follows:]

PREPARED STATEMENT OF NANCY J. VICTORY, ASSISTANT SECRETARY OF COMMERCE FOR COMMUNICATIONS AND INFORMATION AND ADMINISTRATION, NATIONAL TECHNICAL INFORMATION ADMINISTRATION, DEPARTMENT OF COMMERCE

Thank you, Mr. Chairman. I would like to thank you and the Members of the Committee for inviting me here to testify on the important topic of spectrum management. I am Nancy J. Victory, Assistant Secretary for Communications and Information, U.S. Department of Commerce.

Spectrum is an invisible, but indispensable building block for America's future. It is a natural resource that can fuel economic growth. It is key to our nation's digital defense and our citizenry's safety. It is a wireless link that can enable anyone, anywhere to access the marvels of the worldwide web.

Spectrum management is under stress and strain from concurrent challenges. There is the challenge of constantly evolving technological capabilities. There is the challenge of threats to security and safety. There is the challenge of static processes and legacy regulations in a dynamic field. And finally, there is the challenge of the finite nature of the radio spectrum.

As reflected by the interest of this Committee and its Members, spectrum management is one area where we have "to get it right" and "keep getting it right." Too much of our country's future is riding on it to do anything less.

The Spectrum Summit

In early April, I convened a high-level 2-day Spectrum Summit meeting at the Department of Commerce. The purpose of the Summit was to explore new and innovative ideas to develop and implement spectrum policy and management approaches. The focus was upon ways to encourage spectrum efficiency; provide spectrum for new technologies; and improve the effectiveness of the domestic and international spectrum management processes.

Recognizing that improving the national spectrum management process is a multifaceted undertaking that neither government nor the private sector can do alone, I invited a variety of experts in spectrum management from government, industry, and academia to share their thoughts in this area. I was also particularly pleased with the extensive participation of the Federal Communications Commission in our two-day Summit. Chairman Michael Powell and Commissioners Kathleen Abernathy and Kevin Martin helped moderate panels with me.

The first day of the Summit consisted of panel discussions by government and private sector spectrum users, economists and academic analysts who follow spectrum issues, and technologists and futurists. The second day of the Summit entailed three simultaneous breakout sessions focusing on spectrum management, spectrum efficiency, and international issues. The results of the Spectrum Summit were very revealing. Among the major problems identified were:

- Gaps in governmental coordination—NTIA, FCC & State;
- Length and complexity of the allocation process;
- Inefficient uses of spectrum and the absence of efficiency stimulating incentives;
- Challenges in making "room" or "homes" for new services and technologies; and
- Lack of clarity about spectrum rights and the federal spectrum management process.

A common criticism was that the process is usually too reactive—waiting until the technology is ready to be deployed before beginning the allocation process, rather than anticipating future spectrum needs. There was also significant discussion on the hurdles the current system erects that limit the ability to promote sharing and encourage relocations to accommodate new needs or capabilities. Panelists indicated that the allocation process too often pits advocates of new technology against incumbents, instead of focusing on win-win outcomes that preserve existing rights while facilitating new uses.

The Future of Spectrum Management

From the Spectrum Summit, I believe several basic goals emerged. First, the U.S. Government agencies involved in spectrum management—NTIA, the FCC, and the State Department—must work collaboratively as "One Spectrum Team" to serve our Nation's collective interest. Secondly, we should develop policies that encourage spectrum efficiency. Third, we must establish forward-looking policies that enable technological advances and eliminate legacy regulations that stand in the way of innovation. And fourth, we should ensure that we have policies that ensure the deployment of robust wireless networks that are prepared for the worst of crises and able to deliver the very best of services to the American people. Let me describe what I mean by each of these in a bit more detail.

1. "One Spectrum Team"

The Summit was the first effort to bring NTIA, the FCC and the State Department together in a collective look at common challenges. As head of NTIA, I have responsibility for managing the federal government spectrum. As head of the FCC, Chairman Powell has responsibility for managing non-federal spectrum. As the lead State Department official for international telecommunications policies, David Gross, the U.S. Coordinator and Deputy Assistant Secretary, has responsibility for representing U.S. spectrum interests abroad. Our roles are different, but ultimately interdependent.

To promote an improved spectrum management process for the country, Chairman Powell, David Gross and I have established a "One Team" spectrum management approach. Specifically, to enhance NTIA and FCC cooperation, Chairman Powell and I have taken the first steps to improve our interagency communications and to take a more forward-looking approach to accommodate advances in technology. These improvements will enable our agencies to be more "proactive" and "predictive" in spectrum management.

Deputy Assistant Secretary Gross, Chairman Powell and I have also been discussing how we can better coordinate to improve our international outreach as we prepare for international fora. This is increasingly important to U.S. interests as many aspects of spectrum management are addressed in such international bodies. In particular, our ability to reach consensus with other countries in the Americas prior to such meetings helps ensure that U.S. policy views have a greater likelihood of success, given the oftentimes unified positions of the European or Asian-Pacific nations. This is most significant in such fora as the World Radio Communication Conferences (WRC) held by the International Telecommunication Union (ITU) every three years. The ITU develops international radio regulations that have treaty status. We are also discussing ways in which we can begin the development of U.S. positions earlier in the process, including whether the appointment of the U.S. head of delegation for each WRC should be made sooner in the process to allow for the most effective representation of U.S. interests at these meetings.

Last, but not least, NTIA is examining ways to improve its own processes. We have recognized that the frequency authorization and coordination process through which government frequency assignments are made depend upon an inefficient paper-based system. In NTIA's Fiscal Year 2003 budget, we are requesting the funds to streamline this process into an electronic frequency selection, coordination and authorization system.

2. Spectrum Efficiency, Not Spectrum Waste

Effective spectrum management must include policies that create incentives for spectrum efficiency. NTIA has long advocated the use of more spectrum efficient technologies. For example, NTIA has developed and the Federal agencies are now implementing a transition to narrowband technology to relieve the congestion in the land mobile radio bands used by the Government. Under NTIA regulation, Federal agencies will convert to narrowband technology in certain land mobile frequencies by 2005 and in all others by 2008. This should effectively double the number of frequencies available to Federal agencies. Narrowbanding, where technically possible, holds great promise for increasing the number of channels available to all users of the spectrum.

NTIA and the Federal public safety agencies have also advocated the adoption of technical standards for receivers to minimize interference and increase overall spectrum efficiency. State and local public safety entities are also recognizing the importance of establishing receiver standards to minimize interference. The adoption of receiver standards allows transmitters and receivers to operate closer to each other in the spectrum, thereby increasing the overall efficiency of the use of the band. NTIA has worked with several private sector organizations to establish receiver standards, including standards for Global Positioning Satellite (GPS) System receivers and VHF maritime mobile radios.

Federal agencies have also found that trunked systems can improve spectrum efficiency. In particular, trunked systems can be used for limited areas with a high concentration of use and for campus environments. Examples of sites particularly appropriate for trunked systems are Federal prisons, hospitals, laboratories, and training facilities.

Innovative new technologies, including those using adaptive frequency, power, and antenna capabilities, for example, also hold great promise in improving spectrum efficiency. Frequency adaptive technology will permit radios to adaptively select their operating frequencies based on sensing the operating environment and dynamically selecting unused channels. This permits an enhanced opportunity to share channels,

a more efficient use of the spectrum. NTIA will be looking for additional opportunities for promoting and maximizing spectrum efficiency.

3. Forward-Looking Policies Enabling New Uses and Efficiencies

Current spectrum management practices often require users to seek permission from either the FCC or NTIA before changing the services offered over their licensed frequencies. This process can impose time-consuming approval processes that engender lengthy delays. The unintended consequence can be to discourage, rather than enable, new spectrum uses.

As a policy matter, agencies with spectrum management responsibility—NTIA and the FCC—must continually reexamine their policies and rules to eliminate those that have become obstacles to innovation and to more efficient uses of the spectrum. To the greatest extent possible, we should be forward-looking in our policies and practices to remove procedural roadblocks to important federal and public advances.

One promising spectrum management reform is the FCC's proceeding on creating secondary markets for spectrum use. The proposed secondary markets rules would permit parties to "lease" their spectrum to others—encouraging the development of secondary markets in order to put spectrum to its most efficient use. This concept is not entirely new. As the FCC's rulemaking notes, *de facto* leasing already takes place in some circumstances, such as for Instructional Television Fixed Services, where parties are allowed to sell excess capacity. Leasing is also permitted with satellite time and through the relatively new band manager licensing regime. The secondary markets concept would broaden these limited leasing venues and extend the benefits of leasing arrangements across more of the spectrum. If fully developed, it could even lead to dynamic trading of spectrum rights among parties in real time, on an "as needed" basis.

I also supported the FCC's repeal of the spectrum cap on commercial mobile radio services. The FCC adopted an order last December to repeal the cap as of January 1, 2003 and to raise the cap to 55 MHz in all markets in the interim. This will permit carriers to assemble spectrum where appropriate to meet capacity needs and to deploy broader bandwidth services. The spectrum limits were simply too rigid to allow for changing needs and capabilities.

New frequency flexible and low power technologies offer tremendous opportunities for innovative, new services. We need to ensure that wireless systems, such as those under the 802.11 standard, can flourish on an unlicensed basis. Frequency flexible systems will challenge our current block allocation structure and we must ensure that they can be accommodated without needless government micromanagement.

One of our top priorities at NTIA is to work with the FCC to examine policies to alleviate the current congestion below 3 gigahertz (GHz). Over 93 percent of all FCC licenses and Federal Government frequency assignments are in the 0 to 3 GHz range. Among other things, spectrum managers should be examining ways to encourage migration to higher frequency bands as the technology permits. Such policies should include clear incentives for relocation to higher bands, where possible.

In 1998, Congress enacted such a tool to permit Federal agencies to be reimbursed by the private sector for the costs associated with relocating from certain frequencies bands below 3 GHz, as well as any future reallocation of spectrum from the Federal government to private sector uses. Working with the FCC and the Federal agencies, NTIA has finalized these rules and they will be published in the Federal Register shortly. The President's Budget for Fiscal Year 2003 contained a legislative proposal to streamline this reimbursement process by creating a fund from spectrum auction proceeds to reimburse the affected Federal agencies. The Department of Commerce expects to transmit this proposal to Congress this summer.

4. Preparing for the Worst and Delivering the Best

The events of September 11, 2001, demonstrated how critically important communications capabilities are for our nation's first-responders—the public safety and emergency response men and women who protect and serve our country and our communities. Now, more than ever, we must ensure that our wireless facilities are robust and constructed to withstand physical and cyber-attacks. It has been made exceedingly clear that spectrum-based communications can be an indispensable link and lifeline in time of crisis.

NTIA has had a long and active role in providing spectrum for our nation's law enforcement and emergency response activities. Special attention was focused on public safety and multi-agency communications interoperability following the bombing of the Federal office building in Oklahoma City when state, local and federal police agencies had difficulty communicating with each other. In 1996, NTIA and the FCC co-sponsored the Public Safety Wireless Advisory Committee (PSWAC) report, which provided recommendations on public safety issues through the year

2010. As a result of the report, NTIA established the Public Safety Program to address the long-range spectrum requirements of federal public safety agencies, develop a strategy to provide sufficient spectrum for growth of the current services, and to provide for advanced technology and interoperability.

Interoperability is shorthand for ensuring that different organizations with different radio systems operating on different frequencies are able to communicate immediately and effectively with each other. This is a complex problem that requires procedures and spectrum management tools to convert a potential Tower of Babel into a common communications language and an agreed upon process for linking different branches of government and different agencies together in a chaotic environment. NTIA is attempting to assist in tackling this problem in several ways.

First, within NTIA, we have one of the world's leading telecommunications research laboratories located in Boulder, Colorado—the Institute for Telecommunication Sciences (or ITS). ITS is NTIA's chief research and engineering arm, but it also serves as a principal federal resource for solving the telecommunications concerns of other federal agencies, state and local governments, and private associations and organizations. Among other things, ITS has been particularly involved in identifying solutions to the public safety interoperability issue, including developing standards for public safety digital land mobile radio systems

Moreover, at this very moment, NTIA and the Public Safety Wireless Network Program (PSWN), jointly managed by the Departments of Justice and Treasury, are co-hosting the Public Safety Interoperability Technology Summit here in Washington. The Summit focuses on current and emerging solutions for achieving interoperability to better inform public safety officials on their technology choices. NTIA will also be looking for additional ways to assist the public safety community to reach a fully interoperable future.

Current Challenges—Accommodation of New Wireless Technologies

While we wrestle with building a sound spectrum management framework for the future, the demands of the present increase unabated. The search for new homes for new services—whether through new allocations, relocation of incumbents, or advanced sharing techniques—involve inherently nettlesome issues. Let me identify several of the key challenges that are facing all of us involved in spectrum decision-making.

1. Third Generation Wireless ("3G")

Over the past decade, there has been a tremendous growth worldwide in the use of cellular-based wireless telecommunications systems. The Department of Commerce and NTIA believe that this global growth will continue and that it is incumbent upon U.S. policymakers to find the spectrum to accommodate the demand for these new services.

NTIA is currently working with the FCC, the Department of Defense (DoD) and other Federal agencies to accommodate the demand for spectrum for third generation or 3G wireless services. The 3G systems advanced by industry propose to provide mobile and satellite-based broadband capabilities. While current cellular and PCS wireless systems are expected to evolve to 3G technology over time, there is a strong desire from the wireless industry for additional spectrum now to establish 3G networks.

In recognition of this growth and the trend toward global markets for wireless services, the ITU has considered the spectrum requirements for evolving 3G systems, which is internationally termed International Mobile Telecommunications–2000, or IMT–2000. The ITU forecast that 160 MHz of additional spectrum would be required for 3G systems over and above that spectrum already used for 1- and 2G systems. At WRC–2000, the ITU identified several frequency bands that could be used for IMT–2000 systems, leaving individual administrations the right to implement any of the bands in any time frame, for any service or technology, and using any portion of the identified bands that they deemed appropriate to satisfy national requirements.

Since 2000, NTIA, the FCC, and the Federal agencies have been working cooperatively to take certain actions to identify spectrum for 3G services. After extensive public outreach and work with industry and affected agencies on technical analyses of the various band options, NTIA and the Federal agencies are now focusing specifically on the 1710–1770 MHz band, while the FCC is focusing on the 2110–2170 MHz band. A viability assessment on making both of these bands available for 3G is scheduled for release later this month.

2. Digital Defense of National Security

The events at home and abroad have underscored the importance of wireless communications capabilities to our national defense and critical infrastructure. The dig-

ital era of electronic links is a mission critical component of our military and security systems. Every branch of our armed services depend on radios and spectrum-dependent systems to conduct its missions. Information gained from these wireless systems is one of our nation's most effective weapons in today's war. DoD has predicted that its spectrum usage will grow by more than 90 percent by 2005. DoD must have access to these frequencies, not only when it deploys our troops abroad, but also to conduct critical training operations here in the United States. These requirements need to be recognized and addressed as we move forward in encouraging innovation and efficiencies in the public sector.

3. The 700 MHz Band

The Administration has also supported the FCC's postponement of the auction of the spectrum in the upper 700 MHz band to permit Congress and the FCC to develop the policies necessary to ensure certainty as to when and how this spectrum will become available for new wireless services. The Administration recognizes the important role that broadcasting continues to play in the lives of all Americans and the challenges associated with the digital conversion. At the same time, spectrum is needed for new wireless services that provide new communications opportunities to American families, businesses, and public safety providers. An equitable and efficient solution for relocating incumbents in these bands is possible and the Administration looks forward to working with the FCC and Congress to ensure such policies are developed in a timely fashion.

4. Rural Wireless Needs

Spectrum policies designed for the nation as a whole sometimes fail to recognize and address the special problems and challenges of the country's rural areas. Spectrum allocation and licensing policies need to be regularly reevaluated to assess whether they are fully and adequately meeting the needs of all Americans, including those in rural areas.

Conclusion

Mr. Chairman and Members of the Committee, the radio spectrum is vital to our national security and to our economic security. I look forward to working with Congress in developing the best possible spectrum management policies for the future. Thank you again for inviting me to testify. I welcome any questions you may have for me.

Senator INOUYE. Thank you very much, Ms. Victory.

Now may I call on Mr. Sugrue.

STATEMENT OF THOMAS J. SUGRUE, CHIEF OF WIRELESS TELECOMMUNICATIONS BUREAU, FEDERAL COMMUNICATIONS COMMISSION

Mr. SUGRUE. Good morning, Mr. Chairman, Members of the Committee. I am Tom Sugrue, Chief of the Wireless Bureau at the FCC, and I welcome the opportunity to appear before you today to discuss the important issue of spectrum policy.

As everyone's comments this morning have recognized, the radio spectrum is a critically important resource. Our Nation has become extremely dependent on a wide variety of spectrum-based services. In terms of spectrum needs, however, this wireless revolution is becoming a victim of its own success. The simple truth is that as our Nation grows increasingly dependent on wireless technology, spectrum demand is stressing the supply, and that has made spectrum management a difficult task for Government.

The overarching challenge of spectrum policy is to ensure the public interest is best served by balancing competing demands for this scarce resource. Spectrum policy is not static. It requires the difficult task of predicting spectrum needs not just for today, but for the next generation. Twenty-five years ago when the Commission first allocated spectrum for cellular telephone services, no one, neither the FCC nor the industry, realized how rapidly this sector

would grow. In a now often-told story, a prominent consulting firm projected for AT&T that even under the most optimistic assumptions, there would be at most 1 million cell phone subscribers in the United States by the end of the twentieth century. It is reported that ATT took that prediction into account when it agreed to have the cell phone licenses stay with the Bell operating companies at the time of divestiture.

Senator Wyden, you mentioned the potential for competition from wireless technologies. I think if the Department of Justice had appreciated the competitive potential of this technology, they would have made a different choice in deciding which side of that divestiture border those licenses should go.

Well, by the year 2000, there were actually 110 million cell phone subscribers, so that projection was off by 109 out of 110. But to be fair, the FCC did not do much better in its own crystal balling. When we allocated additional spectrum for this market in 1994—that is the PCS allocation of 120 megahertz—that was based on a projection of 54 million wireless subscribers by the year 2000. So even though we were only projecting 6 years in advance, the Commission's estimates, which were well within the mainstream of expert opinion at the time, were still off by 100 percent.

The problem is not that we had stupid people making these predictions. They were the best and brightest in the field at the time. The problem is that the dynamic nature of telecommunications markets, and especially the wireless markets today, render even expert predictions inherently unreliable. In turn, this makes a traditional command and control approach to spectrum management increasingly problematic.

The FCC's recent experience has been to move to flexible policies that allow the market to adjust without constant Government intervention, to promote innovation, competition, and efficiency in commercial wireless markets.

The commission also recognizes that it must ensure that the needs of non-commercial users, such as public safety agencies, are met. In this regard, over the last several years, the FCC has been working actively to ensure public safety entities have access to sufficient spectrum and can operate on a non-interference basis.

After spectrum has been allocated and assigned, the Commission is committed to ensuring that it is used efficiently. Periodically, the Commission revisits existing allocations and reallocates spectrum that can be put to a more economic use. Through this often complex, controversial process, the Commission has reallocated more than 300 megahertz of spectrum in recent years.

In addition, because some users of spectrum, such as public safety and private wireless, do not face the same market-driven opportunity costs to use spectrum efficiently as commercial users face, the Commission has taken additional steps to ensure efficient spectrum use by these users. For example, the Commission adopted explicit efficiency standards for public safety in the 700 megahertz band and is right now in the process of conducting its first-ever audit of public safety and private radio services licensed on frequencies below 512 megahertz.

Well, even as I enumerate some of the actions the Commission has taken already to improve the use of the radio spectrum, I know

we can do better. As Chairman Powell has observed, the Commission's traditional top-down approach to spectrum allocations may be too reactive for the current Internet-speed market. Traditional FCC rules often limit the use of specific bands to particular types of services or even specific technologies, making it difficult to shift spectrum from one use to another. In the current environment, spectrum allocation decisions often do not effectively push spectrum to its highest-valued and most efficient use.

To address these issues, Chairman Powell recently created a spectrum policy task force which will provide a report to the Commission in October of this year. Moreover, the challenge of spectrum management is one of process as well as substance. As the current FCC Wireless Bureau Chief and a former Deputy Administrator of NTIA, I am particularly cognizant of the need for efficient coordination between the two agencies. Indeed, while there is a lot of coordination on a day to day basis, one major current project is the interagency staff level effort to examine and develop possible spectrum options for advanced wireless systems, including so-called 3G systems. These systems would support much higher data rates than the current generation of services.

This effort under NTIA's leadership is being vigorously pursued at this time. There is no doubt it is a complex problem, but the staff is working hard to bring its recommendations forward to the decision makers at our respective agencies in the near future.

Mr. Chairman, I would like to thank you again for this opportunity to appear before you today. I look forward to working with you and Members of the Committee and answering any questions you might have for me.

[The prepared statement of Mr. Sugrue follows:]

PREPARED STATEMENT OF THOMAS J. SUGRUE, CHIEF OF WIRELESS TELECOMMUNICATIONS BUREAU, FEDERAL COMMUNICATIONS COMMISSION

Mr. Chairman, Ranking Member, and Members of the Committee:

Good morning. I am Tom Sugrue, Chief of the Wireless Telecommunications Bureau at the Federal Communications Commission (FCC). I welcome this opportunity to appear before you today to discuss the important issue of spectrum policy.

I am sure that all of us on this panel and everyone on this Committee recognizes radio spectrum is a critically important resource that is in very high demand. State and local public safety officials rely on wireless technologies to help them respond in emergencies; consumers rely on wireless technologies to keep in touch with family and friends and to improve their overall quality of life; broadcasters provide news and entertainment over the air and are moving to spectrally efficient digital transmission; businesses rely on wireless technologies to communicate with an increasingly mobile workforce; and our national defense agencies rely on wireless technologies to provide security to the country. In short, our nation has become dependent on spectrum-based services, which have brought great benefits in the form of enhanced efficiency, greater security, and an overall improvement in the quality of life of our citizens.

In terms of spectrum needs, though, the wireless revolution is becoming a victim of its own success. The simple truth is that, as our society grows increasingly dependent on wireless technology and services, spectrum demand is stressing the supply, and that has made spectrum management a difficult task for government. This is true even though technology advances are enabling more efficient use of the radio spectrum. This is true even though the Commission has taken significant steps to provide its licensees with additional flexibility, allowing them to better respond to market demands and changes. This is true even though the Commission has reclaimed underutilized spectrum on numerous occasions. Thus, the overarching challenge of spectrum policy is to ensure the public interest is best served by balancing

competing demands for scarce spectrum while striving to promote competition through the deployment of new technologies.

Moreover, the challenge of spectrum management is one of process as well as substance. As the current FCC Wireless Bureau Chief and a former Deputy Administrator of the National Telecommunications and Information Administration (NTIA), I am particularly cognizant of the need for efficient coordination between the two agencies. In addition, U.S. domestic spectrum policies exist within the broader context of international spectrum agreements with other countries around the world and specific operational coordinations, especially with Canada and Mexico.

Spectrum policy is not static. It is difficult to accurately predict spectrum needs not just for today, but for the next generation. Indeed, most users and service providers believe they will continue to need more spectrum in the coming years. Twenty-five years ago, when the Commission first allocated spectrum for cellular telephone services, no one—neither the FCC nor the industry—realized how rapidly this sector would grow. Cell phones were perceived principally as a car phone service and not personalized communications devices that people would carry with them throughout the day. In a now often told story, a prominent carrier estimated that at most there would be one million cell phone subscribers in the United States by the end of the 20th century. This reportedly was why the carrier agreed to have its cellular licenses go with the Bell Operating companies at the time of divestiture. Well, by the year 2000, there were actually 110 million cell phone subscribers. And to be fair, the FCC did not do much better with its "crystal ball." The FCC's allocation of additional spectrum for this market in 1994—the Personalized Communications Service (PCS) allocation of 120 MHz—was based on a projection of 54 million wireless subscribers by the year 2000. So, even though it only was projecting six years in advance, the Commission's estimates were still off by 100 percent in anticipating the actual demand for these services. Although technological advances can improve spectrum efficiencies, they are not a panacea and may not offset the increased need for spectrum. The FCC's recent experience has shown that flexible policies that allow the market to adjust without constant government intervention are essential in the dynamic world of wireless communications.

Though spectrum management can be a demanding undertaking, we have seen the benefits of successful spectrum policies to the American people. For example, when the Commission auctioned that 120 MHz of spectrum for PCS, that action and the build-out of new networks transformed mobile telephony from a tight duopoly to an actively competitive market with multiple providers, and from a luxury for business and high-income users to a mass market service. Prior to the PCS auction in 1995, there were approximately 24 million commercial mobile subscribers. Today, there are over 130 million subscribers and over 80 percent of the American public lives in counties that have five or more competitors. Moreover, since 1995, the average price per minute for consumers has been cut by about three quarters. Sound spectrum policies that promote flexibility, competition, and innovation clearly contributed to the marketplace success of PCS.

Spectrum policy has been and continues to be one of the core functions of the FCC, and I am now pleased to discuss the FCC's role in this regard and its efforts to manage the spectrum more efficiently.

An important principle underlying the FCC's recent approach to spectrum allocation and assignment on the commercial side is that the market should be the primary determinant in the success or failure of a new technology or service. In that vein, the FCC has made substantial use of the auction authority granted by Congress in 1993 and made mandatory for most services, including commercial broadcasting, in 1997. All FCC licenses are potentially subject to auction except public safety, public broadcasting, and international satellites. As Congress anticipated, our experience has shown that auctions award spectrum to applicants that value it most, are fast and objective, and compensate the public for use of a valuable and scarce resource.

In addition, the Commission has favored flexibility in its licensing rules in order to permit licensees to respond to market demands and changes. In most recent allocations, the Commission generally has limited its technical and operational rules to those necessary to ensure that harmful interference is avoided. In addition, the Commission permits disaggregation and partitioning so that if a licensee finds that it wishes to transfer some of its spectrum or part of its licensing area, it can do so without relinquishing its entire license. The Commission is currently examining ways to improve opportunities to access spectrum through other mechanisms, including secondary markets.

Though the Commission's initial allocation and assignment process creates the primary market for wireless services, the Commission has recognized the importance of secondary markets as well as the importance of allowing spectrum re-

sources to be used most efficiently. The Commission permits licensees to transfer their licenses to other entities, subject to Commission approval. We process the great bulk of these transactions rapidly, consistent with the needs of a dynamic, competitive market. We also are looking at whether there is a need to stimulate greater use of secondary market transactions to promote the efficient use of spectrum. Also, in several bands, the Commission has authorized the use of "band managers," which are licensees that act as spectrum lessors with market incentives to ensure efficient use of spectrum, especially among private spectrum users.

The Commission also recognizes that it must ensure that the needs of non-commercial users, such as public safety agencies, are met. In this regard, over the last several years, the FCC has taken a number of significant steps to ensure public safety entities have access to sufficient spectrum. For example, the Commission has implemented the Congressional directive to ensure that a portion of the 700 MHz band is used for public safety. The Commission set aside ten percent of the band for public safety interoperability services and, based on input from the public safety community, adopted rules to promote nationwide interoperability in that band. In addition, the Commission has a proceeding underway to address concerns about interference to public safety in the 800 MHz band. Also, earlier this year, the FCC allocated 50 MHz of spectrum in the 4.9 GHz band for fixed and mobile wireless services and designated the band for use in support of public safety. The Commission recognized that this allocation and designation has the potential to provide public safety users with additional spectrum to support new broadband applications such as high-speed digital technologies and wireless local area networks for incident scene management. The spectrum also can support dispatch operations and vehicular or personal communications.

After spectrum has been allocated and assigned for use, the Commission is committed to ensuring that the spectrum is used efficiently. Periodically, the Commission revisits existing spectrum allocations and reallocates underutilized spectrum, either through relocation of existing operations to different—usually higher—frequency bands, by removing existing services altogether, or by providing incentives for communications facility substitutions—for example, switching from radio operations to fiber optic cable. Through this often complex and controversial process, the Commission has reallocated more than 300 MHz of spectrum. This spectrum is located below 3 GHz—an especially prime area of the radio spectrum that is suitable for a multitude of applications but especially valuable for mobile uses. One good example of the Commission's spectrum reclamations is when, in our Emerging Technologies proceeding, we reclaimed more than 200 MHz of spectrum from private fixed microwave services and made that spectrum available for new services, including the 120 MHz for licensed PCS that I mentioned earlier. In addition, we have required some of our licensees to make do with less in order to make room for new and beneficial uses. One such example is when the Commission reduced the allocation of the broadcast auxiliary service (the Commission's term for the service used by those ubiquitous broadcast TV trucks) from 120 MHz to 85 MHz.

In addition, because some users of spectrum, such as public safety and private wireless, do not face the same market-driven opportunity costs to use spectrum efficiently as commercial users face, the Commission has taken additional steps to ensure efficient spectrum use by these users. For example, the Commission has undertaking "refarming," which involves the migration of certain private and public safety users to more spectrally efficient technologies. In some bands, such as 700 MHz public safety bands, the Commission has adopted specific efficiency standards. In addition, the Commission is in the process of conducting its first-ever audit of public safety and business/industrial radio services licensed on frequencies below 512 MHz. This has been an enormous undertaking to verify the construction and operational status of over 400,000 call signs. As a result, over 31,000 licenses have been recovered to date. Licensees who do not respond to FCC letter of inquiry during this audit ultimately risk losing their license.

Even as I enumerate some of the actions that the Commission has already taken to improve utilization of the radio spectrum, we can do better. As Chairman Powell has observed, the Commission's current "command and control" approach to spectrum allocations may be too reactive for the current, Internet-speed market, and often spectrum allocation decisions do not effectively push spectrum to its highest and most efficient use. To address these issues, Chairman Powell recently created a Spectrum Policy Task Force. Some of the objectives of the task force include studying options for a more market-oriented spectrum allocation policy, examining ways to clearly define spectrum interference and usage rights, reviewing methods of aggressively promoting spectral efficiency, and reserving and protecting access to sufficient spectrum for public safety. The task force has sought public comment on these and other spectrum policy issues, will conduct multiple workshops this summer to

facilitate discussion regarding spectrum policies, and will provide a report to Commission by October of this year. Chairman Powell supports systemic reevaluation of spectrum policy as we know it today. Without a doubt, the Commission is struggling to keep pace with market innovations.

The FCC is not the sole manager of the radio spectrum. A significant amount of the spectrum is in bands that are shared with both federal and non-federal users. In these bands we need to coordinate with the Office of the Secretary of the Department of Commerce or, more specifically, NTIA's Interdepartment Radio Advisory Committee (IRAC).

Generally, the IRAC coordination process operates smoothly. Approximately 85,000 items are coordinated annually—these include approximately 5,000 non-government license applications and approximately 80,000 federal government authorizations. In addition, last year, Commission staff coordinated with IRAC on approximately 50 items that were acted on by the full Commission—these include, among other things, rulemakings and waivers. Almost all of the items addressed in the IRAC process involve issues that are successfully resolved through established coordination procedures among the relevant agencies.

Moreover, there are many instances in which we work cooperatively with NTIA and other executive branch agencies that fall outside of the formal coordination context. Usually these efforts arise in the context of implementing spectrum transfers from federal government to non-federal government users. These efforts are not inconsequential. Despite the fact that particular spectrum may be earmarked for transfer, a lot of issues remain in the details associated with the transfer—issues like timing of the availability of the spectrum, the geographic extent of grandfathered federal operations, interference protection criteria, and reimbursement procedures for federal government operations that may need to be relocated to different frequencies. Indeed, often through these cooperative, interagency efforts we have achieved positive results. For example, originally 50 MHz of spectrum at 4.6 GHz was earmarked for transfer from federal government to non-federal government use. In part, the 4.9 GHz band was substituted for this spectrum as the result of concerns raised by the U.S. Navy about possible interference in frequencies adjacent to the transfer frequencies.

The FCC and NTIA currently are working vigorously through an interagency staff-level effort to examine and develop possible spectrum options for advanced wireless systems, including so-called third generation (3G) wireless services. These systems would support much higher data rates than the current generation of services and hold the promise for enabling services such as connection to the Internet while away from your normal work station or computer. This effort, under NTIA's leadership, is also evaluating the potential for sharing between advanced wireless systems and current spectrum users, including government users, as well as reviewing possible options for relocation spectrum. There have been numerous stafflevel meetings with representatives from executive branch agencies in an effort to have a full and productive dialog about the multitude of technical issues associated with the spectrum identified as potential bands for new uses. There is no doubt that this is a complex problem, but the staff is working hard to bring its recommendations forward to the decision-makers at our respective agencies in the near future.

In addition, we recognize that U.S. domestic spectrum policies exist within the broader context of international spectrum agreements with other countries around the world. For example, the Commission is participating in the State Department-led June 2003 World Radiocommunication Conference (WRC)—a treaty-level forum held by the International Telecommunication Union (ITU) to decide on allocation of spectrum. The Commission began its preparations for the 2003 WRC in December 2000, just six months after the 2000 WRC held in Istanbul, by organizing its industry WRC 2003 Advisory Committee. The Commission has recently completed the ninth meeting of the WRC Advisory Committee and approved proposals for all but a few of the 39 WRC Agenda items. The Commission is working with NTIA and the State Department to reconcile a few outstanding proposals to finalize the U.S. Government positions. The Commission also is participating in the State Department-led process of building international support for the U.S. positions in the year remaining before the WRC–03.

I would like to thank you, Mr. Chairman, for the opportunity to appear before you today. I look forward to working with you and other Members of this Committee on these important U.S. spectrum management policies. I would be pleased to answer any questions you might have.

Senator INOUYE. I thank you very much, Mr. Sugrue.

Because of my primary assignment on the Defense Appropriations Committee, I will focus much of my questioning to matters relating to the Department of Defense. Mr. Price, what frequency bands are most heavily utilized and for what requirements?

Mr. PRICE. Well, we use all of our frequency bands and we have to justify those periodically, every 5 years, to NTIA, each of the different assignments and allocations we get. It is fair to say that, as I mentioned in my verbal testimony, we do not use all of our spectrum all of the time, nor do the commercial folks. At 2:00 in the morning not a lot of people are using them.

The key attribute for frequency in the U.S. for the Department of Defense, prior to the undefined-as-yet homeland mission, has been for training and testing. The Department's principle is that we train like we fight. So having 100 percent reliability and 100 percent certainty when it is needed is the critical aspect.

So the overall question is we feel, and we have done a number of studies, that we use our spectrum, all of our spectrum. Almost all of our spectrum is shared, if not with the commercial—more than half of it is with commercial users. A large chunk of it is with other Federal Government users. Even in the military-only bands, it is shared within the services.

Senator INOUYE. Now, you brought up training. Do you currently have limited access to spectrum required to carry out training exercises and system testing, and if so how do you derive enough spectrum to carry out exercises?

Mr. PRICE. Through the incredible hard work of the young men and women in our military, sir. We have been increasingly spectrum-constrained. It is not unlike the commercial sector, if you asked if you took away their T1 lines and gave them dial-up lines could they operate their business as effectively. Wireless, because our last tactical mile is often not connected, whether it is on a ship or on a plane, wireless is a critical component of our last mile.

I will give you one other specific example. In the flight test telemetry arena where, as you know, we get a lot of data on new platforms, the Department of Defense had 80 megahertz devoted to flight test telemetry. Because of spectrum reallocations, that amount of bandwidth, frequency, is now down to 25 megahertz. That severely impacts our ability to test the performance of air platforms.

If there is one F–22 in training today in southern California, we must cease all other operations of air platforms, including the B–1, including the Global Hawk UAV, at Vandenberg, China Lake, and other ranges. So one small example of how our training and testing—I can give you a whole series of examples, but one example of how we are constrained in the U.S.

Senator INOUYE. Why is the 1710–1850 megahertz bandwidth of critical importance to your military communications, intelligence, and platforms?

Mr. PRICE. Thank you for asking that, sir. As anyone at this table clearly knows and I think all you and your staff, the frequency below 3 gigahertz is really what's considered beachfront property—very valuable, particularly for mobile applications. We use a lot of frequency for radars and the like in the upper portions of the band. But this beachfront property, and particularly the

1710 to 1850 area, has a number of unique propagation characteristics that make it very valuable for the Department of Defense.

The band enables small antennas and it has sufficient beam widths for simple, reliable link establishments and preservation, which helps us do low probability of intercepts and some of the things that the Department of Defense requires. It supports low-power transmissions for extended ranges of communications. Since we have joint dispersed forces, we need extra, more ranges than you might expect, and for high data rates. So that is a band that is beachfront property, very valuable for our satellite communications, precision guided munitions, air training, tactical data links—a whole series of uses within the Department.

Senator INOUYE. Finally for this segment, what spectrum have you lost over the last few years and what effect has this had on your operations? And what impact have prior spectrum sales had on your ability to carry out your war-fighting effort?

Mr. PRICE. In 1993, over 1993, the Government lost 247 megahertz. That has not actually been allocated yet, so DoD in a number of cases, and other Federal agencies, are still there, but, so to speak, the clock is ticking. So to some extent we do not fully know the implications. But it is important to understand that there are direct and indirect effects.

The direct effects are clearly there is this system here—the Marines have a number of radios that they have had to figure out where to relocate. There are things like that. But then, as I mentioned, there are other kinds of effects—the host nation approval that I mentioned. When I was down at Special Forces Command at SOCOM and CENTCOM in Tampa a few weeks ago, there is a radio in the 1755 to 1770 band that took in a particular country in CENTCOM's area of operations, AOR, 6 years to get host nation approval. So now, after 6 years, we are able to use that radio in that band. To the extent that we are required to move, that clock starts again. So how long will it take before we can use that radio in that band?

So the impact is things like that; on our allies who bought interoperable systems that now are told: Well, you bought these interoperable systems to operate with us; now, because of commercial pressures, we are moving; you should move too. Their defense budgets are challenged. Things like that.

But there are also the indirect effects. I actually have some people looking at it, but the amount of time that we spend—and I am not complaining; people are happy and working hard—on spectrum reallocation issues, it is an inordinate amount of time. It is really not to a large extent moving the ball forward. If we are at the, to use a football expression, at the 40 yard line and want to get to the goal line, this brings us back to the 50 and then we have to get back to the 40. We are not moving the ball forward. We are not helping the war fighter and helping further our military requirements. At best we are fighting and spending resources to stay where we were.

So predictability and certainty are the two principal things that DoD would like out of any spectrum management plan. A number of the reallocations have impacted our operations.

Senator INOUYE. Senator Burns.

Senator BURNS. Mr. Price, I wish you had answered the first question. What spectrum is the most heavily used and which spectrum is the least used?

Mr. PRICE. Well, it is a hard question to answer, sir.

Senator BURNS. It should not be, because you said you have got acres of studies.

Mr. PRICE. We do, but heavily used when? We have studies of during training, during exercises. We use tactical radios in a lot of different places. We always use the TT and C, the telemetry tracking and command, for the satellites. But if I had to answer the question, I would say the spectrum that we have below 3 gigahertz, of which exclusive Federal use is about 15 percent and about half of ours is shared, is really the sweet spot where we are looking, not only today, but as we move to a network-centric force, where we would like every war fighter to be able to have voice, data, video, power to the edge.

Senator BURNS. When we start into this, when we start into this thing, because this is going to be a monumental issue, and I am very supportive of a classified hearing with DoD and their uses, we do not want to drift into areas where we should not drift into, but I think that information is going to be warranted before we make any final decisions on how we want to manage this.

Thank you for that. I am concerned that our preparations for the World Radio Communications Conference are inadequate right now. I am really worried about that. For instance, the President appoints an ambassador to head the U.S. delegation to a term of only 6 months. Given the monumental complexity and the contentiousness of international spectrum coordination, this seems to be a job suited for OJT more than anything else. This is really—you have to be a quick study on an issue this big, and then the retention of it. Then just about the time you understand what spectrum really is, then you have to move on.

I am the only person—keep in mind, I am the only person in this United States Congress that believes that spectrum is not a national resource. It is a technology. We commandeered it just through the business of, we are going to regulate it and make sure everybody stays in their lanes whenever they are assigned to it. We commandeered it. So I am the only one, and I am the only man in this whole town who believes that, probably the whole Nation, and I will believe it until they stick me in the ground, because we commandeered it and we commandeered it mostly for budgetary reasons. That is a terrible reason to do that.

But anyway, that is another thing. Should we change the process of appointing the ambassador—Ms. Victory, you can probably answer or respond to this—to ensure some continuity in the leadership? If not, what other reform would you recommend to improve the preparations for these international conferences? They become very important. I know you just returned from one and I look forward to your report on that.

But I think this is a very important area.

Ms. VICTORY. Well, clearly the short term of the WRC ambassador is something that has been identified repeatedly over the last couple of years as an issue for further study. I do not think anyone

has really done that further study yet. I think it should be done, because it is a challenging job.

But there are really two points of view with respect to the WRC ambassador. You do have some who believe that it is important for that individual to have full knowledge of the issues and have relationships with the ministers abroad in order to be able to effectively cut those deals. On the other side of the coin, you also have folks saying very emphatically that this has to be a very politically connected person within the White House who can make the hard decisions, when you have differing viewpoints among agencies or among constituencies, as to which is going to be the U.S. view.

So I agree that that is an issue for further study. At this point the administration has not made a recommendation for changing the nature of that position. But I think that that is one area to be looked into further.

In terms of other things that can be done to improve the preparation, clearly one is, as we have mentioned, starting the process earlier in developing the U.S. position. That is something that NTIA and FCC have attempted to do in preparation for this upcoming WRC next year. In fact, one month after the last meeting was over NTIA and FCC began their process of starting to meet with the constituencies to talk about what issues are coming up for the next round.

Indeed, that has been very helpful because at the last CTEL meeting among the various countries in the Western Hemisphere the United States was really the only one that had their tentative list of issues. The good news about that is we are then able to be the one that the other countries follow. When we lay out our positions first, we have a better chance of having the other countries sign onto our positions or sign onto them with tweaks, as opposed to playing catch-up and not having our issues on the table first.

So I think for this next WRC we are going to be very well prepared. But you are right, the ambassador status remains an issue that should be looked into further.

Senator BURNS. Mr. Guerrero, you seem like I ticked part of your curiosity there. Do you want to respond to that?

Mr. GUERRERO. Yes, Senator, thank you. As you heard in our statement and in our work, we will be reporting on this issue specifically, and we have some of the same concerns that you articulated.

I would just want to lay out, although we do not make specific recommendations on what to do about this at this time, I would say there are several principles that we need to keep in mind as we move forward in making this process more effective. One is we have to make sure that whatever process we choose produces a position that is timely. These conferences involve nations voting. Each nation has one vote in these conferences. For the U.S. vote to count, it is really important for us to do our homework. It is important for us to have our positions laid out in advance and to have worked with other nations to form the kinds of alliances and support that we need for our position. So timing is of the essence.

The second is the continuity of the focus and the sustainability of that focus. The 6-month term is an issue there.

The third is the expertise that we bring to bear in terms of focusing on that process.

So however we organize this, we have to make sure that we have those three principles in mind: that there is enough continuity, sustainability of focus, and expertise, and that the preparation process that is used, whatever it is, is completed in a timely manner so that we can be ahead of the curve in terms of developing our positions and working with other countries.

Senator BURNS. The NTIA is required by law to promote efficient use of spectrum use by the Federal Government. I understand that NTIA has directed Federal agencies to use only as much spectrum as they need. It also requires each agency to conduct a 5-year review of its spectrum use, to justify the allocation.

In testimony offered by the GAO today, however, it was noted, and I noted in your testimony, that very few of these reviews have been done. The major agency division has over 1,000 frequency assignments that have not been reviewed in 10 years or more. Another spectrum manager in another agency said that all field staff responsible for conducting the 5-year reviews have simply been eliminated. Are these isolated examples? What sorts of enforcement mechanisms are in place to ensure that the agencies are indeed being held accountable for their efficient spectrum?

I noticed in your testimony, Mr. Guerrero, that we just—is it a lack of resources or what is the problem here? Because we are going to have to have those studies. I know it has been one of your toughest challenges in finalizing this report.

Mr. GUERRERO. Senator Burns, I would say there are probably three important issues here. One is a lack of resources and it is really a lack of staffing at the Federal agencies level. The Federal agencies have experienced difficulty attracting the expertise necessary to manage spectrum. It requires unique engineering expertise and background.

Also, as with many Federal agencies, they are faced with the retirement of those people who are on their staff now who are expert. For example, at Commerce roughly 40 percent of those spectrum management individuals who are on board now are eligible or will be eligible over the next 5 years to retire. So it is a staffing issue. Holding agencies accountable for doing these periodic reviews and ensuring that spectrum is being used appropriately requires that you have the expertise and resources, and some Federal agencies have told us they do not.

Secondly, for Federal agencies to use their spectrum allocations more efficiently, they need resources for the technologies that would allow them to do that. Nancy Victory talked about narrowbanding and I mentioned it in my statement. That is a technology that has the ability to significantly improve the efficiency of the equipment that is currently being used in certain applications in land-mobile radio.

Unfortunately, several of the 7 agencies we reviewed have not gotten the support they need in the budget process to purchase this equipment and they are behind the curve in terms of meeting the requirement to narrowband. So that is a resource issue.

Finally, and I agree with the FCC on this point, spectrum management is fundamentally a very, very difficult thing to manage

from the top down in a command-control type of structure. It is critically important that there be incentives in place for behaviors that encourage efficient and effective use of spectrum. Generally, those incentives on the Federal side are lacking.

I mentioned in my statement that the fees that are now charged Federal agencies for their spectrum assignments are really meant to only cover part of NTIA's spectrum management administrative costs. They are not meant to provide an incentive for federal agencies to use spectrum more efficiently. So we need to also look at what kinds of incentives can we put into the system so we can better manage the 270,000 federal assignments. It is almost impossible to do that in a command-control environment.

Senator BURNS. Would you like to respond to that, Ms. Victory?

Ms. VICTORY. Yes. I think you have put your finger on a couple of important points here. You know, it does take a lot of resources to be constantly monitoring what all the Federal agencies are doing. Within NTIA we do try to do periodic reviews, but one of the things we are trying to explore are incentives for good behavior.

We actually had a very interesting discussion when we had our spectrum summit back in April. We had one of the officials from the U.K. who came over, and they are experimenting with an interesting approach for spectrum efficiency for non-auctioned services and Government services. Specifically they are charging an annual fee of a substantial nature that the Government agencies need to pay and that licensees of non-auction services need to pay. The idea is that if the figure is significant enough it is going to cause people to review and decide whether or not they really need to retain the spectrum.

Obviously, the devil is in the details as to how you create that mechanism and how you ensure that it continues to provide incentives. It was a very interesting discussion. The U.K. official was relating their experience so far and it is very limited because the fee is something that they have just implemented. That is just one of a number of ideas, and I think the direction we really need to move in is to look at what sorts of spectrum-efficient incentives can we place not only on Government licensees, but on those in the private sector as well, to manage their own spectrum efficiently.

Senator BURNS. This is the initial hearing on this issue and we are just trying to lay the groundwork on where do we go from here and how do we establish a relationship that we can formulate policy. I think it is very important to the Chairman. I know it is important to this Senator on how we proceed.

Thank you, Mr. Chairman. I will have some more questions later.

Senator INOUYE. Thank you.

Senator Wyden.

Senator WYDEN. Thank you, Mr. Chairman.

Let me begin by asking you about some of the new technologies that may alter some of the assumptions about spectrum allocation. Software-defined radio may permit devices that do not use, for example, a fixed slice of spectrum, but instead adapt to whatever spectrum is available at the time. Ultra-wideband uses quick pulses of energy across a wide frequency range, sharing spectrum with more traditional spectrum users.

I think I would like to begin by saying what is your sense of how these new technologies may change the way the country thinks about spectrum management and how should that affect today's debate? Do you want to begin with that, Mr. Sugrue?

Mr. SUGRUE. Those technologies are very exciting and potentially very profound for how we approach spectrum management. If they fulfil all their potential, as some of their most enthusiastic advocates describe them, they could be the silver bullet to some extent. In other words, they could be so flexible, so adaptive to the spectrum environment in which they find themselves, as you describe, they could search out—I am talking about software-defined radio right now—search out what frequency is available at a particular time and use that, so that some of the traditional approaches we use of allocation, block allocations and assignments, may prove to be obsolete or even counterproductive.

The Commission has proceedings on software-defined radio and adopted some rules to permit the development to go there. By the way, as an operational matter it is still a ways from being as flexible and adaptive in real time as I describe. But there is a lot of work and the Defense Department is actually doing a lot of work in this area.

One benefit from all the work our friends on the military side do on spectrum matters is that over time some of that, indeed a lot of that, will filter into the commercial sector in constructive ways.

There are regulatory issues that do crop up. The recent disputes about ultra-wideband, for example, were an example of that. The ultra-wideband proponents said: We can spread our signal across multiple bands, and no one would even know we are there, because the only interference would be below the noise level. People in those bands who were concerned about them said: We do not believe that or we do not have confidence of that, and if it does not work that way and we have interference, some very bad things could happen.

So it is not quite a slam-dunk yet, and technological debates will have to take place. But I think they are very exciting and, as I said, potentially very profound.

Some of the issues we would have to deal with, for example, on a software-defined radio, if you were outside this building and you had a software-defined radio, found a frequency that was licensed to, say, a particular carrier and you were not a customer of that carrier, could you just grab it and use it on the ground that, well, it is available, it is not being used now? Is there a payment mechanism that would have to be in place?

So there are a number of nontechnological issues that would have to be addressed going forward. But we are very excited about the potential.

Senator WYDEN. Ms. Victory, Mr. Price, and then I want to ask about one other area. Ms. Victory.

Ms. VICTORY. Well, I think you have raised what some of the challenges are with new ways of thinking about dealing with new technologies. Those are certainly challenges that we need to tackle because it is very important.

But I wanted to highlight that, with respect to dealing with our spectrum management challenges, there are really three ap-

proaches. One is to make more spectrum, which sounds silly but is actually possible because with new technology you are constantly expanding the bounds of what is useable. Indeed, I have met with one company that is using lasers to try to bridge that last mile, and they are outside the bounds of what is currently the regulated spectrum. They are being very efficient by doing that.

Another way is to share, and I think some of these new technologies are prime examples for providing us with new, more efficient and more effective ways to share. Yes, there are regulatory challenges in dealing with that, but that is clearly a very promising approach.

Then finally, there is more efficient technology—using less of what you have to provide the service. I think we need to pursue all three approaches. I know the FCC is looking along those lines and so is NTIA.

Mr. PRICE. Sir, I agree wholeheartedly that ultimately this spectrum—there is only so much beachfront property and we want more and the commercial industry wants more, public safety wants more. So we fully support a national plan, but ultimately a national plan is going to have to set priorities.

My personal view is that you are right, technology will solve the allocation issues. The Department of Defense is spending hundreds of millions of dollars on spectrum-efficient kinds of technology, technology that I cite in my written statement some of the ways: frequency and bandwidth agility, phased array antenna configuration, interference mitigation techniques, congestion control.

We have a number of programs at DARPA, one called XG which looks for the holes that are not being used. We have a program—well, the Department, as you know, is one of the founders of ultra-wideband, which you mentioned, CDMA, software-defined radio. We are looking at that. We have started—DARPA has started a program called NETX looking at ultra-wideband, to see how it can be used and how it can coexist with defense systems.

The Defense Science Board last month kicked off its study on wideband RF and wideband communications. Our office along with the Air Force and others are looking at laser communications for satellites.

So there are a number of different areas where technology I believe will significantly help the Department and the commercial sector.

Senator WYDEN. The reason I asked about technology is I think there is the potential here for some real breakthroughs. But I will tell you that, no matter how far we get with these new technologies, we are still not going to be able to address this issue as the American people deserve without some fundamental changes in the way we make this policy. For example—I want to address this to you, Mr. Sugrue, and Ms. Victory—I think what is going on at the FCC and what the administration is doing in this area is very useful and very constructive.

But my concern is that at the pace that we are going here, this will be the longest-running battle since the Trojan War, because as I look at it the FCC is essentially going band by band. So this is going to mean proceedings on proceedings and more proceedings, I think just for years and years.

I think what the administration is doing, Ms. Victory, with respect to looking at other countries, the U.K. and the various studies under way, is also very useful. But my sense is that this is just going to take eons to get it done at this rate. In particular, I think we all know what needs to be done. The commercial side lacks adequate incentives with respect to sharing spectrum and flexibility and the same is true on the Government side. We all recognize that commercial uses and governmental uses are different and the incentives that will be needed on both sides are different as well.

I think my question here is, Ms. Victory, would it not make sense for the administration now to set down with the Congress on a bipartisan basis, with Chairman Inouye and Chairman Hollings, Senator Stevens, the leaders in this area, roll up our sleeves and say: We are now going to move together over the next 6 months, say, to come up with a comprehensive reform plan?

My guess is that you can do a big chunk of this administratively. There may be some areas where legislation is needed, but I think you could do a big chunk of this administratively. The Congress is anxious to do this. There is not anything partisan about that. That way we get beyond this sort of process like we are seeing at the FCC on the commercial side, where we just go band by band by band, and it is going to take forever.

You and I have talked about this. I have talked about it with Chairman Powell. I just think we ought to recognize that is what it is going to take here, and I would be interested in getting your reaction on the record with respect to this point.

Ms. VICTORY. I would agree with you that the piecemeal approach is not the end game. I think we are stuck with the piecemeal approach to deal with some of the current challenges that are now in front of us. But I do agree that we need to have an overall approach. That is one of the reasons we kicked off our spectrum summit in April, and we are trying to work with Chairman Powell. We would be pleased to sit down with the Members of this Committee to do some brainstorming, because if we are going to have a creative approach to this it may be that some legislative changes are necessary in addition to administrative changes. So we would be pleased to sit down with this Committee.

Senator WYDEN. When do you think we can say, all right, we have looked at a number of these issues, the FCC is going at it band by band; now we are going to have a bipartisan effort, the Congress and the administration, to address this in a comprehensive way?

Maybe, Mr. Sugrue, you would like to get into this as well. But I would like both of your opinions, because I think until we make that fundamental judgment, we are going to find it very hard to make the kind of progress the country wants.

I think this is the communications ball game. I know a lot of people in the telecom sector would not agree with this comment I am going to make, but I think those fights are yesterday. I think this is where it is at, folks, and I think we ought to recognize it. I think we ought to get on with it. If I had my first choice, I would not leave until Mr. Sugrue and Ms. Victory said, we want to work with Chairman Inouye and Senator Stevens to come up with a bipar-

tisan plan. I am not going to maul you or anything like that this morning, but that is what I think really needs to be done.

Mr. Sugrue, your reaction?

Mr. SUGRUE. Well, I think you can leave now, Senator, because I think we are happy to work with you and the Committee on developing such a plan. I do not mean to be flip about it. But we do have this—Chairman Powell just announced the spectrum policy task force, which is working on a very accelerated schedule. In fact, our first feedback from people when we put out our public notice was: How do you expect us to answer these questions, considering how broad they are and how deep they are in terms of spectrum management policy, in 30 days? That was the comment cycle.

What we are telling people is: You do not have to answer every question in that PN. Pick out the five that are the most important to you and address them, and we will work it over the summer.

We have been proceeding with a number of reforms band by band. Secretary Victory mentioned spectrum leasing as a reform, which would increase the flexibility, allow spectrum to move more easily, and use a marketplace mechanism. People use land as an analogy. Leasing is used, obviously, all the time in land. We have been permitting leasing on a band by band basis.

I think we are at the point where that has some virtue, in that it gives us an experience base, both as to how it works in the real world, also a regulatory and legal base to go forward. I think the Commission is working on generalizing that approach for the entire bands that the Commission oversees.

Senator WYDEN. How different would the allocation system look 3 years from today if we just said, okay, FCC, continue to do your own thing the way you are doing it?

Mr. SUGRUE. Well, if you left us to our own devices, I think we would be moving towards significant reforms in the direction I think that you indicated. At least that would be my anticipation. I do not want to prejudge what the Commission or any particular Commission would do.

The trend is certainly toward greater flexibility. That is, rather than say you have to put this service in these megahertz and then if it turns out the marketplace does not reward that service, then you have got to come back, do "Mother may I, FCC, may I change this from a mobile service to a fixed service, may I change this from a one-way service to a two-way service?" That takes 2 years because people, potential competitors, come in and say: No, that would be terrible, you cannot let that happen, or whatever.

Just say "No, you can do one-way, two-way, mobile, fixed." We try to write general interference rules. Practically all the allocations we have done, at least in the 3½ years I have been here, have been in that direction. We could probably pick out one or two exceptions for various special reasons, but that clearly is the trend.

But you are quite right, there is a legacy. The entire band has been pretty much allocated, at least the most valuable parts of the band, and a lot of those legacy rules are very specific, very technology-specific, and very inflexible.

Senator WYDEN. I am going to wrap up with this, Mr. Chairman.

Ms. Victory, I think Mr. Sugrue just made my point in his last answer. This is an individual who I know is dedicated and com-

mitted to these changes, and it is in your testimony. When I asked him what it would be like in 3 years under the FCC's current system, he essentially—in fact, his exact words: We will be moving towards significant reforms. Not this will be completed, that will be completed. We will be moving towards significant reforms.

I will close by saying I think we can do better. Would it not make sense to take a kind of more comprehensive approach and begin that now? Maybe what you do is you go at it on a two-track system. You continue these various piecemeal kind of efforts, but we also say we are going to go at it with the Congress to try to put in place the kind of comprehensive reform effort that can allow Mr. Sugrue to answer that question differently than he just did.

I want him to be able to say, for example, that in 3 years we completed this and this, in year 4 and 5 we want to do this and this. I think his last answer, from a good man who believes in this, sort of highlights what needs to be done here.

Mr. SUGRUE. May I amend my answer to the past tense: Moved. [Laughter.]

Ms. VICTORY. I agree with Tom's comments. And I agree with yours as well. I think you should be moving on a two-track system. We should be thinking the big thoughts as to what the end game is and be moving quickly to get that in place. We stand ready to work with you on that.

But we also will need to deal with these current challenges that come up while we are working on our overall solution. So we are happy to work with this Committee.

Senator WYDEN. Thank you, Mr. Chairman.

Senator INOUYE. Thank you.

Senator Allen.

STATEMENT OF HON. GEORGE ALLEN, U.S. SENATOR FROM VIRGINIA

Senator ALLEN. Thank you, Mr. Chairman. I thank you for calling this hearing today and thank all the witnesses. I am sorry I could not be here. We had a Foreign Relations Committee meeting at the same time with the Prime Minister of Israel Ariel Sharon.

I do want to associate myself—and I have been looking at notes, but listening to Senator Wyden's remarks, and do associate myself with the sentiments that he expressed and the importance of moving and acting. Obviously, we are going to have to study and be considerate of all the different aspects of the spectrum allocation management issue.

I understand that Senator McCain had mentioned how important this is and it needs to be reemphasized how much growth, substantial growth, there has been in the wireless industry, both internationally and in the United States. Better quality of service, greater functionality in product offerings, and faster transmission speeds largely account for the large increase in public electromagnetic spectrum demand.

According to the Cellular Telecommunications and Internet Association, there are over 130 million wireless subscribers in the United States, triple the number of subscribers in 1996. Additionally, traffic volume—and this is why we have to move—the traffic volume in terms of minutes of use has grown by more than 75 per-

cent a year for the past 2 years, and there is no reason to believe that that trend will not continue.

In the international marketplace, Third generation wireless services are providing high-speed Internet access. Analysts predict approximately 1 billion subscribers will make use of 3G networks in a decade's time, and full services based on 3G technologies are expected to be available in most countries by the year 2006, offering downloads speeds—and this is what I think is great—download speeds of up to 2 megabits per second.

Now, clearly spectrum is becoming one of the most valuable, scarce resources now and obviously in the near future. I would like to underscore two points that I think are most important in considering any overarching spectrum management policy. First, it is important to emphasize that the world community is moving forward with third generation wireless services with or without the United States. I am one who is very competitive and wants the United States to stay in the competitive lead. The reason we are strong in some regards is because creativity flourishes in this country, much of it from the private sector.

Now, it is up to the Congress as well as the FCC, NTIA, and the Department of Defense together to make sure there are not any impediments to the growth and the progress of this country's wireless capability for consumers and enterprise. We need to make sure that the United States stays competitive internationally.

Additionally and importantly, third generation wireless services have the potential to significantly impact the broadband deployment and access problems throughout rural areas of the United States. We have talked about incentives and I support the Rockefeller broadband tax credit because it is technology-neutral, and it is not just going to address DSL and the local co-op. There is a lot of dirt you have to dig up and to the extent you mix the wire or the fiber with wireless is the way that I think rural areas we will be able to bring broadband access to people in rural markets. That is a method that I think is a cost-effective method of delivering those broadband services.

Secondly, with regard to any spectrum reallocation it is important that we act responsibly towards essential security incumbents. We can argue what is essential. In my view one of the main reasons the States and the people created the Federal Government was for national defense. So essential security incumbents, especially national security interests, need to be taken into account.

With that said, there are reallocation plans being considered which offer incumbents responsible approaches to relocation. Now, I think it is a bit of a legal fiction in the way that the Federal Government looks at things to look as if the incumbents have a property right to their spectrum allocation. I have and will continue to support the administration's proposal for a relocation trust fund where the incumbents receive a portion of the auction revenues to pay for both the relocation costs and any necessary system upgrades.

Based on our country's current demand for wireless services and the additional benefits for third generation service, I think it is increasingly important and the time is really now to move. It is not going to get done this year, but it needs to start. We need to know

what we are doing. By this time next year, we need to know what the game plan is, the strategic plan, and it needs to be formally executed.

It is important, I think, while we do this to harmonize the United States in this effort with the rest of the world. We need to increase the public spectrum consistent with international providers and also to make sure that we are competitive with international providers.

With that said, Mr. Chairman, I would like to ask a few questions here, first of Mr. Price. This is a follow-up question on your questions previously asked of Deputy Secretary Price. It has to do with the frequency band that is used most by the Department of Defense.

Most of the rest of the world operates in the 1700 to 1800 megahertz bands for wireless commercial use. The major difference between the United States and the rest of the world is the use of the portion from 1755 to 1850 megahertz. In the rest of the world that band is used primarily for commercial use, where in the U.S. that band is allocated to the Department of Defense.

Now, let me ask you this just as a technical matter. When the Department of Defense operates or is operating overseas, has the Department of Defense experienced any interference with international users in this band?

Mr. PRICE. We experience interference with many of our systems in many different theaters all the time. One of the tasks of the frequency management and communications folks, the J–6's at the combatant commanders, is to work those problems out with the host nations. As I mentioned earlier, we had one tactical radio that is actually in the band that you are referring to, that took us in Central Command, CENTCOM's area of operations, 6 years to get host nation approval. But we have gotten it.

So in direct answer to your question, we are very comfortable that the systems we have in the band from 1755 up to 1850. we have very workable, very real negotiated bilateral solutions, so that the systems that are there can work in those bands internationally for the long term. So we are comfortable with that. We have developed those.

One of the concerns about moving is if we move to another band, how long—will it take 6 years? Again, will we restart the clock? Where will we go and how long will it take to get the same operational competition?

So the Department of Defense has never said that is it, we will not move, we are stopping, head in the sand, that is it. We are very active with these folks in the 3G viability study. But one of the things we have said—two of the things we have said is: one, over time we believe that as we transform and move to a network-centric force we will need more spectrum, not less. We are feeling spectrum-constrained. So we need to think through how much additional spectrum we will need over the long term to meet our constitutional obligations.

It is an important point. So I think that probably sums up where we come out.

Senator ALLEN. Well, the question on this then becomes, on the relocation, I understand you may need more spectrum and so forth.

A lot of times, as you well know, and I guarantee you the presiding Chairman today understands this as well, that sometimes for national security interests the military does not have time to be renegotiating and trying to get the spectrum or the band area to operate efficiently. They need to move quickly and cannot dawdle for proper efficiency in communications.

The question really becomes if we relocate to another band, will that other bandwidth eventually be utilized for commercial purposes in some other part of the world. That is why this whole effort needs to be coordinated, and it will be actually beneficial to work with our NATO allies and other countries.

But the reality is at this point, I doubt if the rest of the world is going to change their commercial use of the spectrum area between 1755 and 1850. So it is really a question of whether we relocate or they relocate. Some of this really gets back to what Senator Wyden was saying and whether or not there are advances in technology. It is an engineering, a technology or a technologist engineering matter to get more information or greater utilization of existing spectrum.

Do you all—and I guess I would ask Ms. Victory or Mr. Sugrue or any of the witnesses—What incentives, what could we do as a Government to incent advances in technology? This is kind of a follow-up on Senator Wyden's lack of patience. And I do not think there is anything wrong with having a lack of patience. I am impatient with this as well. I think we need to be moving quickly.

Are there any things that we can do to incent a greater utilization of existing bandwidth, which would actually help the Department of Defense? I am not going to want to take it from the Department of Defense, they are a necessity which is important for our freedoms and our protection.

So do you have any suggested incentives or policies that we could put forward so that we can better utilize existing spectrum bands?

Mr. SUGRUE. Well, yes, Senator, two sets of ideas. One has to do with greater reliance on market forces. That is, along the line I was discussing with Senator Wyden, providing licensees with greater flexibility in both the use they put to the spectrum, that the spectrum can be used, and also flexibility in terms of being able to transfer some or all of their rights under a license, on which we have some flexibility, but it is constrained in certain ways.

The reason that would encourage flexibility is—pardon me, innovation—is if you come up with a new idea right now you have got to find a band to put it in and then you have got to find a licensee. Well, first of all, some bands, you are not allowed to put that in, if it is for a particular use or, as I said, even a particular technology. Then we have to go through a regulatory proceeding to do that, even though introducing a new technology, you think that should be apple pie and motherhood. It often is not, for various strategic or tactical reasons of various licensees. So we get involved in a big brouhaha, legal challenges, and so forth.

If we just said you can put any technology in there and allowed the market to reallocate those resources, not without being subject to Government oversight, but hands off a little bit more than we have had in the past, I think that would go a long way.

Another approach would be, frankly, a little bit more interventionist, by actually writing rules. This dichotomy is set out in the public notice that the spectrum policy task force released last week: Should we have rules on spectrum efficiency, for example, that say you have to use, you have to hit some measure of spectrum efficiency? For example, in the public safety bands at 700 megahertz we did specify; 25 kilohertz is the standard voice channel on a public safety system. We said you had to start at 12.5, in other words twice that, and you have to migrate to 6.25 over time, and there is a schedule to do that.

We could do comparable things in the commercial side. Our approach has generally been on the commercial side we try to provide the right market incentives for that and on the public safety and private side we often feel we have to intervene somewhat.

By the way, the public safety agencies typically are in favor of at least reasonable spectrum efficiency standards, in part because a lot of their spectrum is shared, so if one agency is using spectrum inefficiently that detracts from the pool that is available for all of them. So I think it is a win-win there.

Senator ALLEN. Well, thank you.

Is there any legislation, Mr. Chairman—or I would ask Mr. Sugrue—so far as the first point, I think that it makes sense that if you have Government agencies the Government can have greater oversight or intervention to make sure that they are not utilizing—it is a question of Government efficiency, really, in a technological sense.

Is there any legislation proposed and has it been subject to any comment on your first point, as far as the greater flexibility and utilization of existing granted bandwidth?

Mr. SUGRUE. On market mechanisms? I think for the most part we have some discretion. I will look over my shoulder. I am looking at our Deputy Chief who is in charge of the auction program and she would chastise me if I did not mention our auctions authority expires in 2007 and we would lose that very effective market-based mechanism in assigning licenses, which is a little different than what you talk about, but it is part of the toolkit we have. So an extension of that at an appropriate time would be useful.

But I can give that some thought and we can get back to you on that.

Senator ALLEN. Well, again, I do not think that we are going to solve it this year, but this Committee hearing is very important. We have had a previous one in this Committee earlier in the session, but I think that we need to build momentum for solutions and getting this solved.

As far as 2007, whether we make it an Oklahoma land rush approach or continue with the way it is, that remains to be seen. The most pressing issue is this. I look forward the working with you. I know Senator Burns has great concerns on this as well, and I look forward to working with him, you, Mr. Chairman, Senator Wyden, and others.

Yes, Mr. Price. I see you want to say something to me or to share with the rest.

Mr. PRICE. Thank you, sir. I just want to make a couple of quick points. Going back to the last question, I heard the point. I would

just caution you a little bit, if I may, on the harmonization issue worldwide, some would say an argument, some would say rhetoric. I think it is a little bit more myth than reality that the world is harmonized around any bands.

I think it is fair to say that if you actually look at specifics, the world is waiting for the United States to see where, to some extent, where we go. In fact, where other countries have put 3G, in many cases it is where the U.S. has 2G. So our view is that harmonization should occur, but it should occur through technology. You already have tri-band radios. The Department of Defense is working on software-defined radios. Our JTRS core platform will have 33 different wave forms, so you can go in almost any band with a single radio. In our view it obviates the need to harmonize just through spectrum bands.

The second point is you mentioned property rights. It is not our place to get into an argument about whether or not spectrum is property rights. That is the folks to my left to get into that argument. But the important thing for the Department and I think as people think through a national spectrum plan is the need for incumbents to have predictability and certainty. The risks of should we move, will we have to relocate, where will we relocate, it affects us; as you mentioned, it affects the host nation; it affects NATO; it affects our allies, our coalition partners.

I was in a meeting yesterday for 3 hours with the Joint Strike Fighter program office, a large new program, a large program at the Department of Defense. These planes will be flying, I do not know the exact year, some 10 years out. They have already identified the spectrum bands they are going to be in for over 20 different uses: radars, command and control, communications. Those have not even been close to being procured yet and yet we have already picked the spectrum bands.

So to have predictability and long-term certainty as to where we are going to operate is a fundamental issue that DoD fears going forward.

Senator ALLEN. Well, I am glad you shared those views with us, not just me, with all of us, because I do not think any of this will ever arise or occur in the event that the Department of Defense feels, justifiably, that it is harming their essential mission, which is the primary mission of the Federal Government. I think that a lot of the technological advances actually will be coming from the military. The fact that our military is so technologically advanced, especially with our air superiority and superiority on the seas, is what is allowing us to fight this war on terrorism with minimal casualties to ourselves as well as minimal casualties for indirect hits on nontargets.

I do think it is important that there is a predictability for the military as you deploy and procure the systems in the future. It is also important, predictability and credibility, for the private sector if people are going to be investing millions, if not billions, of dollars on various platforms or enterprises, to know that when they do deploy it it is not just going to be flippantly changed by the Government.

The flexibility ideas that Mr. Sugrue is talking about has no harm whatsoever to the Department of Defense. It is a creative

way of maybe allowing the private sector to do what you are envisioning, as far as the way to switch from maybe a dozen different spectrum bands. I realize the DoD concerns are important and it can never be emphasized too much. However, I do think that we are getting behind in 3G, and 3G is very important internationally. I think it is also important for our economic competitiveness as a country and has the potential to be very helpful in rural areas as far as getting high-speed or broadband to rural areas.

I know that is not necessarily a primary concern of the Department of Defense, but it is important for homeland opportunities.

Yes, Ms. Victory.

Ms. VICTORY. Senator, since you had emphasized predictability and certainty as something that you also hear from the private sector, I just wanted to mention that I hear it from both sides as well. Government agencies want predictability and certainty and so does the private sector. I think one of the challenges in spectrum management is trying to provide that predictability and certainty, when technology and consumer demand and Government demand is anything but.

So I think that we are constantly trying to do a little bit of a balancing here. But I think the predictability and certainty would be a lot easier if technology was static and consumer demand was static and Government ideas were static. But I think the challenge that we all face is that this is a very dynamic environment and trying to come up with that predictability and certainty in this environment is going to be extremely hard.

Senator ALLEN. Well, we certainly do not want any static thought in Government. We do not want static approaches in the private sector. The status quo is not good enough in this area or anywhere else. The advances in technology are wonderful for our quality of life, for communications, for security and all the rest. So when you have a situation that is so dynamic as this, where there are things that are in constant motion and every new day there is a new improvement and a better way of doing thing, that is exciting.

In a situation such as that, what you have to have are guiding principles which people can operate in. Now, obviously for the military, their guiding principles are national security. For the private sector, you have guiding principles or rules that will allow them to adapt to change, to innovate, and to improve within a credible, stable situation.

That is where we have to look at this as a philosophical approach of how are we going to address this. That is why I think the idea of the creativity or the flexibility, making sure, though, that they are not squatting. In other words, it is being utilized when it is a Government service, so they are not squatting or slow or static and utilizing more than they are wasting. In the private sector, maybe if you could give them greater opportunity, greater flexibility. If they do not want to use it, maybe they can sublease it, so to speak.

So I look forward to working with all of you. I think it can be achieved. It will not be easy, but if there is a will there is a way, and we have to adapt, we have to innovate, and we must improve.

Thank you all. Thank you, Mr. Chairman.

Senator INOUYE. Thank you very much, Senator.

Because of the complexity of the issue before us and because of the uncertainty and the ambiguity of the policy, if we are to have an impact on this issue, this will be the first of a whole series of hearings. We have yet to hear from other interested parties.

Accordingly, the record will be kept open for this hearing for 3 weeks, and during that time if you have any corrections, addendums, or suggestions or statements that you would like to place in the record. It will be open to the Members of this Committee to submit more questions if they so wish.

I have just one question I would like to ask Mr. Price before we adjourn. I am certain that after September the 11th home security missions resulted in more extensive use of the spectrum by your Department. In conducting combat air patrol missions over the cities as part of Operation Noble Eagle, did you experience any difficulties in coordinating spectrum operations with civil authorities, like the FAA?

Mr. PRICE. Almost shockingly, we did not. That was because within hours the FCC, FAA, NTIA, Department of Defense worked together around the clock to coordinate extensive use of military aircraft over the United States. There were also NATO AWACS planes as well as U.S. planes. It was a very complex ecosytem of military aircraft that were protecting the skies, not only for the first few days, but for a number of months.

It took a significant coordination within the interagency—there were no rules, no regulations. This was just hard-working people—to help coordinate that, and subsequently helped coordinate when there was military support to the 2002 Winter Olympics in Salt Lake, helped coordinate when there were National Guard and other troops at airports around critical infrastructure.

These were uses that had not heretofore been anticipated. We did not necessarily have spectrum where we had used it in the past, assignments or allocations. But the hard work of a number of people within the Government allowed that to work very smoothly.

Senator INOUYE. I wish to commend you for that. Do you think that this coordination should be made part of rules and regulations?

Mr. PRICE. Well, we're talking through how to work similar kinds of issues as they arise and should they arise. Not only airplanes but first responder kinds of events. I do not know if it is rules, regulations, but we are thinking through all those processes within the Government.

Senator INOUYE. It would appear that in this crisis everyone saw the need for coordination and collaboration. Do you think this can happen again in the crisis we face today?

Mr. PRICE. I believe so.

Senator INOUYE. With that high note, I thank you very much.

[Whereupon, at 11:42 a.m., the Committee was adjourned.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MAX CLELAND TO PETER GUERRERO

Question 1. Do you believe there currently exists a non-partisan person or group who can objectively review spectrum recommendations and uses? If not, do you believe such a person or group would be helpful?

Answer. Our work to date has not directly looked at whether a person or group outside of the current spectrum management process is needed. However, we are currently gathering information from spectrum management organizations in several countries and have found that the organization of spectrum management functions varies considerably. In the U.K., for example, the United Kingdom Spectrum Strategy Committee (UKSSC) addresses issues that affect all spectrum managers within the UK Similarly, we found that in Canada, an entity known as the Radio Advisory Board, which includes trade groups and government representatives, is very important in gaining consensus and developing recommendations on spectrum policy issues that are provided to Canada's spectrum managers. We are continuing to gather information for several other countries as well, and will report in January on these issues.

Question 2. Do you believe this country has in place an efficient spectrum use plan? Why or why not?

Answer. Virtually none of the federal or commercial officials we interviewed said that the U.S. has a national spectrum plan or strategy. FCC officials told us that while FCC does planning on specific spectrum issues, it does not plan comprehensively by itself and there has been no comprehensive, coordinated interagency planning by FCC and NTIA. They noted that the closest thing to a national spectrum strategy is the process used by FCC, NTIA, and the State Department to reach consensus on a U.S. position for agenda items for World Radiocommunication Conferences.

There is debate, however, as to the usefulness of long-term planning. A key problem is the difficulty of predicting future trends in wireless services. For example, FCC officials noted that the growth in cell phone and PCS deployment was much greater than either FCC or the industry anticipated in the early 1990s. Emerging technologies may not develop as planned and could result in wasted spectrum if plans are not flexible. For this reason, FCC prefers to rely on market forces as much as possible. For its part, NTIA has done studies of long-term federal spectrum needs. Overall, there is a consensus around the importance of defining core values and goals for spectrum management, while retaining flexibility to allow for technical innovation.

Question 3. Cost of moving from one band of spectrum to another is an issue. However, do you believe that if a move could result in greater efficiency, then it could result in actual cost savings?

Answer. It is certainly possible for the savings from greater spectrum efficiency to outweigh the cost of moving. However, it can be a difficult issue to estimate these relative costs and benefits. In a well-developed market environment, market forces provide information about the relative costs and benefits of alternative arrangements. With spectrum resources, however, these markets are not fully developed. Moreover, for some users, including the Department of Defense and certain other government agencies, the financial evaluation of alternative means of achieving a particular mission capability would be extremely complex even if additional market information were available. Our January 2003 report will be looking at whether there are feasible ways of valuing spectrum when market information is not available.

Question 4. How long do you think it would take to do a comprehensive examination of our domestic spectrum plan?

Answer. GAO believes that a comprehensive spectrum evaluation could be important, and we are examining this issue for our January 2003 report. We believe that

an appropriate analysis should address the multitude of spectrum-related issues the Congress faces today, because these issues are highly interrelated. Moreover, an effective analysis requires the involvement of all interested parties. The United Kingdom completed a comparable review in one year. A study in the US could take more or less time depending on the resources devoted to the review.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ERNEST F. HOLLINGS TO PETER GUERRERO

Question 1. What can be done to improve U.S. participation in the World Radiocommunication conferences?

Answer. A central challenge for United States spectrum management is preparing for the WRC. This has become more difficult in recent years because of increases in the frequency of conferences, the number of attendees, and the size of conference agendas. Federal and non-federal spectrum experts have suggested a number of improvements to our WRC preparatory process.

- *Appointing the head of the U.S. delegation earlier*. Many experts believe that the appointment of an ambassador to head the U.S. delegation to the WRC just six months before the conference does not leave enough time for them to adequately prepare for the conference and resolve any disagreements in the U.S. position. Appointing an ambassador for a longer term, or having a career civil servant head the delegation could address this problem. However, each of these choices also has drawbacks. Appointing an ambassador for a longer term would involve a potentially time-consuming Senate confirmation process. A career official, on the other hand, would lack White House connections and ambassadorial status. State Department officials also said that the ambassador title provides a good tool for recruiting top non-government candidates. The government may have found an informal way around the short term of the appointment. For the last several international conferences, the government has tried to identify the person that is to become the ambassador and involve her/him in conference planning prior to the 6-month appointment. For example, this approach was effectively used for the 2000 WRC ambassador, State Department officials said that she was told that she would be appointed to the position and given a temporary telecommunications policy position in the White House four months prior to her appointment. That allowed her to learn the issues and observe WRC preparatory meetings, but she could not lead the meetings until her formal appointment about 5 months before the conference.
- *Setting deadlines for achieving important WRC preparatory objectives*. Federal officials said that some of the difficult issues regarding the U.S. position for WRC agenda items are not resolved until the eve of a WRC, when the need to reach a decision has become urgent. Setting firm deadlines for formulating and finalizing the U.S. position for an upcoming conference could help to force earlier action. However, setting deadlines could have drawbacks. It is unclear how such deadlines would be enforced. In addition, some of the U.S. positions rely on reaching consensus with the other countries in our regional telecommunications body, which will not be governed by U.S. deadlines.
- *Merging the separate NTIA and FCC preparation processes*. NTIA and FCC currently develop the U.S. position for WRCs through separate processes. At the end of the WRC preparatory process, the two positions must be merged into a unified U.S. position. In order to accomplish this, FCC and NTIA must work out any disagreements they have with the assistance of the Department of State. WRC 2000 Ambassador believes that merging the separate processes into one WRC planning process could help resolve disagreements in the U.S. position earlier in the preparatory process. However, NTIA said that the separate processes are needed because much of government side of spectrum policy and use is classified.

Question 2. Congress has, in the past, called for the FCC and NTIA to engage in national spectrum planning. What did GAO learn about the status of implementing these plans and based on GAO's review what concerns have been raised with respect to establishing a national spectrum plan?

Answer. Although FCC and NTIA conducted individual planning efforts of various sorts, they said that they have not fully complied with requirements to engage in joint national spectrum planning. However, the agencies have both recently indicated that they plan to comply through increased joint coordination and planning. For example, FCC and NTIA could use the momentum from recent NTIA Spectrum

Summit and the new FCC Spectrum Task Force to fulfill their requirements for joint national spectrum planning.

Please refer to the prior answer to Senator Cleland for further views on a national spectrum plan.

Question 3. Do federal agencies have spectrum that is under or un-utilized? If so, how can this spectrum be identified and better utilized?

Answer. Our review did not focus on identifying unused or underused federal government spectrum, and we did not find any specific examples of such. However, NTIA does not have assurance that its activities to encourage efficient spectrum use among federal government agencies are effective. It has eliminated all of its monitoring programs due to staff and resource shortages, and it depends on agencies that are also struggling with staff and resource shortages to review their spectrum assignments as required. As a result of staff shortages, many of the agencies we reviewed are behind in conducting their reviews and/or do not conduct robust reviews of their spectrum use.

Improving the quality and timeliness of frequency assignment monitoring and reviews would increase accountability for efficient use among federal agencies, but it may not be possible to centrally manage hundreds of thousands of frequency assignments in an effective way. NTIA may want to consider creating incentives at the user level to encourage spectrum conservation. Our continuing work on spectrum management is looking into the question of how other countries pursue efficiency in government use. For example, we have learned that other countries are moving toward using payment mechanisms for government spectrum users that are specifically designed to encourage government users to conserve their use of spectrum. NTIA currently requires agencies to pay spectrum fees (about $50 per frequency assignment), but the purpose of the fees is to recover part of the costs of NTIA's spectrum management function, rather than provide an economic incentive for effective spectrum use.

Once unused or underused spectrum assignments are identified through monitoring, reviews, or some sort of incentive, they can be deleted from the Government Master File—NTIA 's spectrum database—making them immediately available for other uses.

Question 4. In your statement, you noted that some federal agencies were unable to complete the required spectrum management reviews because of staffing and resource shortages. How serious is this staffing problem?

Answer. We found that the staffing and resource shortages were significant for some agencies. Several agencies told us that their staff had been reduced during a time when requirements of their offices were increasing. This problem may be getting worse. Several of the agencies we reviewed are facing recruitment and retention problems and/or are facing the retirement of key spectrum management staff Several agencies said that the staffing problems caused them to reduce the timeliness and depth of their frequency assignment reviews. Some frequency managers said that this could lead to mistakes or inefficient spectrum use. Specifically, two agencies we reviewed have conducted spectrum management workforce needs assessments that showed their staffing levels to be inadequate.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO PETER GUERRERO

Question 1. What can be done to improve the current coordination process between the FCC and NTIA and more effectively allocate spectrum and better balance the needs of commercial and government users?

Answer. FCC and NTIA could improve their coordination by fully implementing the congressional mandate to conduct joint spectrum planning and meeting on a more regular basis to coordinate spectrum issues. Although they are making progress through the NTIA Spectrum Summit and the FCC Spectrum Task Force, FCC and NTIA have not yet fully implemented these requirements.

The current allocation process depends on FCC and NTIA being able to reach consensus, but this is often difficult because the entire usable spectrum has already been allocated. As a resul4 reallocation negotiations between FCC and NTIA can become lengthy and difficult. To help force a decision, some officials we interviewed have suggested establishing a third-party to arbitrate or resolve differences between FCC and NTIA. However, FCC officials said that there could be complicated legal issues of establishing an arbitrator over an independent commission like the FCC. In some other countries, decisions are made within one agency or within interagency mechanisms that exist for resolving contentious allocation issues. Our continuing

spectrum work focuses, in part, on the regulatory structure for spectrum management in 12 other countries. It will be published in early 2003.

Question 2. The President's FY 2003 Budget calls for a new process, a "Spectrum Relocation Fund," for reimbursing government users for costs incurred when they are required to relocate to different spectrum blocks.

"The Administration will propose legislation to streamline the current process for reimbursing Federal agencies that must relocate from Federal spectrum which has been reallocated for auction to commercial users. Under current law, winning bidders must negotiate with Federal entities upon the close of an auction and reimburse the agencies directly for their relocation costs. The Administration proposes to streamline this process by creating a central spectrum relocation fund. Auction receipts sufficient to cover agencies' relocation costs would be paid into the fund, and Federal agencies would be reimbursed for their relocation costs out of the fund." Budget of the U.S. Government, Fiscal Year 2003, Appendix, Page 241.

The Administration has not yet submitted language to Congress.

Do you have any specific concerns about how such a Fund to reimburse government users for relocation costs might work?

Answer. Generally, providing some certainty that government users would be reimbursed for having to relocate from existing spectrum assignments could facilitate their willingness to move. There are a number of ways to provide such compensation; this proposed fund is just one approach that appears to mitigate the burden industry would face in individually negotiating reimbursement amounts with each affected agency. Generally, whatever approach is used to compensate federal agencies, it is important to establish up front what control the Congress wants to maintain over these funds. For example, if this type of fund were to be used, Congress might want to maintain control over it by requiring agencies to obtain annual appropriations.

Also, it seems from the description in the budget that the reimbursement under current law is negotiated *in addition to* the auction receipts. If the proposal is to have the reimbursement paid out of the auction receipts, the government may be receiving less overall as a result. It might be desirable to specify that the auction bids are to include amounts to finance the relocation.

Question 3. Do you believe that the proposal to use auction proceeds to reimburse government users as outlined in President Bush's budget would make the spectrum management process more effective and efficient?

Answer. Using auction proceeds to reimburse government users for moving to other parts of the spectrum would help to facilitate such moves to the extent that cost is a determining factor. However, other factors can be just as determinative as cost and even more difficult to resolve. For instance, government users may need to be given spectrum that has comparable technical qualities to the spectrum they are vacating in order to meet mission requirements. Also, because much of the spectrum is shared, interference issues may make it difficult to move users to other parts of the spectrum where incumbents are already operating. In addition, considerable time may be needed to effect a move, even if adequate reimbursement funds were available, as in the case of satellite-based systems where new satellites might need to be built and launched in order to obtain new frequency assignments.

Question 4. There is some discussion that the Relocation Fund could be established as a trust fund. However, monies in Trust Funds are sometimes used for other budgetary purposes. How can legislators ensure that monies will be available for government users to address their relocation costs since in some instances it could take years for a government user to complete its relocation?

Answer. Trust funds are one of several accounting mechanisms used to link earmarked receipts with the expenditure of those receipts. Concerns have been raised that, because the actual earmarked cash in such funds is commingled in the Treasury with other receipts and used to pay whatever bills the government currently has on hand, the federal government has inappropriately diverted funds for purposes other than what was intended. Treasury accounts for earmarked monies by crediting these collections to the appropriate funds, in this case, the Relocation Fund. Although monies are commingled in the Treasury, amounts equal to the earmarked funds are available when needed for the purposes for which they are earmarked. In most cases the trust funds are given special, nonmarketable Treasury securities in return for the cash. These are claims on the Treasury (i.e., IOUs) that can be redeemed in the future to obtain the cash needed to be spent on the intended purposes. History provides no evidence to suggest that the U.S. would not honor these obligations as it does its other obligations.

However, trust funds are not the only mechanism for earmarking funds. Special funds are also used for the same purpose of tracking receipts and spending for pro-

grams that have specific revenues earmarked for their use. The only difference between a "special" fund and a "trust fund" is the word "trust" in the legislation establishing the account. GAO has said that the use of the term "trust "fund is confusing to the public, primarily because in the federal budget the meaning of the term "trust" differs significantly from its private sector usage. The federal government does not have a fiduciary responsibility to the trust beneficiaries and can raise or lower future trust fund collections and payments or change the purposes for which the collections are used by changing existing laws. Use of a term that is not identical to a private sector term with a different meaning could clear up some of the public's confusion. For example, using the term "special fund" instead of trust fund could eliminate the confusion.

Finally, a permanent earmarking of auction receipts limits Congress's ability to change priorities, especially if the trust or special fund has a permanent appropriation. If Congress did not wish to restrict its budget flexibility to such an extent, it could retain some control over the earmarked funds. For example, when the various transportation trust funds were created, Congress dedicated receipts to particular purposes but retained annual control, through the appropriations process, over the timing of the expenditures.

Question 5. The United States seems to be at a disadvantage in the World Radio Conference (WRC) process with respect to other countries such as those in Europe. How can Congress ensure that the U.S. develops a U.S. position as well as names its delegation in a timely manner and prior to a WRC, thereby allowing for sufficient time to lobby other parts of the world?

Answer. Federal and non-federal spectrum experts have suggested a number of improvements to our WRC preparatory process.

- *Appointing the head of the U.S. delegation earlier*. Many experts believe that the appointment of an ambassador to head the U.S. delegation to the WRC just six months before the conference does not leave enough time for them to adequately prepare for the conference and resolve any disagreements in the U.S. position. Appointing an ambassador for a longer term, or having a career civil servant head the delegation could address this problem. However, each of these choices also has drawbacks. Appointing an ambassador for a longer term would involve a potentially time-consuming Senate confirmation process. A career official, on the other hand, would lack White House connections and ambassadorial status. State Department officials also said that the ambassador title provides a good too/for recruiting top non-government candidates. The government may have found an informal way around the short term of the appointment. For the last several international conferences, the government has tried to identify the person that is to become the ambassador and involve her/him in conference planning prior to the 6-month appointment. For example, this approach was effectively used for the 2000 WRC ambassador, State Department officials said that she was told that she would be appointed to the position and given a temporary telecommunications policy position in the White House four months prior to her appointment. That allowed her to learn the issues and observe WRC preparatory meetings, but she could not lead the meetings until her formal appointment about 5 months before the conference.
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Question 6. Should the ambassador to a WRC be appointed at least a year instead of 6 months prior to the conference? Should there be a State Department employee designated to drive consensus with respect to the U.S. position prior to and until the ambassador is appointed?

Answer. As noted above, many experts believe that the appointment of an ambassador to head the U.S. delegation to the WRC just six months before the conference does not leave enough time for them to adequately prepare and resolve any disagreements in the U.S. position.

The U.S. ambassador to the 2000 WRC suggested establishing a high-level civil servant as the permanent deputy head of delegation within the Department of State. While that has not happened, the current Deputy Assistant Secretary of State for International Communications and Information Technology has taken the lead in chairing WRC organizational meetings and is mediating disagreements between FCC and NTIA until an ambassador is named.

Question 7. Should the State Department be required to establish a timetable for resolving issues, establishing consensus and lobbying other countries prior to WRC? If a timetable is established, what incentives can be used to ensure that NTIA, the FCC, and industry work to meet the timetables?

Answer. As noted above, federal officials said that some elements of the U.S. position on WRC agenda items are not resolved until the eve of the conference. Part of the ambassador's role is to facilitate the process of consensus-building and compromise. Setting firm deadlines for formulating and finalizing the U.S. position may help to force earlier resolution of these issues, since the presumption would be that the ambassador would make the final call on any positions unresolved when the deadline passed. However, setting deadlines could have drawbacks. It is unclear how such deadlines would be enforced. In addition, some of the U.S. positions rely on reaching consensus with the other countries in our regional telecommunications body, which will not be governed by U.S. deadlines.

Question 8. Do you have any other concerns about coordinating a U.S. position for the World Radio Conference? What can be done to address these concerns?

Answer. Besides the challenges to the preparatory process we identified, we were also told that the United States does not implement WRC agreements in a timely manner. Although the U.S. can informally implement WRC agreements, none of the agreements reached at the 1992, 1995, 1997, or 2000 WRCs have been formally ratified by the Senate. The Department of State said that the delays were necessary because of the policy overlap in recent WRCs. In addition, NTIA officials said that FCC has occasionally changed parts of WRC agreements causing adverse impacts to government and the scientific community's use of the radio spectrum. FCC officials, however, stated that they occasionally interpret WRC agreements differently than NTIA. We continue to look into this issue and will report on it in our final report in August.

Question 9. GAO has indicated that while NTIA has attempted to promote spectrum efficiency, there is no accountability to ensure government users are using spectrum efficiently. Also GAO found that many federal agencies are understaffed with respect to employees who could assist agencies to manage spectrum. The FCC has recently indicated its need to increase its number of engineers.

Does NTIA believe that increasing engineers in federal agencies could assist agencies in better managing spectrum as well as improving spectrum efficiency?

Answer. NTIA officials said that some IRAC member agencies seem to have a shortage of engineering expertise in their spectrum management departments. For example, NTIA officials noted that the Coast Guard has been unable to provide the needed engineering support for maritime issues at the World Radiocommunication Conferences. We spoke with officials from the U.S. Coast Guard and they confirmed this shortage of engineering support for international conferences and said that they are working to improve the situation. We asked NTIA whether increasing the number of engineers could help agencies manage their spectrum more efficiently. NTIA is currently looking at this matter and told us they will respond to you directly.

Question 10. Is there anything else that can be done to increase the level of accountability with respect to government users and spectrum efficiency?

Answer. NTIA places primary responsibility for promoting efficiency in the hands of the individual agencies because they are in the best pos ition to know their spectrum needs. Yet, because agencies are resource constrained they do not often conduct spectrum reviews in a timely or meaningful way. For example, one agency has over 1,000 frequency assignments that have not been reviewed in 10 years or more. NTIA, itself has eliminated its oversight of agency spectrum due, in part, to resource shortages. Reactivating these oversight programs, which NTIA said provided important and useful information about agencies ' spectrum use, would increase ac-

countability among the federal agency users. NTIA could also make a greater effort to enforce its five-year review requirement for federal agency frequency assignments.

However, these efforts alone may not be sufficient given the hundreds of thousands offrequency assignments to be managed. NTIA may want to consider creating incentives at the user level to encourage spectrum conservation. Our continuing work on spectrum management is looking into the question of how other countries pursue efficiency in government use. For example, we have learned that other countries are moving toward using payment mechanisms for government spectrum users that are specifically designed to encourage government users to conserve their use of spectrum. NTIA currently requires agencies to pay spectrum fees (about $50 perfrequency assignment), but the purpose of the fees is to recover part of the costs of NTIA's spectrum management function, rather than provide an economic incentive for effective spectrum use.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MAX CLELAND TO STEVEN PRICE

Question 1. Do you believe there currently exists a non-partisan person or group who can objectively review spectrum recommendations and uses? If not, do you believe such a person or group would be helpful?

Answer. Under current law, the Assistant Secretary for of Commerce for Communications and Information (Administrator, National Telecommunications and Information Administration, or NTIA) is responsible for cooperating with the Federal Communications Commission (FCC), to develop long-range plans for improved management of all electromagnetic spectrum resources and to jointly determine the National Table of Frequency Allocations. One of the primary functions of the NTIA is to manage the spectrum use by the Federal Government, while one of the primary functions of the FCC is manage spectrum use by non-Federal Government entities. Therefore, the NTIA and FCC, by nature of their defined roles, share the responsibility for managing the nation's spectrum. The coordination between NTIA and the FCC, which each represent different constituencies, allows the balancing of different priorities and the compromises inherent in managing a scarce resource. There is currently no single "person or group" that has sole responsibility for determining spectrum allocation, but all of the agencies of the Federal Government have a role in shaping allocation decisions and spectrum policy.

DoD supports a spectrum management process that allows for planning and setting of national priorities. Development and enforcement of a national, long-term spectrum plan that would set national priorities would afford the incumbent user a higher degree of predictability and certainty that currently exists. DoD's view is that in such a plan, essential national security needs would have highest priority.

Question 2. The cost of relocating due to switching spectrum bands can be significant. Reimbursement proposals are being developed in order to reimburse government users when they move. What affect do you think reimbursement has on the success of auctions and the amount that commercial users are willing to pay for spectrum?

Answer. Under current law (the FCC's auction authorities and 47 USC 923(g)), successful spectrum auction bidders are required to pay into the General Treasury the amount of their winning bid and, separately, negotiate with and pay to federal agencies the costs of relocating federal incumbent systems prior to the actual relocation. In general, we believe that auction winners view reimbursement of relocating incumbents as a cost of doing business and an expected "capital" expense. This approach, however, has the benefit of ensuring that new spectrum users, rather than the general public, will pay the costs of relocating existing federal government spectrum users. To the extent that the objective of spectrum auctions is to raise money for the U.S. Treasury, the current law also has the benefit of avoiding hidden costs to the U.S. Treasury of spectrum auctions and enhancing the validity of Congressional Budget Office scoring.

The goal of cost reimbursement should be to fully reimburse the incumbent for all actual costs—direct and indirect—associated with moving to new spectrum. The reimbursement should include all costs, including for example training and testing of new systems and the cost of calculating all the expenses required in such a move.

It must be emphasized, however, that the issue of finding and securing comparable spectrum is inextricably linked to the issue of relocation. Current federal law, section 1062(b) of the National Defense Authorization Act for Fiscal Year 2000 (47 U.S.C. 921 note), provides that "[if, in order to make available for other use a band of frequencies of which it is a primary user, the Department of Defense is re-

quired to surrender use of such band of frequencies, the Department shall not surrender use of such band" until several conditions are met. First, the NTIA must make available to DoD "for its primary use, if necessary, an alternative band or bands of frequencies as a replacement for the band to be so surrendered." Second, the Secretaries of Defense and Commerce, and the Chairman of the Joint Chiefs of Staff, must jointly certify to the congressional armed services and commerce committees that "such alternative band or bands provides comparable technical characteristics to restore essential military capability that will be lost as a result of the band of frequencies to be so surrendered." We note that the statute does not apply to the 1710–1755 MHz band. The statute would apply to the 16 protected sites within the 1710–1755 MHz band if they were required to move.

Thus, any relocation compensation regime must dovetail with DoD's requirements for comparable spectrum. Indeed, the identification of comparable spectrum must be completed before any practical assessment of relocation costs can be attempted. This provision of the law is a vital protection for national defense and helps ensure the continuing operational quality of military communications systems.

The availability and suitability of comparable spectrum that will meet ongoing and growing DoD needs will always be a critical factor in determining relocation costs. And the level of such costs is likely to be a key influence in attracting potential bidders, setting potential bidding floor prices, and otherwise conducting a successful auction.

A final point is that the issue of switching or relocating from spectrum bands is far more than a cost issue. Clearly, cost is important but DoD focuses on operational impacts: will we be able to operate as efficiently, will we be relocated in time should that national call on our warfighter to act, will we remain interoperable with allies and other Coalition partners who use the same frequencies we currently do, will we be able to garner the crucial host nation approvals to operate our systems within the new frequencies to which we are relocated. These are important issues—and ones that are distinct from cost reimbursement—that must be taken into account during relocation discussions.

Question 3. As you know the International Telecommunications Union (ITU) designated two bands of spectrum for international harmonization of Third Generation or 3G use. European and Asian countries are able to secure this spectrum for this use. However, the U.S. has government and commercial entities operating in these bands. Specifically, with regard to the DoD users, if our troops are using one band of spectrum to communicate domestically, will they be able to communicate with American troops abroad who will not be using the same spectrum bands?

Answer. Member States and Sector Members of the International Telecommunication Union have actually identified multiple bands that countries are able to consider for the implementation of Third Generation (3G) systems. At the World Administrative Radio Conference of 1992 (WARC–92), the bands 1885–2025 MHz and 2110–2200 MHz were identified (230 MHz total). Almost every European country and all major Asian countries have allocated these two bands for the initial implementation of 3G capabilities and have conducted auctions to implement the allocation to our knowledge. No country is planning at this time to establish initial 3G systems in the 1755–1850 MHz band that is designated in the U.S. for Federal Government systems and on which the Department of Defense is critically dependent.

The World Radiocommunication Conference of 2000 (WRC–2000) did identify additional bands to those identified at WARC–92. These bands were 806–960 MHz, 1710–1885 MHz, and 2500–2690 MHz (total for WRC–2000 of519 MHz). The total of bands identified by the ITU at both WARC–92 and WRC–2000 is 749 MHz. The U.S. Federal band that falls within these ITU identified bands is the 1755–1850 MHz band (95 MHz total). Within the ITU and regional working bodies, most countries are indicating a preference to follow the initial 3G implementations in the WARC–92 bands with expansion in the WRC–2000 band of 2500–2690 MHz and not the U.S. Federal band of 1755–1850 MHz. Many of these same countries have existing second-generation cellular systems operating in the 1710–1885 MHz band.

U.S. forces do currently use the 1755–1850 MHz band both domestically and abroad. The use of the band abroad is possible due to several factors. DoD carefully works with foreign governments and their military to coordinate frequency usage for our systems, ensuring foreign spectrum users do not cause or suffer from interference from DoD systems. In addition, DoD negotiates host nation agreements with many countries across the globe to use this spectrum abroad. Finally, for certain systems in some locations we use spectrum other than 1755–1850 MHz—spectrum not available to DoD in the U.S..

Often, reaching understandings with host nations takes considerable time and requiring DoD to move out of its current spectrum assignments in this band would necessitate DoD to seek and negotiate new host nation agreements in a different

band, some of which might not be achievable. Retaining these bands for DoD use is the most effective and efficient manner to protect access to spectrum for our nation's warfighters.

Question 4. Do you believe this country has in place an efficient spectrum use plan? Why or why not?

Answer. Efficiency in spectrum use is a continuing challenge. Spectrum management continually needs to be adapted to meet changing needs and new technologies. Greater spectrum efficiency should be a goal common to all users of the radio spectrum and this is an area of continuing examination for both the FCC and NTIA. Moreover, there are justifiable variations in views regarding spectrum efficiency and system reliability. From a DoD perspective, efficient spectrum use takes on a very different meaning than it might to a commercial operator. A dropped call or message from an American soldier in the field, or a misguided instruction to a smart bomb, takes on implications well beyond those of the average dropped wireless call. While the DoD does and must operate its spectrum-based systems as efficiently as it can, it does so in circumstances where there is no margin for error. This requires us to plan for our spectrum use in a very different fashion than others might. To DoD, efficiency means 100% certainty and reliability of access; this is not the same standard used by commercial entities.

As manager of the Federal Government's use of the radio spectrum, NTIA continues to encourage Federal agencies to deploy the most spectrum-efficient technology to meet their missions. At the same time, efficiency is but one factor NTIA considers when making decisions involving the specialized and critical missions that many Federal agencies perform, including national security, law enforcement and public safety. Others include the economic costs and the degree to which the mission requirements can be met. New technologies, including software defined radios and dynamic frequency selection, hold great promise for significant future advances in spectrum utilization by the Federal Government, and ultimately through technology transfer, by the private sector. NTIA also advocates adoption by the FCC of policies that promote spectrum-efficient use by the private sector, including secondary markets and careful accommodation of ultra wide band systems.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. BYRON L. DORGAN TO STEVEN PRICE

Question 1. Does the Department of Defense believe that commercial satellites have an important role to play in meeting its communications needs? If so, what can be done to ensure that this important industry remains competitive and viable?

Answer. The Department historically looks at a variety of methods to satisfy long haul communication requirements and the commercial sector has been an integral part of such capabilities. We expect this trend to continue, if not accelerate, for the foreseeable future. Commercial satellite services should be valuable and useful complements to government-owned assets.

The military's current satellite assets are making a very real contribution to Operation Enduring Freedom. The scope and speed of joint operations would be impossible without MILSATCOM systems. But it is equally clear that the U.S. military cannot, and will not, rely solely on DoD space assets for its satellite communications. This means there will have to be an ongoing partnership with the U.S. commercial satellite industry in order to satisfy the demand for military bandwidth.

We all must be concerned about creating the proper conditions for a vibrant U.S. satellite industry.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ERNEST F. HOLLINGS TO STEVEN PRICE

Question 1. Last year, NTIA concluded that it would be difficult for DoD to share the entire 1710–1850 MHz band and NTIA is now focusing its efforts to address sharing in the 1710–1770 portion of the band. Would you both agree that the scaled-back plan means that there is less impact on specific DoD systems—compared to the original plan? (For example, three of the systems that operate in the 1710–1850 MHz band do not operate in the 1710–1770 MHz portion of the band.) So, in general terms, the specific DoD systems would be better accommodated by the October 2001 NTIA plan?

Answer. The DoD would agree that the most recent NTIA plan would have less of an impact on DoD systems compared to the original plan which considered the impacts that would result from loss of the entire 1710–1850 MHz band. The DoD

would also agree that, in general terms, specific DoD systems would be better accommodated by the October 2001 NTIA plan. Currently DoD is participating in the NTIA-FCC 3G viability assessment process within the 17 10–1770 MHz band. DoD has a vast number of permanent and temporary assignments in the 1755–1770 band alone. These include important systems used for satellite control, precisions guided munitions, tactical communications, tactical data links, air combat training and other uses. Further, it is one of the few places that DoD can look to when considering new mobile applications and weapons platforms. The unique propagation characteristics of the band is ideally suited for military use in that it enables small (therefore light-weight) antennas, supports low power transmissions for extended range and allows sufficient beam widths for simple, reliable link establishment and preservation.

Moreover, times and circumstances have changed since the original NTIA plan. Given the events of September 11 plus DoD's aggressive moves to a transformed, network centric military, DoD believes that over time it will need access to more, not less, spectrum in order to continue to meets its mission.

Question 2. It appears from DoD's testimony that DoD remains concerned about the potential reallocation of the 15 megahertz (between 1755–1770 MHz) from the DoD to commercial use. In broad terms, is this concern with a "net-loss" of DoD spectrum based on your expectation that the DoD will be seeking to implement additional wireless systems?

Answer. Current law provides that comparable spectrum must be identified in order to insure that there is no "net loss" of *capability* to DoD. DoD has always stated that it would analyze any comparable spectrum that could be used if required to move. DoD's concern in the 1755–1770 study is that no comparable spectrum has yet been identified and therefore the capability will be lost.

As I mentioned in my testimony, DoD is concerned about the specific systems that would be affected by the reallocation of 1755–1770. The major class of systems that would be affected is satellite telemetry, tracking and command systems which reside in this band. These systems allow operators to communicate with airborne satellites. As you know, airborne satellites are not re-tunable and very expensive to replace in advance of the end of their service life. Other systems that would be affected include Precision Guided Munitions and Tactical Radio Relay, which is a battlefield communications system.

Question 3. I also understand that DoD's concern is not just with the number of megahertz, but obtaining spectrum below 3 GHz. Are you concerned about this spectrum because the spectrum below 3 GHz has certain propagation characteristics such as penetrating foliage and buildings?

Answer. Yes, spectrum below 3GHz is highly valued for military operations given its unique technical characteristics that dovetail with DoD's need for reliable, all weather, ad hoc wireless communications that can afford our warfighters communications with the lowest probability of detection.

Current law provides that comparable spectrum must be identified in order to insure that there is no "net loss" of capability to DoD. This is necessary to meet the Department's operational requirements. DoD has always stated that it would analyze any proposed comparable spectrum that could be used if our systems are required to move. DoD's concern in the 1755–1770 study is that no comparable spectrum has yet been identified. Technical analysis would need to be done to determine if spectrum above 3 GHz could be "comparable spectrum" for spectrum below 3 GHz. It is true, however, that spectrum below 3 GHz does have unique propagation characteristics of the band is ideally suited for military use in that it enables small (therefore light-weight) antennas, supports low power transmissions for extended range and allows sufficient beam widths for simple, reliable link establishment and preservation.

The spectrum DoD uses for a particular system is carefully chosen based on the physical properties such as, propagation characteristics, power required, antenna sizes, etc. Different regions of the spectrum have different properties and DoD optimizes system design by choosing particular frequencies. None of DoD choices for frequencies are accidental; they are purposeful and carefully thought out. Moving particular functions from one frequency band to another may or may not be feasible based on the physical properties of the new spectrum and the engineering decisions and compromises that these properties compel.

Question 4. If DoD is able to share the 1710–1770 MHz band with 3G service, what would be the estimated cost of modifying or relocating DoD's operations in order to accommodate 3G service? How long would it take for DoD to modify or relocate its operations?

Answer. The key element in determining the cost to relocate DoD operations is the identification of replacement spectrum that meets operational requirements and that, as provided for in the National Defense Authorization Act, Fiscal Year 2000 (Pub. L. 106–65), has "comparable technical characteristics to restore essential military capability" ("comparable spectrum"). To date, replacement spectrum that could be considered comparable for all of the systems that would be relocate/modified has not been identified. Accordingly, any cost estimates provided prior to such identification are a guess. We note also that relocation may often mean the development of new systems. The normal development and acquisition cycle for DoD systems is 8 to 12 years depending upon the complexity of the system and what other DoD systems the replacement systems must interoperate with.

The costs associated with modifying or relocating operations from the 1755–1770 MHz band are likely to be on the order of the cost estimates provided for segmentation options of the 1755–1850 MHz band, which could reach several billion dollars. The timelines for relocating systems out of this band are also significantly longer than for the 1710–1755 MHz relocations with some systems requiring more than ten years to complete relocation.

Question 5. Does DoD share the 1710–1770 MHz band with wireless providers in other countries? If so could you identify the kind of wireless services and/or technologies and in which countries are these wireless services and/or technologies operating? If DoD does share the band internationally with other wireless providers, what techniques does the DoD employ in order to protect each of DoD's wireless operations (i.e. Satellite; Conventional Fixed Microwave; Tactical Radio Relay; and Precision Guided Munitions) and accommodate each of the non-DoD wireless services?

Answer. DoD does share the use of the 1710–1770 MHz band in some other countries with commercial wireless services. The primary commercial systems that operate in this band on a widespread basis are second-generation cellular telephone systems. Some countries, such as Japan have also employed this band for national purposes similar to the U.S.. The DoD is able to coexist in this band in other countries with second-generation cellular systems due to several factors. These include the fact that second generation cellular systems do not create sufficient energy levels to cause significant interference to DoD systems, DoD systems typically operate at training facilities that are remote from extensive cellular networks, and frequency coordination procedures are employed to avoid harmful interference between DoD systems and host country commercial systems. These coordination procedures have been painstakingly established over the years, and any alteration of spectrum use by DoD would necessitate a time-consuming and costly duplication of negotiations around the world to re-establish coordination agreements involving the new DoD bands.

In addition, DoD has been able to negotiate host nation arrangements to use this spectrum abroad and is confident that retaining these bands for DoD use is the most effective and efficient manner to protect access to spectrum for our nation's warfighters.

Question 6. There were seven basic categories of military systems that were being studied by NTIA, FCC and DoD in the entire 1710–1850 MHz band. Those systems are: Air Combat Training; Land Warrior; Combat Identification for the Dismounted Soldier; Satellite; Conventional Fixed Microwave; Tactical Radio Relay; and Precision Guided Munitions. However, NTIA and DoD are currently exploring the option of using the 1710–1770 MHz band for 3G service. I understand that three of these systems Air Combat Training; Land Warrior; and Combat Identification for the Dismounted Soldier do not use spectrum in the 1710–1770 bands. Is it correct to assume that since there is no overlap for these three systems, there is no potential for harmful interference from the 3G service operating in the 1710–1770 MHz band?

Answer. Unfortunately, these assumptions are not correct. The Air Combat Training systems air-to-ground air frequencies are above 1770 MHz, but the ground-to-ground links that transfer the aircraft data to and from the Master Station use frequencies below 1770 MHz. However, these ground links could be relocated to other federal frequency bands if necessary.

The Land Warrior system uses frequencies between 1772 MHz and 1822 MHz with a bandwidth of 20 MHz. This means that the lowest channel of Land Warrior uses spectrum from 1762 MHz to 1882 MHz, with a center frequency of 1772 MHz. The second channel also overlaps the 1755–1770 MHz band, so reallocation of the 1755–1770 MHz band would mean the loss of two of the 11 channels possible, or about 18 per cent of the system's capability.

The Combat Identification for the Dismounted Soldier system has been superceded by the Individual Combat Identification System (ICIDS). ICIDS operates

in the 1755–1850 MHz band. The reallocation of the 1755–1770 MHz band would mean the loss of 150 channels out of a possible 950 channels, or about 16 per cent of the system's capability.

The Land Warrior and the Combat Identification for the Dismounted Soldier systems do depend to some extent on operations within the 1755–1770 MHz band. The loss of access to this spectrum would constrain the operations of either system, possibly requiring a redesign to restore full system capabilities. No acceptable alternate bands were identified for the relocation of the Land Warrior or Combat Identification systems.

Question 7. Satellite systems are one of the seven major DoD systems in the 1710–1770 MHz band. To be specific, I understand that the satellite systems at issue is the Satellite Control Stations—the satellite up-link for Tracking Telemetry & Control (TT& C). These satellite stations operate between 1761–1842 MHz. So, under the current NTIA proposal, commercial carriers and DoD would use the 1761–1770 MHz band at the same time. I understand that under NTIA current proposal, the only commercial use permitted in the 1710–1770 MHz would be relatively low-powered cell phones and not the higher-powered cellular towers. Is that the case?

Answer. NTIA has not made a specific proposal regarding 3G accommodation. NTIA has examined several options for the accommodation of 3G services in the 17 10–1850 MHz band. All these options have been analyzed under the assumption that the mobile component of the 3G system (e.g., the low-powered, hand-held phone) would transmit in the lower part of the band, including 1710–1770 MHz, and the 3G base stations would transmit in the higher part of the band (above 2110 MHz).

Question 8. With respect to the operation of DoD satellite systems in the 1755–1770 MHz portion of the band, NTIA in its Final Report at October of 200l recognized the "the potential interference is within the range of prudent risk management." As a result, the commercial mobile systems operating at 1710–1770 MHz will have no adverse impact on the military satellite systems. However, there could be interference from the satellite systems into the commercial mobile systems. Is this correct? Given that NTIA has concluded that potential interference into DoD's satellite operations in the 1755–1770 MHz portion of the band is within range of prudent risk management, is it correct that commercial cell phones would not interfere with DoD satellite systems—but, that DoD satellite systems could interfere with commercial cell phones that might be near a satellite base station?

Answer. Assuming the cell phones are in 1755–1770 MHz as discussed above, that is what the analysis shows.

The major source of potential interference between the two systems would be from Federal ground-based satellite control stations into 3G base stations. These 3G base stations receive on the frequency on which the hand-held phones transmit. The high-power satellite control stations could cause interference up to 300 kilometers, in a worst-case situation. Terrain shielding between the base station and the satellite control station, and the fact that the satellite control station antennas move when tracking the satellites, serve to mitigate the interference.

Question 9. In this situation would commercial systems have the burden of not interfering with DoD satellite systems and are there mitigation techniques that can be used to protect DoD satellite operations?

Answer. New entrants into a frequency band generally have the burden of protecting the incumbent users. In this case, 3G operators would have to protect Department of Defense operations. Among other problems, the Department of Defense satellites have a wide view of the Earth and will receive signals from a large number of hand-held phones in the United States. Shielding is not an option since the phones must be in sight of a cell base station tower. Moreover, Department of Defense requirements will likely increase over time requiring greater protection and accommodation by 3G operators. The concern is how to address this issue if harmful interference is caused to Department of Defense satellites. Possible mitigation techniques would be to limit the number of mobile phones transmitting simultaneously on satellite channels, and by using smaller cell sizes so the power transmitted from the mobile phones would be lower.

Question 10. DoD's Fixed Microwave Systems operate throughout the 1710–1770 MHz band and would need to be moved to other spectrum before commercial systems could use the spectrum. I understand that the DoD in its February 2001 Report on the original NTIA spectrum plan indicated that alternative, comparable spectrum is available for the Fixed Microwave Systems:

"A significant amount of frequency spectrum is already allocated to the Government on an exclusive basis for Fixed Service operations in higher frequency ranges.

The 4400 to 4990 MHz and 7125 to 85 MHz bands are already employed by the DoD for fixed point-to-point microwave communications." DoD IMT 2000 Assessment, Appendix E, Page 9

Do you agree with the finding that there is comparable spectrum available for these systems?

Answer. The report cited in the question indicates that the 4400–4940 MHz band is NOT comparable spectrum to the 1710–1770 MHz band. Among other factors, the fact that fixed, point-to-point microwave systems operate in both bands does not imply that the bands are comparable. The 4400–4940 MHz band is characterized by a much more severe propagation environment in which to operate radio communication systems than the 1710–1770 MHz band. Some of these engineering challenges include, multi-path, ducting, fading, and atmospheric absorption. Substantial non-recurring engineering funds will be required to assess systems on a case-by-case basis as part of a frequency band transition. This factor was implicitly recognized during NTIA and FCC deliberations when commercial licensees in the 2500–2690 MHz band unanimously rejected both the 3600 MHz and 4940 MHz bands as spectrum into which they could move, because of technical characteristics and for other reasons.

In addition, it should be pointed out that almost all of these alternative bands are already used extensively and relocating systems to these bands may be impossible. A recent survey, conducted by the Range Commanders Council found there are no available assignments in the 4400–4940 MHz band for the Southwest United States—an area where many of the major DoD test centers such as White Sands Missile Range, Ft. Huachuca, and the Yuma Proving Grounds are located.

Question 11. If there is comparable spectrum available, what would DoD need in order to relocate these operations, what would be the cost to relocate these operations, and how much time would it take for such relocations?

Answer. Relocation cost and schedule are critically dependent on the band selected for relocation. Since the 4400–4940 MHz band has not been identified as comparable spectrum to the 1710–1770 MHz band and since no other spectrum has been so identified, no accurate cost estimates exist.

However, if comparable spectrum were identified each existing fixed point-to-point microwave link would have to be addressed individually. Assuming no additional constraints, such as environmental impacts, which is a very aggressive assumption, it is anticipated that it will require at least 2–4 years to change the operating frequency of each of the fixed microwave point-to-point systems operating in the 1710–1770 MHz band. Additional non-recurring engineering funds will be required if these systems are operated in other than nearby frequency bands.

Question 12. Is it true that many of these systems are in very remote areas of our nation, which might facilitate a phased approach to re-location?

Answer. The draft report cited in the question indicates that a high-powered weapons control system now operates in the 4400–4940 MHz band, and successful relocation of fixed microwave systems from the 1710–1770 MHz band into the 4400–4940 MHz band is problematic. The 1710–1770 MHz band systems and the high-powered weapons control systems operate in the SAME areas of the country, so remoteness of operations is not a consideration. Some of the ranges such as White Sands Missile Range, Utah Test and Training Range, and the DOE Nevada Test Site are located in what were once considered very remote areas. The increasing population of the Southwestern United States has caused population centers to be established in locations ever closer to the borders of decades old DoD test ranges. Unfortunately, their location does not make them immune from interference that may result from the lack of available frequency guard bands or adequate transmitter power control.

As a prime example, in the mid 1980's the DoD built a system to be used at Ft. Erwin, CA, an extremely remote location at the time, that operates in the 800 MHz band. The proliferation of cellular telephone service in that frequency band and increased vehicular traffic in this area has resulted in severe limitations and restrictions on the use of this system that continues to affect testing and training at this range.

The important consideration is that all systems now operate in close physical proximity and would operate over the same frequencies if the reallocation were accomplished. An analysis tool named "Spectrum XXI" was utilized to identify the potential for relocating the 1710–1770 MHz band systems into the 4400–4940 MHz band. Parameters contained in a frequency assignment database are utilized by this tool to produce preliminary estimates of the spectrum potentially available to a system. The tool does not consider system operational characteristics or detailed performance characteristics, and databases do not always contain classified systems.

Additional analysis must be accomplished to include these effects. After further consideration, the final version of the draft report (to be published late June or early July) cited in the question removes all references to relocating systems into the 4400–4940 MHz band.

Question 13. Another of the seven DoD systems in the 1710–1770 MHz band is referred to as "Tactical Radio Relay" wireless communications system that can be set up for a battlefield to provide vital communications. I understand that these radios can be "tuned" to different spectrum frequencies—allowing them to be used throughout the 1710–1850 MHz band. In other words, the DoD could use these radios in spectrum between 1770 and 1850 MHz, without interfering with commercial use in 1710–1770 MHz (as contemplated by the October 2001 NTIA plan). Is this correct? If it is correct, what would be the cost of retuning these radios and how long would it take to retune the radios?

Answer. The reduction of available spectrum from 1710–1850 MHz to 1770–1850 MHz will be particularly detrimental to the operations of the Marine Corps and Navy Digital Wideband Transmission System (DWTS) which are Tactical Radio Communication systems. Due to interference from other systems, the operations of the Navy and Marine Corps DWTS are generally restricted to 1710–1850 MHz. Reducing the available spectrum to 1770–1850 MHz would severely impact training exercises using these mission critical radios since the same radio transmit/receiver frequency separation (minimum 63 MHz frequency separation between its transmit and receive frequencies) for co-site situations can be as great as 25 MHz. The Marine Corps routinely co-locates multiple radios in all large-scale exercises and training scenarios which are conducted frequently. A single node terminating just two links may require slightly more than 88 MHz of spectrum, so therefore, limiting our use to the 1770–1850 MHz (aggregate of 80 MHz) band cannot accommodate our communication requirements.

Question 14. DoD uses spectrum in the 1710–1770 MHz band, at least in part, for Precision Guided Munitions. Here in the U.S., training with Precision Guided Munitions relies on spectrum in this band. I understand that the DoD has deployed these systems not only here in the U.S., but in many locations around the world—including areas of Europe. In Europe, I understand that there is already extensive use of the 1710–1770 MHz band for commercial wireless operations.

What can you tell us about how the DoD handles the potential for interference into precision guided munitions operations overseas? If DoD's precision guided munitions system affected by wireless systems in other countries can work around European commercial traffic—can DoD do the same here in the U.S.?

Answer. To the best of our knowledge Air Force and Navy units in Europe have not reported any interference problems from wireless systems. In addition, Air Force units in Europe report that they do not employ any specific or general interference work-arounds.

The U.S. European Command has negotiated frequency usage agreements through NATO and bilateral agreements for frequency use in each European nation. DoD PGM use in peacetime in Europe is limited to training scenarios but that training is significantly limited to prevent interference to the wireless systems. The overwhelming majority of proficiency training and exercise missions—for both U.S. and Allied forces—occur here in the U.S. because of the access to the air ranges and the frequency band, so the potential for interference from wireless systems here in the U.S. to affect our armed forces is much greater here than overseas. Also, live firing of PGMs, essential to U.S. and Allied combat crew performance, is only done in the U.S.

Question 15. If DoD's Precision Guided Munitions could be interfered with by commercial cell phones—is this a potential vulnerability overseas?

Answer. PGM data link system vulnerabilities are classified and can be made available where appropriate. However, one should note that the same potential vulnerabilities would apply, regardless of where the PGM data links are employed. Additionally, the National Telecommunications and Information Administration (NTIA) study released to the public described generalized training impacts to PGMs.

Question 16. I also want to understand the specific nature of potential interference issues. Is it the case that commercial cell phones would interfere with Precision Guided Munitions? Or is it that Precision Guided Munitions might interfere with commercial cellphones? Does DoD 's systems or the commercial wireless systems bear the burden of not interfering?

Answer. The PGMs currently in question (AGM–130 and E/GBU–15) use two simultaneous frequencies for command and video transmission respectively. Without delving into system specifics, we can say that one channel is susceptible to interference and the other is likely to cause interference. In most cases PGM data link

systems would overpower commercial systems. The burden in the United States for not interfering depends upon the details of how the spectrum is allocated. For example, if the 1755—1850 MHz band remains allocated on an exclusive basis to the Federal Government, then the question is moot. If the U.S. reallocates the spectrum to the nonfederal sector on an exclusive basis, then any Federal use would be on—at best—a noninterference basis to any civil systems.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO STEVEN PRICE

Question 1. If DoD is required to share or vacate some portion of the 1710–1770 MHz band so that it can be used for third generation wireless service, to what spectrum would DoD be able to relocate? How much would such a move cost DoD?

Answer. Current law provides that comparable spectrum must be identified in order to insure that there is no "net loss" of *capability* to DoD. DoD has always stated that it would analyze any comparable spectrum that could be used if required to move. To this date no comparable spectrum has been identified by NTIA to which DoD could move. Without knowledge of to what band DoD might be asked to move it is not possible to provide a cost estimate for moving.

Question 2. The President's FY2003 Budget calls for a new process, a "Spectrum Relocation Fund, "for reimbursing government users for costs incurred when they are required to relocate to different spectrum blocks.

"The Administration will propose legislation to streamline the current process for reimbursing Federal agencies that must relocate from Federal spectrum which has been reallocated for auction to commercial users. Under current law, winning bidders must negotiate with Federal entities upon the close of an auction and reimburse the agencies directly for their relocation costs. The Administration, proposes to streamline this process by creating a central spectrum relocation fund. Auction receipts sufficient to cover agencies' relocation costs would be paid into the fund, and Federal agencies would be reimbursed for their relocation costs out of the fund." Budget of the U.S. Government, Fiscal Year 2003, Appendix, Page 241.

The Administration has not yet submitted language to Congress.

Do you have any specific concerns about how such a Fund to reimburse government users for relocation costs might work?

Answer. We are working closely with the Office of Management and Budget, the National Telecommunications and Information Administration and other interested federal agencies put forward an Administration proposal that streamlines the reimbursement process in a manner that both benefits successful auction bidders and incumbent spectrum users that are required to relocate and ensures the continued, seamless operational transition of federal systems to new spectrum. The principal of cost reimbursement should be to fully reimburse the incumbent for all actual costs—direct and indirect—associated with moving to new spectrum. The reimbursement should include all costs, including for example training and testing of new systems and the cost of calculating all the expenses required in such a move. We believe that any proposal must provide both additional certainty as to reimbursement costs to successful bidders and assurance that relocating federal government incumbents are made whole (in terms of costs of relocation and maintaining operational capacities). We also believe it is vital to ensure that federal system operators have first priority in reimbursement from the fund, before additional monies are diverted for other public policy needs.

Question 3. Do you believe that the proposal to use auction proceeds to reimburse government users as outlined in President Bush's budget would make the spectrum management process more effective and more efficient?

Answer. Use of auction proceeds to reimburse federal government users in itself does not make the spectrum management process more effective or more efficient. Rather, spectrum is a national asset that must be used to, among other purposes, carry out national security, public safety, law enforcement and other critical public services. Cost reimbursement can help to ensure that changes in federal spectrum allocations do not adversely impact these critical public services and that the broad based costs of changing spectrum uses are appropriately taken into account when such decisions are made. However, we should resist the temptation to view a reimbursement trust fund as a panacea for dealing with complex spectrum policy issues, which include maintaining sufficient spectrum access for critical public services and national security. Indeed, any mechanism which appears to make relocation easier, but which does not address key issues of comparable spectrum and preventing the loss of critical government capabilities may, in fact, harm the national interest.

Question 4. There is some discussion that the Relocation Fund could be established as a trust fund. However, monies in Trust Funds are sometimes used for other budgetary purposes. How can legislators ensure that monies will be available for government users to address their relocation costs since in some instances it could take years for government a user to complete its relocation?

Answer. We look forward to working with the Congress and with the Office of Management and Budget and other parts of the Executive branch to craft legislation and appropriate Executive branch implementation procedures that ensure that federal government entities are provided with all funds necessary to successfully relocate when spectrum is to be made available through auction to commercial users. As the question implies, it is DoD's view that a trust fund should be trustworthy (i.e. a fund that the incumbent spectrum user can rely on for full reimbursement of all costs associated with relocation). Government users should have top priority to receive sufficient funding to ensure their successful relocation without the loss of crucial national security and public safety capabilities.

Question 5. Do you have any concerns about coordinating a U.S. position for the World Radio Conference? What can be done to address these concerns?

Answer. As with U.S. preparation for past WRC and WARC conferences, there is a role for all stakeholders in the spectrum allocation process, including government agencies that rely on spectrum resources, as well as the U.S. telecommunications industry, which also relies on the WRC process, in part, for its growth and profitability. In an era in which the demand for spectrum is extremely high, all stakeholders must realize that the U.S. position going into a WRC will be based upon the needs and views of government and commercial users alike. As in the past, the current WRC preparation process is proceeding upon this basic understanding, which is the foundation for any consistent approach to developing a national position. We are confident that the country will be well represented by its delegation to the next WRC, and look forward to continuing to work with the State Department, the NTIA, the FCC and our colleagues in the U.S. telecommunications industry to make sure that diverse and important U.S. interests are wellserved.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MAX CLELAND TO NANCY J. VICTORY

Question 1. Do you believe there currently exists a non-partisan person or group who can objectively review spectrum recommendations and uses? If not, do you believe such a person or group would be helpful?

Answer. Both the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA) are charged with managing the nation's radio spectrum resources in the public interest and perform their respective responsibilities in a cooperative manner to ensure that the spectrum is used for its highest and best purpose whether by the Federal agencies or private sector users. The NTIA Organization Act (47 U.S.C. § 901(c)(4)) specifically charges NTIA with fostering full and efficient use of telecommunications resources, including effective use of the radio spectrum by the Federal Government, in a manner that encourages the most beneficial use of such resources in the public interest. In performing its spectrum management responsibilities on the President's behalf, NTIA is always mindful that the spectrum policy decisions it makes must be consistent with both the national security and economic security of the nation and understands the importance of balancing both commercial and Government perspectives for better policy outcomes.

Since most use of the radio spectrum is shared between Government and non-government users, NTIA and the FCC work together to ensure that the needs of all constituents are met. I do not believe that an outside entity capable of reviewing these decisions currently exists or that the addition of one to the spectrum management process would result in better or more timely decisions.

Question 2. Do you believe this country has in place an efficient spectrum use plan? Why or why not?

Answer. Efficiency in spectrum use is a continuing challenge. Spectrum management continually needs to be adapted to meet changing needs and new technologies. Greater spectrum efficiency should be a goal common to all users of the radio spectrum and this is an area of continuing examination for both the FCC and NTIA. As manager of the Federal Government's use of the radio spectrum, NTIA continues to encourage Federal agencies to deploy the most spectrum-efficient technology to meet their missions. At the same time, efficiency is but one factor NTIA considers when making decisions involving the specialized and critical missions that many Federal agencies perform, including national security, law enforcement and public

safety. Others include the economic costs and the degree to which the mission requirements can be met. New technologies, including software defined radios and dynamic frequency selection, hold great promise for significant future advances in spectrum utilization by the Federal Government, and ultimately through technology transfer, by the private sector. NTIA also advocates adoption by the FCC of policies that promote spectrum-efficient use by the private sector, including secondary markets and accommodation of ultrawideband systems.

Question 3. How long do you think it would take to do a comprehensive examination of our domestic spectrum plan?

Answer. The National Table of Allocations, which represents the United States's spectrum plan, is comprised of over 40 radio services spread out over 900 frequency bands. A comprehensive re-examination of all of these services and bands would be a time-consuming and resource-intensive undertaking. This task would be complicated by the fact that a number of our domestic spectrum allocations are the subject of international agreement and harmonization (e.g., frequencies used internationally for commercial aviation and space communication). Moreover, the rapid advances of technology often completely change the relative requirements of the services studied during the course of their study.

The FCC and NTIA, therefore, currently conduct examinations of those services and bands as circumstances dictate, usually in areas of congestion or where growth is expected, or to accommodate a new technology or service. NTIA has examined various aspects of the Federal Government's ability to meet its spectrum requirements, including the use of radars, land mobile radio, and fixed microwave systems. These studies generally focus on the identification of current or foreseeable problems (such as congestion), future spectrum demands for these services, and spectrum efficiency policy initiatives.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. ERNEST F. HOLLINGS TO NANCY J. VICTORY

Question 1. Last year, NTIA concluded that it would be difficult for DoD to share the entire 1710–1850 MHz band and is now focusing its efforts to address sharing in the 1710–1770 portion of the band. Would you both agree that the scaled-back plan means that there is less of an impact on specific DoD systems—compared to the original plan? (For example, three of the systems that operate in the 1710–1850 MHz band do not operate in the 1710–1770 MHz portion of the band.) So, in general terms, the specific DoD systems would be better accommodated by the October 2001 NTIA plan?

Answer. I would agree that the current focus on the 1710–1770 MHz portion of the 1710–1850 MHz band for accommodation of third generation (3G) mobile systems is, in part, due to a recognition of the greater impact on certain Department of Defense systems if the entire band had remained under consideration. An interagency working group led by NTIA and the FCC is currently completing a viability assessment of the 1710–1770 MHz portion of the band for 3G use in the United States, which, upon completion, will provide a clearer picture of the impact on the Department of Defense.

Question 2. What if any spectrum below 3 GHz that can be made available for DoD systems if it is determined that DoD must share the 1710–1770 MHz band with commercial users, and as a result, DoD will need additional spectrum?

Answer. NTIA has not yet identified any band of spectrum below 3 GHz to accommodate Department of Defense systems if they must be relocated from 1710–1770 MHz band. Current efforts are focused on ways in which the band can be shared without such relocation to other spectrum bands. This viability assessment will be completed shortly.

Question 3. What can be done to improve the U.S. preparatory process for reaching consensus and naming a U.S. delegation with respect to the World Radio Conference? What can the NTIA do to improve its participation in this process?

Answer. The keys to the United States' success at any World Radio Conference (WRC) are coordinated efforts by U.S. Government and industry stakeholders in the early formulation of U.S. positions and unified and consistent advocacy of those positions in the months preceding the conference in both governmental and industry fora. WRCs occur on a three-year cycle. In recognition of the increasing complexity and importance of the issues addressed in these conferences, the U.S. Government has initiated the preparatory process much earlier in the cycle to give the United States the ability to formulate its positions and to obtain domestic consensus. For example, preparations started for WRC 2003 almost immediately after the close of

the last conference, and most of the U.S. proposals have been completed—nearly a year early. The United States can now actively begin to promote U.S. positions in bilateral meetings and regional fora. These regional fora have become important venues in which the United States has been able to persuade neighboring countries of our common interests, garner support for U.S. proposals, and build strong coalitions.

NTIA is an active participant in all areas of WRC preparation, focusing principally on those issues on which NTIA has particular expertise. To promote the improved spectrum management process for this country, including WRC preparations, NTIA, the FCC and the Department of State, have established a "One Team" spectrum management approach. Specifically, we have taken the steps to improve our interagency communications and to coordinate our international outreach efforts.

Question 4. What do you consider the critical items for the US Government to support on behalf of US commercial industry at WRC–03 and why?

Answer. NTIA will support all U.S. proposals to WRC–2003 as key members of the U.S. delegation. There are a number of issues that appear to be particularly important to certain segments of the U.S. industry, including, but not limited to, identification of frequency bands within the fixed satellite service to permit the ubiquitous deployment of future high density satellite earth stations; authorization of satellite communications within the 14 GHz band to permit Internet connectivity aboard commercial aircraft; the resolution of certain issues affecting the Global Positioning System (GPS); and accommodation of radio local area networks in the 5 GHz band.

Question 5. What are you and your colleagues in Government doing to ensure U.S. commercial interests are advanced at WRC–03?

Answer. Government members of the U.S. delegation, including NTIA representatives, actively advocate U.S. positions at the WRC, including those of particular interest to U.S. commercial stakeholders. This advocacy includes garnering support for these positions in all bilateral meetings and regional fora in the months leading up to the WRC. It also includes advancing these positions through the Committee meetings and plenary sessions of the conferences themselves.

Question 6. GAO noted that some federal agencies were unable to complete the required spectrum management reviews because of staffing and resource shortages. How serious is this staffing problem at NTIA and other federal agencies? What can Congress do to address this issue?

Answer. NTIA can verify that several Federal agencies have not completed five-year reviews of their frequency assignments; however, we cannot independently verify whether Federal agencies with whom GAO spoke have experienced staffing or resource shortages that have prevented them from conducting these reviews. With respect to additional spectrum management resources for NTIA, the President's Budget for Fiscal Year 2003 contains an initiative that would provide funding to permit NTIA to review and improve its overall performance of spectrum management duties.

Question 7. I understand that spectrum below 3 GHz is congested in part because it has certain characteristics that are useful in a mobile environment. Are there any incentives that Congress should be contemplating that would encourage the development of technology that makes better use of spectrum above 3 GHz and more efficient use of spectrum below 3 GHz?

Answer. The spectrum below 3 GHz does have favorable propagation characteristics for a variety of commercial, private sector and governmental uses. One of our top priorities at NTIA is to work with the FCC to examine policies to alleviate the current congestion below 3 GHz. Over 93 percent of all FCC licenses and Federal Government frequency assignments are in the 0 to 3 GHz range. Among other things, spectrum managers should be examining ways to encourage migration to higher frequency bands as the technology permits. Such policies should include clear incentives for relocation to higher bands, where possible.

In 1998, Congress enacted such a tool to permit Federal agencies to be reimbursed by the private sector for the costs associated with relocating from certain frequencies bands below 3 GHz, as well as any future reallocation of spectrum from the Federal Government to private sector users. Working with the FCC and the Federal agencies, NTIA has finalized these rules, which were published in the Federal Register on June 17, 2002. Moreover, the President's Budget for Fiscal Year 2003 contained a legislative proposal to streamline this reimbursement process by creating a fund from spectrum auction proceeds to reimburse the affected Federal agencies. The Department of Commerce expects to transmit this proposal to Congress this summer.

The President has also proposed broadening and making permanent the research and experimentation (R&E) tax credit. The R&E tax credit could encourage private sector investment in research on advanced technologies that would provide greater spectrum efficiency or allow all spectrum users to utilize frequencies in the higher, less congested spectrum bands.

Question 8. If DoD is able to share the 1710–1770 MHz band with 3G service, what would be the estimated cost of modifying or relocating DoD's operations in order to accommodate 3G service? How long would it take for DoD to modify or relocate its operations?

Answer. There is no current estimate of the modification or relocation costs for Department of Defense systems if they shared the 1710–1770 MHz band with 3G mobile systems. NTIA, in coordination with the Department of Defense and industry, is analyzing the sharing potential with Department of Defense systems that operate in the band. The costs for such sharing could vary depending on which systems would have to be modified or relocated and the spectrum to which such systems would be relocated.

The time required for modifying or relocating Department of Defense systems depends on the specific systems that must be moved or modified. Earlier 3G studies estimated that any satellite system relocations would take the longest time, since satellites would operate until their end-of-life or as late as 2017. The estimates indicated that conventional fixed systems can be moved within two to four years and other systems within two to five years.

Question 9. There were seven basic categories of military systems that were being studied by NTIA, FCC and DoD in the entire 1710–1850 MHz band. Those systems are: Air Combat Training; Land Warrior; Combat Identification for the Dismounted Soldier; Satellite; Conventional Fixed Microwave; Tactical Radio Relay; and Precision Guided Munitions. However, NTIA and DoD are currently exploring the option of using the 1710–1770 MHz band for 3G service.

I understand that three of these systems Air Combat Training; Land Warrior; and Combat Identification for the Dismounted Soldier do not use spectrum in the 171 0–1770 bands. Is it correct to assume that since there is no overlap for these three systems, there is no potential for harmful interference into these systems from the 3G service operating in the 1710–1770 MHz band?

Answer. Unfortunately, these assumptions are not correct. The Air Combat Training systems air-to-ground air frequencies are above 1770 MHz, but the ground-to-ground links that transfer the aircraft data to and from the Master Station use frequencies below 1770 MHz. However, these ground links could be relocated to other federal frequency bands if necessary.

The Land Warrior system uses frequencies between 1772 MHz and 1822 MHz with a bandwidth of 20 MHz. This means that the lowest channel of Land Warrior uses spectrum from 1762 MHz to 1782 MHz, with a center frequency of 1772 MHz. The second channel also overlaps the 1755–1770 MHz band, so reallocation of the 1755–1770 MHz band would mean the loss of two of the 11 channels possible, or about 18 per cent of the system's capability.

The Combat Identification for the Dismounted Soldier system has been superceded by the Individual Combat Identification System (ICIDS). ICIDS operates in the 1755–1850 MHz band. The reallocation of the 1755–1770 MHz band would mean the loss of 150 channels out of a possible 950 channels, or about 16 per cent of the system's capability.

Question 10. Satellite systems are one of the seven major DoD systems in the 1710–1770 MHz band. To be specific, I understand that the satellite systems at issue is the Satellite Control Stations—the satellite up-link for Tracking Telemetry & Control (TT&C). These satellite stations operate between 1761–1842 MHz. So, under the current NTIA proposal, commercial carriers and DoD would use the 1761–1770 MHz band at the same time.

I understand that under NTIA's current proposal, the only commercial use permitted in the 171 0–1770 MHz would be relatively low-powered cell phones and not the higher-powered cellular towers. Is that the case?

Answer. NTIA has not made a specific proposal regarding 3G accommodation. NTIA has examined several options for the accommodation of 3 G services in the 1710–1850 MHz band. All these options have been analyzed under the assumption that the mobile component of the 3G system (e.g., the low-powered, hand-held phone) would transmit in the lower part of the band, including 1710–1770 MHz, and the 3G base stations would transmit in the higher part of the band (above 2110MHz).

Question 11. With respect to the operation of DoD satellite systems in the 1755–1770 MHz portion of the band, NTIA in its Final Report at October of 2001 recog-

nized the ". . . the potential interference is within the range of prudent risk management." As a result, the commercial mobile systems operating at 1710–1 770 MHz will have no adverse impact on the military satellite systems. However, there could be interference from the satellite systems into the commercial mobile systems.

Is this correct? Given that NTIA has concluded that potential interference into DoD's satellite operations in the 1755–1770 MHz portion of the band is within range of prudent risk management, is it correct that commercial cell phones would not interfere with DoD satellite systems—but, that DoD satellite systems could interfere with commercial cell phones that might be near a satellite base station?

Answer. The conclusion that interference would be "within the range of prudent risk management" does not mean that NTIA has concluded that there would be no interference to Department of Defense satellites. It means that NTIA believes that the interference could be managed to an acceptable level, though NTIA is not an expert source on Department of Defense mission analysis. Since the release of NTIA's March 2001 report, industry has increased its estimate of the number of hand-held phones that may be operating. In this regard, potential interference to Department of Defense satellites may need to be re-analyzed using new data.

The major source of potential interference between the two systems would be from Federal ground-based satellite control stations into 3G base stations. These 3G base stations receive on the frequency on which the hand-held phones transmit. The high-power satellite control stations could cause interference up to 300 kilometers, in a worst-case situation. Terrain shielding between the base station and the satellite control station, and the fact that the satellite control station antennas move when tracking the satellites, serve to mitigate the interference.

Question 12. In this situation would commercial systems have the burden of not interfering with DoD satellite systems and are there mitigation techniques that can be used to protect DoD satellite operations?

Answer. New entrants into a frequency band generally have the burden of protecting the incumbent users. In this case, 3G operators would have to protect Department of Defense operations. Among other problems, the Department of Defense satellites have a wide view of the Earth and will receive signals from a large number of hand-held phones in the United States. Shielding is not an option since the phones must be in sight of a cell base station tower. Moreover, Department of Defense requirements will likely increase over time requiring greater protection and accommodation by 3G operators. The concern is how to address this issue if harmful interference is caused to Department of Defense satellites. Possible mitigation techniques would be to limit the number of mobile phones transmitting simultaneously on satellite channels, and by using smaller cell sizes so the power transmitted from the mobile phones would be lower.

Question 13. DoD's *Fixed Microwave Systems* operate throughout the 1710–1770 MHz band and would need to be moved to other spectrum before commercial systems could use the spectrum. I understand that the DoD in its February 2001 Report on the original NTIA spectrum plan indicated that alternative, comparable spectrum is available for the Fixed Microwave Systems:

"A significant amount of frequency spectrum is already allocated to the Government on an exclusive basis for Fixed Service operations in higher frequency ranges. The 4400 to 4990 MHz and 7125 to 85 MHz bands are already employed by the DoD for fixed point-to-point microwave communications." DoD IMT 2000 Assessment, Appendix E, Page 9

Do you agree with the finding that there is comparable spectrum available for these systems?

Answer. NTIA agrees that there is alternative spectrum available to relocate the Government's conventional fixed microwave systems now located in the 1710–1770 MHz band, including Department of Defense links. As the Department of Defense notes in its IMT 2000 Assessment, it already operates fixed point-to-point microwave systems in other Government exclusive bands.

Question 14. If there is comparable spectrum available, what would DoD need in order to relocate these operations, what would be the cost to relocate these operations, and how much time would it take for such relocations?

Answer. Like all Federal agencies that would be required to relocate fixed microwave operations from the band, the Department of Defense would need adequate resources to cover the costs of such relocation. Implementing current law, NTIA recently issued rules that would require new licensees to compensate federal agencies that relocate their operations to make frequency spectrum available for commercial use. See 67 Fed. Reg. 41182 (June 17, 2002). The President's Budget for Fiscal Year 2003 contained a legislative proposal to streamline this reimbursement process by

creating a fund from spectrum auction proceeds to reimburse the affected Federal agencies.

NTIA has estimated that the average cost of relocating a conventional fixed microwave system would be approximately $350,000 per frequency assignment. The Department of Defense currently has 289 such for a total of approximately $101 million in relocation costs. The time for relocation, from reimbursement, is estimated to be from two to four years.

Question 15. Is it true that many of these systems are in very remote areas of our nation, which might facilitate a phased approach to re-location?

Answer. For Department of Defense systems, many of the fixed links are in rural or remote areas. There may be merit to a priority list of links to be relocated, but the interdependence of links within a system must be established before any phased approach is planned. The integrity of systems must be maintained at all times.

Question 16. Another of the seven DoD systems is referred to as "*Tactical Radio Relay*" wireless communications system that can be set up for a battlefield to provide vital communications. I understand that these radios can be "tuned" to different spectrum frequencies—allowing them to be used throughout the 1710–1850 MHz band. In other words, the DoD could use these radios in spectrum between 1770 and 1850 MHz, without interfering with commercial use in 1710–1770 MHz (as contemplated by the October 2001 NTIA plan). Is this correct? If it is correct, what would be the cost of retuning these radios and how long would it take to retune the radios?

Answer. The Tactical Radio Relay system (TRR) tunes from 1350 MHz to 1850 MHz in 125 kHz steps. TRRs could technically be retuned to avoid channels between 1710 MHz and 1770 MHz. However, this would reduce the number of available channels by approximately 500 channels and could affect the usefulness of the TRR system for military training operations.

Question 17. DoD uses spectrum in the 171 0–1770 MHz band, at least in part, for Precision Guided Munitions. Here in the U.S., training with Precision Guided Munitions relies on spectrum in this band. I understand that the DoD has deployed these systems not only here in the U.S., but in many locations around the world—including areas of Europe. In Europe, I understand that there is already extensive use of the 1710–1770 MHz band for commercial wireless operations.

What can you tell us about how the DoD handles the potential for interference into precision guided munitions operations overseas? If DoD's precision guided munitions system affected by wireless systems in other countries can work around European commercial traffic—can DoD do the same here in the U.S.?

Answer. NTIA is not qualified to completely answer questions on this subject, and much of the technical and operational information regarding Precision Guided Munitions (PGMs) is classified. It is our understanding that PGM training is conducted primarily in the United States. Air units deployed overseas using PGMs use them operationally. PGMs have been used in the Persian Gulf war, in the Balkans, and in Afghanistan. In an operational situation, some interference can be expected, and could reduce the efficiency of the munition.

Question 18. If DoD's Precision Guided Munitions could be interfered with by commercial cell phones—is this a potential vulnerability overseas?

Answer. NTIA is not qualified to answer questions related to Department of Defense weapons vulnerability.

Question 19. I also want to understand the specific nature of potential interference issues. Is it the case that commercial cell phones would interfere with Precision Guided Munitions? Or is it that Precision Guided Munitions might interfere with commercial cell phones? Is it DoD systems or the commercial wireless systems that bear the burden or not interfering?

Answer. As I understand it, there is a slight potential for 3G mobile hand-held phones to interfere with PGMs, but the main interference problems would arise from PGMs into receiving 3G base stations. Commercial operators would have to accept any harmful interference to their operation of 3G systems caused by Department of Defense operations of PGMs in the authorized protected sites and would also be required to protect such Department of Defense operations from interference.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. DANIEL K. INOUYE TO NANCY J. VICTORY

Question 1. What can be done to improve the current coordination process between the FCC and NTIA and more effectively allocate spectrum and better balance the needs of commercial and government users?

Answer. In early April, NTIA and the FCC co-hosted a Spectrum Summit to focus on these issues. At the Summit, we elicited the views of expert panelists from industry, government, and academia on the spectrum management process and how it can be improved to serve all stakeholders and users. Among the major problems identified were: gaps in governmental coordination between NTIA, the FCC, and the State Department; the length and complexity of the allocation process; inefficient uses of spectrum and the absence of efficiency-stimulating incentives; challenges making "room" or "homes" for new services and technologies; and lack of clarity about spectrum rights and the federal spectrum management process.

The U.S. Government agencies involved in spectrum management must work together collaboratively as "One Spectrum Team" to serve our Nation's collective interests. FCC Chairman Michael Powell and I have established a "One Team" spectrum management approach where we will be meeting on a regular basis to discuss various spectrum issues including spectrum planning. This approach is an effort to improve our interagency communications and to take a more forward-looking approach to accommodate advances in technology. These improvements will enable our agencies to be more "proactive" and "predictive" in spectrum management.

The FCC has created a special Task Force on spectrum management and one of the major themes of the effort is spectrum efficiency. NTIA plans to support the FCC's Task Force and work closely with the FCC to address the issues of efficiency. NTIA also plans to meet with the FCC to see what improvements can be made in the coordination of various rule-makings, the assignment/licensing process, the preparation to radio conferences, and long range planning. Finally, the President's Budget for Fiscal Year 2003 contained an initiative to review the entire spectrum management process and implement such reforms that would make the spectrum management processes more effective and the use of spectrum more efficient.

Question 2. The FCC is examining whether the 2110–2170 MHz band can be used for third generation wireless service. Do you know of any difficulties that may exist in allowing 3G providers to use in this band?

Answer. There are over 6,900 licenses in the 2110–2170 MHz band, including common carrier, radiotelephone, local television transmission, and paging services. The FCC has indicated that these stations will need to be relocated into other spectrum. The National Aeronautics and Space Administration (NASA) also operates a deep-space facility at Goldstone, California that transmits high power signals to space probes in the 2110–2120 MHz portion of the band. Interference to hand-held mobile 3G phones is possible within approximately 200 km of the NASA facility.

Question 3. If DoD is required to share or vacate some portion of the 1710–1770 MHz band so that it can be used for third generation wireless service, to what spectrum would DoD be able to relocate? How much would such a move cost DoD?

Answer. If Department of Defense systems are able to share the band with 3G systems, the cost to the Department of Defense should be minimal and relocation would be unnecessary. However, if the Department of Defense systems cannot share with 3G systems and must be relocated to other spectrum, NTIA has not yet identified such spectrum. For the most part, conventional fixed systems could be relocated to alternate federal spectrum, but spectrum has not yet been identified for systems such as tactical radio relay, air combat training systems, precision guided munitions, satellite control stations, Land Warrior, and the Individual Combat Identification System. Pending the identification of such spectrum, NTIA cannot provide cost estimates. The costs of designing and implementing new systems have many factors, one of which is the operating frequency that affects the costs of components, the power required to achieve the required range, and the antenna size.

Question 4. The President's FY 2003 Budget calls for a new process, a "Spectrum Relocation Fund," for reimbursing government users for costs incurred when they are required to relocate to different spectrum blocks.

"The Administration will propose legislation to streamline the current process for reimbursing Federal agencies that must relocate from Federal spectrum which has been reallocated for auction to commercial users. Under current law, winning bidders must negotiate with Federal entities upon the close of an auction and reimburse the agencies directly for their relocation costs. The Administration proposes to streamline this process by creating a central spectrum relocation fund. Auction receipts sufficient to cover agencies' relocation costs would be paid into the fund, and Federal agencies would be reimbursed for their relocation costs out of the fund." Budget of the U.S. Government, Fiscal Year 2003, Appendix, Page 241.

The Administration has not yet submitted language to Congress.

How would such a Fund be structured? Do you have any concerns about how such a Fund to reimburse government users for relocation costs might be structured?

Answer. Under current law, Federal agencies that must relocate their radio communications operations from certain bands of Government spectrum that have been reallocated to private sector uses are entitled to reimbursement from the private sector entities that obtain licenses to use the spectrum through an FCC auction. Each FCC licensee is required to negotiate with each affected Federal agency in their new license area upon the close of an auction and pay the agencies directly for their relocation costs. Current law, however, provides that such payments are subject to further authorization or appropriations, and thus, Federal agencies would be unable to expend these payments without additional Congressional action.

The proposed Spectrum Relocation Fund would replace this potentially complex series of negotiations and payments between Federal agencies and licensees with a centrally managed account from which the Federal agencies' relocation costs will be paid. The fund will be managed by the Office of Management and Budget (OMB) and funded by receipts from the auction of the reallocated Government spectrum. The Administration anticipates that the internal Executive Branch processes for this Fund would be similar to the processes used to administer the Y2K and Emergency Response Funds, also centrally managed by 0MB. The President's proposal also would provide Federal agencies with mandatory spending authority (often also called "direct spending authority") to expend these funds without requiring further Congressional action. The proposal would also make the funds available until expended.

Question 5. Do you believe that the proposal to use auction proceeds to reimburse government users as outlined in President Bush's budget would make the spectrum management process more effective and more efficient?

Answer. By replacing the time-consuming and potentially complex and costly negotiations between Federal agencies and FCC licensees with a centrally managed relocation fund, the proposal will benefit Federal agencies by providing greater certainty in recovering the costs of relocations; the private sector by ensuring more timely access to the reallocated spectrum and greater certainty about the ultimate price of spectrum licenses obtained at auction; and consumers by providing opportunities for new communications services to the public. By significantly streamlining the reimbursement process, the President's proposal will make the spectrum management process more effective and efficient.

Question 6. There is some discussion that the Relocation Fund could be established as a trust fund. However, monies in Trust Funds are sometimes used for other budgetary purposes. How can legislators ensure that monies will be available for government users to address their relocation costs since in some instances it could take years for government a user to complete its relocation?

Answer. The Administration does not propose to set up the Spectrum Relocation Fund as a trust fund. Rather, the Spectrum Relocation Fund will be a special fund set up for the specific purpose of ensuring that Federal agencies receive payment for their relocation costs. As noted above, the Administration intends to seek mandatory spending authority for the payments so that once the auction receipts are deposited in the Fund, funds would be immediately available to the Federal agencies to relocate their operations. In addition, the Administration's proposal would make the funds available until expended in recognition that some relocations could take a period of time to complete.

Question 7. The United States seems to be at a disadvantage in the World Radio Conference (WRC) process with respect to other countries such as those in Europe. How can Congress ensure that the U.S. develops a U.S. position as well as names its delegation in a timely manner and prior to a WRC, thereby allowing for sufficient time to lobby other parts of the world?

Answer. The keys to the United States' success at any World Radio Conference (WRC) are coordinated efforts by U.S. Government and industry stakeholders in the early formulation of U.S. positions and unified and consistent advocacy of those positions in the months preceding the conference in both governmental and industry fora. WRCs occur on a three-year cycle. In recognition of the increasing complexity and importance of the issues addressed in these conferences, the U.S. Government has initiated the preparatory process much earlier in the cycle to give the United States the ability to formulate its positions and to obtain domestic consensus. For example, preparations started for WRC 2003 almost immediately after the close of the last conference, and most of the U.S. proposals have been completed—nearly a year early. The United States can now actively begin to promote U.S. positions in bilateral meetings and regional fora. These regional fora have become important venues in which the United States has been able to persuade neighboring countries of our common interests, garner support for U.S. proposals, and build strong coalitions.

The United States has been very successful in past WRCs and we are optimistic that we can meet our objectives for WRC–2003. Europe does have an advantage because European countries generally vote as a block (45 votes for Europe versus 1 vote for the United States). On the other hand, the United States has been successful in pursuing its objectives by developing technically sound proposals and strongly advocating their importance to other countries. NTIA is currently examining a wide range of spectrum management issues under our spectrum reform effort.

Question 8. Should the ambassador to a WRC be appointed at least a year instead of 6 months prior to the conference? Should there be a State Department employee designated to drive consensus with respect to the U.S. position prior to and until the ambassador is appointed?

Answer. Most countries in the International Telecommunication Union (ITU) rely completely on career ITU technical and regulatory experts. These people know each other and are well versed on the issues. The United States, on the other hand, selects an ambassador specifically for each WRC. The ambassador brings knowledge of the Administration's policy goals, but may not know the key WRC players, details of the issues, or have sufficient time to develop the necessary expertise. The ambassador's six month appointment presents a tremendous challenge for learning the issues, becoming part of the team in a preparation process that has been underway for two and a half years, and conducting outreach. The possibility of moving the appointment date forward should be considered.

Given that the WRC ambassador cannot serve more than approximately 6 months without Senate confirmation, the State Department could designate an employee to serve as interim WRC delegation head starting about 15 months prior to the WRC being held. The purpose of such an appointment would be to begin to facilitate formal outreach efforts and promulgate U.S. views and proposals. This would also allow administrative planning for the conference to begin in a timely manner. The interim head of delegation would also be in a good position to bring the appointed Ambassador rapidly "up to speed" on the issues. Nonetheless, the U.S. preparatory processes within the FCC and NTIA and reconciliation of their views and proposals proceeds separately from the appointment of the ambassador.

Question 9. Should the State Department be required to establish a timetable for resolving issues, establishing consensus and lobbying other countries prior to WRC? If a timetable is established, what incentives can be used to ensure that NTIA, the FCC, and industry work to meet the timetables? Do you have any other concerns about coordinating a U.S. position for the World Radio Conference? What can be done to address these concerns?

Answer. While WRCs have gotten a lot more attention over the last few years at the senior level, there is still room to improve coordination among the State Department, NTIA, FCC and other key agencies in promoting U.S. positions, particularly in our dealing with other countries. Having a more clearly defined State Department focal point earlier would be helpful. The general timetable for WRC preparatory activities is well established based on the motivation of federal and nonfederal participants to meet regional deadlines and to begin promoting positions. The State Department's formulation and promotion of an agreed timetable would be helpful in bringing issues to closure and helping all parties involved to understand the process objectives. At the same time, some flexibility may be required to solve particularly difficult issues. The State Department's development of a WRC outreach plan would be a big step in gaining support. However, outreach on WRC issues, though having political components, tends to be highly technical and require experience in radio regulation, and cannot be realistically covered in broad high-level bilateral discussions on telecommunications in general. To be successful, outreach must be focused on WRC issues specifically and include experts knowledgeable on those issues.

Question 10. GAO has indicated that while NTIA has attempted to promote spectrum efficiency that there is no accountability to ensure government users are using spectrum efficiently. Also GAO found that many federal agencies are understaffed with respect to employees who could assist agencies to manage spectrum. The FCC has recently indicated its need to increase its number of engineers.

Does NTIA believe that increasing engineers in federal agencies could assist agencies in better managing spectrum as well as improving spectrum efficiency?

Answer. At the most basic levels, Federal agencies need adequate personnel resources with the requisite expertise (telecommunication specialists, engineers, and computer specialists) to perform the tasks necessary to ensure spectrum efficiency. Various members of the Interdepartment Radio Advisory Committee have indicated to NTIA spectrum management staff that the lack of resources has affected their ability to address spectrum efficiency initiatives as well as to perform their basic

tasks of processing agency requests for frequencies and review of spectrum management policy decisions.

Question 11. Is there anything else that can be done to increase the level of accountability with respect to government users and spectrum efficiency?

Answer. One mechanism NTIA uses to ensure some level of accountability is the review process in which each Federal agency is required to certify that the frequency they are authorized to use by NTIA is still required and the characteristics of the system using the spectrum are still up-to-date. Most frequency authorizations require this review every five years. Some agencies have indicated that they have been unable to perform this five-year review for lack of personnel resources.

In the past, NTIA performed spectrum management surveys (as many as four per year) in which various locations were visited where spectrum was authorized. NTIA would audit these various Federal agencies to determine whether the agencies were using the spectrum under the conditions for which it was authorized. The audit was an incentive for agencies to ensure they were using the spectrum authorized as approved by NTIA. NTIA discontinued this practice a number of years ago because of the lack of fiscal and staff resources to perform such audits.

To increase the level of accountability for spectrum usage within the Federal agencies, NTIA also imposes fees to recover a portion of the costs of its spectrum management responsibilities. These fees are assessed on the basis of the percentage of spectrum utilized by the Federal agencies. Along with adoption of various spectrum efficiency initiatives (e.g., narrowbanding for land mobile radio services), this fee system has reduced the number of Federal assignments over the last 5 years by approximately seven percent. NTIA has also developed a new computer software program that the Federal agencies can use to prepare frequency assignment requests that comply with spectrum management rules and regulations and ensure interference-free operations with others in the environment. This capability is continually being revised based on feedback from the Federal agencies.

Question 12. Most government and commercial users estimate that they will need more spectrum over the coming years as they introduce advanced mobile services such as consumer broadband and richer information for emergency responders. Given that the amount of spectrum for such uses is finite, will it be possible to accommodate these demands if spectrum efficient technologies are implemented?

Answer. NTIA anticipates increased spectrum demand for all Federal agencies, particularly those with national security, public safety, and law enforcement missions, in the future. NTIA believes that these demands can only be met if new technologies are available that permit greater spectrum efficiencies or allow Federal agencies to migrate their operations to bands above 3 GHz to relieve some of the current congestion. New technologies, including software defined radios and dynamic frequency selection, hold great promise for significant future advances in spectrum utilization by the Federal Government, and ultimately through technology transfer, by the private sector. NTIA also advocates adoption by the FCC of policies that promote spectrum-efficient use by the private sector, including secondary markets and accommodation of ultrawideband systems.

Question 13. It is possible that the government and industry are not using spectrum—a valuable public resource—as well as we might. For instance, in some cases, they are using technologies that are more than 50 years old and were not designed to make efficient use of spectrum. In other cases, spectrum has been allocated to services that are not making extensive use of it. And, in still other cases, the spectrum has been allocated to services that could instead operate in other, less crowded frequency bands.

Should we consider a regulatory or legislative approach that reviews spectrum allocations say every 25 years, reallocating spectrum that has not been efficiently used?

Answer. Given the accelerating pace of advances in telecommunications technologies and the increasing demand by all users of the spectrum, a review of spectrum allocations should be conducted more frequently than every 25 years. Conversely, too short a time frame might tend to undermine the stability of well established telecommunications industries. Currently, at the international level, the International Telecommunication Union has adopted a policy of major spectrum planning conferences every two to three years to address specific agreed-upon topics. Domestically, reviewing spectrum allocations is essentially a continuous, on-going process through the FCC's rulemaking proceedings and parallel activities within NTIA. In these proceedings, current and projected spectrum needs are addressed as they are defined with appropriate spectrum review and allocation being effected as required. NTIA has for many years undertaken detailed reviews (called Spectrum Resource Assessments) of selected frequency bands to characterize the current and

projected use of the identified bands, identified spectrum sharing and interference issues, and identified alternative spectrum management approaches. These studies provide support for NTIA's spectrum policy actions. Since each of the myriad telecommunications industries in the United States evolve along unique time scales, establishing a predetermined fixed time for reviewing and reallocating spectrum use may be counter-productive in promoting new technologies, meeting national defense and homeland security spectrum needs, and promoting spectrum efficiency.

Question 14. If so, is 25 years an appropriate timeframe to determine whether to reallocate spectrum or is the element of risk that this introduces too great for the spectrum users, whether in the government or private industry, to bear?

Answer. As noted above, a 25-year time frame is not appropriate given the accelerated pace of advances in telecommunications technologies.

Question 15. Would such a requirement stifle innovation and the deployment of services, etc.? If not, what mechanisms would you suggest we employ to update spectrum allocations over time? Would we need to employ a different approach to promote spectrum efficient use among government users?

Answer. Undertaking a major spectrum review and reallocation at predetermined fixed intervals might well stifle innovation and deployment of services. Telecommunications advances do not follow predetermined schedules. As discussed above, the process to update spectrum allocations over time is an on-going process through the FCC rulemaking proceedings and the spectrum management activities at NTIA. Conducting more focused periodic reviews by both NTIA and FCC on selected bands or services of interest in a manner similar to NTIA's Spectrum Resource Assessments would be a positive step forward.

Question 16. Is there a quantitative mechanism to measure the efficiency with which spectrum is used such as the number of subscribers served per MHz of spectrum used? Should there be a different definition of efficiency for each general type of service, for example paging versus PCS voice services?

Answer. NTIA uses the definition of spectrum efficiency described by the ITU, namely the ratio of the communications achieved to the spectrum space used. In practice, this definition has value when applied to many types of commercial communications systems such as cellular/wireless systems, pagers, fixed microwave, and some communications satellite systems. For each of these systems, the specific technical equations may take a different form. For example, for wireless systems, spectrum efficiency might be measured in terms of subscribers served per MHz of spectrum used per square kilometer of service area. However, many or most of the systems used by the Federal government do not fall within the scope of this type of measure of spectrum efficiency. These systems include, for example, radars, navigation, military tactical, and scientific systems. To date, no effective measure for spectrum efficiency has been identified for the latter types of systems.

Question 17. What incentives or disincentives should be put in place to encourage the efficient use of spectrum? Should there be spectrum efficiency measurements and standards that progressively increase over time?

Answer. A number of incentives have been established by both NTIA and the FCC, and are currently in place to encourage the efficient use of spectrum. The incentives adopted and/or planned by NTIA take a wide variety of forms including, (1) requirements to use only as much transmitter power as necessary to ensure a satisfactory service; (2) assigning new users to the most heavily used channel first before resorting to those less heavily used, in order to minimize the total spectrum space used; (3) charging an annual fee to recover costs of NTIA spectrum management services based on Federal frequency assignments, which has encouraged the release of underused or unused frequencies; (4) requiring that use of the radio spectrum by Federal agencies be justified for reasons such as specific Presidential, legislative, or international commitments; (5) mandating that federal agencies adopt narrowband technology for land mobile communications, releasing channels for future Federal growth; (6) adopting effective receiver performance standards for Federal radiocommunications equipment, and advocating greater use of receiver standards, in general, to reduce interference and allow tighter "packing" of frequency assignments; (7) promoting and conducting research into new spectrum efficient technologies such as software defined radios; (8) promoting the continued transition to more spectrum-efficient digital techniques; (9) adopting stringent emission standards for high power systems such as radars to facilitate spectrum sharing; and (10) promoting greater sharing among incumbent spectrum users.

While the concept of establishing spectrum efficiency standards should be included in any assessment of most radio communications systems, this would be but one element in a more comprehensive strategy to improving the efficient use of the spectrum. Establishing spectrum efficiency standards that progressively improve

with time may on the surface appear desirable, yet it may at the same time be viewed as excessive micromanaging spectrum management. Also, technical definitions of spectrum efficiency based on current technology may be less valid for new emerging technologies, thus tending to stifle new developments.

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