FEDERAL MANAGEMENT OF THE RADIO SPECTRUM

HEARING

BEFORE THE

SUBCOMMITTEE ON
TELECOMMUNICATIONS AND FINANCE

OF THE

COMMITTEE ON COMMERCE
HOUSE OF REPRESENTATIVES

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FEDERAL MANAGEMENT OF THE RADIO SPECTRUM

THURSDAY, SEPTEMBER 7, 1995

HOUSE OF REPRESENTATIVES,
COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON TELECOMMUNICATIONS AND FINANCE,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 2123, Rayburn House Office Building, Hon. Jack Fields (chairman) presiding.

Members present: Representatives Fields, Oxley, Schaefer, Hastert, Stearns, Paxon, White, Coburn, Markey, Hall, Boucher, Gordon, Rush, Eshoo, Klink, Furse, and Dingell.

Also present: Representative Deal.

Staff present: Harold Furtchgott-Roth, majority counsel; Catherine Reid, majority counsel; Michael Regan, majority counsel; and David Leach, minority counsel.

Mr. FIELDS. This hearing is called to order. The chairman will recognize himself for 5 minutes.

First of all, I want to welcome our witnesses today. I know you will provide some expert testimony on the issue of Federal spectrum management. The Commerce Committee will begin marking up the budget reconciliation legislation next week, and, as everyone knows, we have a score from the budget resolution of $14 billion over the next 7 years from increased spectrum receipts, and let me make just a few specific comments about how the committee will approach meeting that particular target.

The committee is looking at a myriad of alternatives, which is why today's testimony from our witnesses is so important. We have an open mind on how best to meet that particular target, and I hope no one thinks otherwise, because we will meet the target. I am sensitive to the numerous concerns of both the executive branch of government and the telecommunications industry as to how the reconciliation goal is met. There is an understandable concern that no one's personal ox be gored, and I am not referring to one of our subcommittee members.

The committee will endeavor to take into account the legitimate views that have been expressed and I am sure will be expressed in the coming days. There are several specific issues relating to national security, public safety, reimbursement for relocation, that must also be considered in whatever decisions that we make. This presents a difficult balancing act, but, again, it is one which we are committed to achieving in a very short timetable.

I look forward to working with the ranking member, Mr. Markey, to achieve this result, and I am confident that the committee chairman, Mr. Bliley, and ranking member, Mr. Dingell, Mr. Markey, and myself will work out a bipartisan consensus on how to resolve this issue, which has historically been the case in this committee on telecommunication issues.

Mr. FIELDS. Again, I want to welcome our witnesses. I look forward to their testimony, and I guess in an unprecedented fashion, after the chairman's statement, we will turn to our witnesses.

[The prepared statements of Hon. Thomas J. Bliley, Jr., Hon. J. Dennis Hastert, Hon. Cliff Stearns, and Hon. Bobby L. Rush follow:]

PREPARED STATEMENT OF HON. THOMAS J. BLILEY, JR., CHAIRMAN, COMMITTEE ON COMMERCE

I want to thank the witnesses in advance for finding time in their schedules to share their expertise on this important matter with the Subcommittee.

The growth in the telecommunications industry provides our country with the greatest opportunity to advance and continue to lead in the world economy. As the leader in the provision of telecommunications equipment and services in the world today, our ability to avoid placing regulatory pitfalls on this industry will only increase the standard of living for the people of our nation, produce higher paying jobs for our workers, increase technological advances throughout various industries, and more directly, provide lower prices and better products for the American consumer. As certain industries are forced to downsize and others move abroad, it is refreshing to observe one of the largest growth industries in our nation. We must not lose sight that our telecommunications industry has developed and grown *despite* our over burdensome regulatory scheme.

Today, we continue the process of examining the federal government's role in managing the radio spectrum. In 1993, The Omnibus Budget Reconciliation Act (OBRA) authorized the FCC to auction rights to portions of spectrum.

In creating the competitive bidding process in 1993, Congress produced a valuable source of revenue for the U.S. government and more importantly, introduced competitive free market principles to the distribution of the radio spectrum. In addition to providing revenue, the FCC's competitive bidding process has provided an efficient method to distribute the rights to portions of the spectrum. The FCC's former attempts at distributing spectrum—by lottery and competitive hearings—provided the FCC with more problems than benefits.

OBRA '93 also required the Commerce Department, through the NTIA, to identify 200 megahertz of radio spectrum used by the federal government for reallocation to the private sector. This identification process was completed earlier this year. Today we will examine the possibility of freeing more spectrum for private sector use and to increase the amount of spectrum that is shared between the federal government and private industry.

There are legitimate uses of the spectrum by federal agencies. Few would question the use of the spectrum by the Department of Transportation to keep our nation's airplanes in the air. But there are also legitimate questions that, as policy makers, we must continually ask: Is the federal agency using its current spectrum to its full potential? Is it possible to move the spectrum used by the federal agency to new frequencies without jeopardizing its operation? Would an agency release *excess* spectrum if forced to pay for the spectrum like we are increasingly asking of the private sector? These are the questions I hope our distinguished witnesses can help us answer.

Telecommunications is too large a part of our economy and far too important for the warehousing of spectrum to occur. Proper spectrum management must focus on the need to create incentives for efficient use of this resource.

Lastly, I want to also make the point that it is the Committee's intent to avoid authorizing the auction of any spectrum *currently* allocated for use by public health and safety officials. From telecommunications equipment use by the railroad industry to prevent the collision of two locomotives to spectrum used by the utilities industry to notify officials of the need to shut off power to a specific location, industries acting in the interest of public health and safety provide a valuable service to our nation. In fact, we do our nation no service we if raise revenue while additionally increasing the probability of serious injury and damages caused by accidents

that could have been prevented. This does not imply that we do not expect the spectrum used by public safety officials to be used in the most efficient manner possible. New technology and more efficient operations should help decrease the amount, or minimize the need for additional spectrum allocations for public health and safety concerns. Currently, we are looking at proposals to ensure the spectrum used by these special and select users is not unduly threatened. We hope to find an acceptable compromise on this important issue.

Thank you, Mr. Chairman.

PREPARED STATEMENT OF HON. J. DENNIS HASTERT, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. Chairman, I want to thank you for holding this hearing because the Committee has some very difficult decisions to make in the coming weeks. The testimony we hear this morning will be crucial to Committee decisions related to our reconciliation instructions.

Management of the spectrum is a complex issue. I remember working on similar issues in 1992 when this committee passed legislation to transfer 200 MHz of government held spectrum to private use. The fact that most of this spectrum has not yet made it into private use is testament to the difficulty of the identification and relocation matters involved.

Thus, I look forward to the testimony of our distinguished witnesses this morning.

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

Mr. Chairman: I would like to commend you for holding this hearing on such an important issue—the federal management of the radio spectrum. I would also like to welcome our distinguished panel here today.

We, on the Commerce Committee, have been assigned the important task of increasing spectrum receipts by an a additional 14 billion dollars over the next seven years, in order to meet the requirements of the congressional budget resolution. Make no mistake about it, it will be done.

Radio spectrum is one of our most valuable resources. It affects, simplifies and improves the lives of every citizen, every day. From watching television, to listening to the radio, to using a taxi, to using a cellular phone, it is quite easy and commonplace to use radio spectrum in today's society. However, what is not so easy is understanding, managing, allocating, and assigning this spectrum in the most efficient and cost effective manner. Referring to the role and nature of this valuable resource as the "silent crisis" because few, except for a select few truly understand it, is quite appropriate.

It is my hope that this hearing will provide us with a better understanding of radio spectrum. I look forward to hearing from our witnesses. I am sure they will help us answer some difficult questions as we move forward in the process of spectrum reform.

One issue I would like us to keep in mind during this process is, while we look to raise 14 billion dollars, we must ensure the public's continued safety.

With that in mind we have before us a golden opportunity to reform federal management of spectrum. It is up to us to ensure that spectrum is utilized and managed in the most efficient, safe, and cost-effective manner.

The time for radio spectrum reform is now. New technology and new uses are creating new opportunities for U.S. companies and consumers. We cannot let this golden opportunity slip through our fingers.

Thank you.

PREPARED STATEMENT OF HON. BOBBY L. RUSH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. Chairman, thank you for convening this vitally important hearing on the federal management of spectrum. The management of spectrum, and the auctioning of spectrum has profound implications now, more so than ever before.

Historically, spectrum has been given away. However, the current market driven environment, and economic necessity, has prompted our government to identify creative methods to raise revenue to respond to reduce the deficit, and to allocate the precious spectrum we use for commercial and public safety purposes.

It is clear that new telecommunications applications will enable businesses to take advantages of compressed spectrum. This compressed spectrum will multiply the number of applications that can be used.

In recognition of this new technology, and economic realities, I am concerned about two things. First, how, do we ensure that spectrum does not only flow to the highest bidder,but also to lower bidders who will put the spectrum to good practical use. And second, how do we ensure that the federal government will remain a pivotal component in the allocation of a very precious commodity.

Over the past year we have witnessed financial benefits to the federal government associated with the auction of spectrum. In an effort to assist small businesses I developed an amendment that would allow interest to accrue on spectrum auction upfront payments to be deposited in the Telecommunications Development Fund, a designated financial institution. The interest from the deposits will be used as seed capital for small businesses involved in the telecommunications industry.

This is an innovative and practical solution to respond to the age-old dilemma of lack of access to capital for small businesses interested in the telecommunications field. That is why I have a strong interest in tracking what will ultimately happen with the allocation and sale of spectrum.

I hope that this hearing will provide vital insights into how we manage spectrum, and what the future holds regarding applications involving this limited but very valuable commodity.

Mr. FIELDS. First of all, the Honorable Larry Irving, Assistant Secretary for Communications and Information, United States Department of Commerce; Mr. James Gattuso, vice president for policy development, Citizens for a Sound Economy; Dr. Charles Jackson, a principal, Strategic Policy Research; and Mr. Dale Hatfield, the chief executive officer of Hatfield Associates.

Mr. Irving, we will recognize you for 5 minutes.

STATEMENTS OF HON. LARRY IRVING, ASSISTANT SECRETARY FOR COMMUNICATIONS AND INFORMATION, U.S. DEPARTMENT OF COMMERCE; JAMES L. GATTUSO, VICE PRESIDENT FOR POLICY DEVELOPMENT, CITIZENS FOR A SOUND ECONOMY; CHARLES L. JACKSON, PRINCIPAL, STRATEGIC POLICY RESEARCH, INC.; AND DALE N. HATFIELD, CHIEF EXECUTIVE OFFICER, HATFIELD ASSOCIATES, INC.

Mr. IRVING. Thank you, Mr. Chairman. It is always a pleasure to return to my alma mater, so to speak, and, in the spirit of last night, I look forward to your help in breaking Cal's record as I try to serve 2,132 days as assistant secretary.

Mr. Chairman, let me——

Mr. FIELDS. Let me just ask, how many days do you have?

Mr. IRVING. I have about 700, so we are only talking about 4 more years.

Mr. Chairman, we have attempted to be responsive to greater demand for spectrum. No one understands better than NTIA how both industry and the public sector need more spectrum and need to use it more efficiently. In 1993 this committee directed NTIA to reallocate 200 megahertz of spectrum. We did it early, we did it well, and we identified 235 megahertz of spectrum, about a 20 percent premium over what this committee asked for.

Since 1978 when NTIA was initially founded, we have reallocated more than 5,000 megahertz to private sector use, and many U.S. domestic industries, satellite services, digital audio broadcasting, little LEOs, fixed satellites, feeder links to those LEOs, all are benefitting from us turning over spectrum from the Government to the private sector.

We have been very active in the international force, such as the World Radio Conference of 1993, and we expect to be active again next month in the World Radio Conference in 1995 in identifying and moving spectrum to support U.S. domestic industry and their needs internationally.

Mr. Chairman, there is one myth that needs to be debunked, pierced, eliminated, whatever other word that we can find in our thesaurus: The Federal Government does not horde spectrum, and I would like to draw your attention to a chart that will come up.

The Federal Government users have access to approximately 94.5 percent of the spectrum below 300 megahertz. Federal Government users have exclusive use or exclusive access to only 1.4 percent. What that means, Mr. Chairman, is that while the private sector has exclusive use of 95.5 percent of the spectrum, they have access to 98.6 percent of all the spectrum available; 98.6 percent is available to the private sector today.

We at NTIA are trying to do several things. We are trying to use the synergy of NTIA to do what you want us to do. We are promoting greater efficiency by Government users. We are trying to make sure that our folks have the latest technology and they are using it efficiently. We are promoting auctions. No one worked harder than NTIA, before I got there, under Janice Obuchowski and Greg Chapados and subsequent to my arrival in promoting market-based approaches to deployment of spectrum.

We have developed strategies for the present spectrum auctions, working with the FCC. We are continuing to work with the FCC so that those auctions will become more efficient and more effective. We are suggesting reimbursement for Federal Government users for Federal agencies since they have an incentive to get out faster and so they can effectuate or speed sharing of technology and spectrum.

Interactive and international proceedings on behalf of international industries: All of NTIA works together to try to do the best job we can in promoting wireless spectrum. We have three major objectives, Mr. Chairman: Revenue raising, efficiency, and optimal allocation among users. But there are tradeoffs, because we can't just look at revenue raising and we can't just look at the public good. We can't talk about public safety, because all spectrum—and make a one-to-one correlation with use by our commercial broadcaster or commercial service of some other kind. How do I trade off loss of life versus commercial incentive? It is a very, very difficult issue, one we grapple with every day. We have public safety and public good versus revenue.

Let me just take three personal examples: The FAA. All of us have families who fly. My mother is coming up here for Columbus Day to visit her grandchildren. When she comes up, I want to make sure that the air-to-ground transportation plus the ability of a pilot to land in low-level lighting or low-visibility circumstances is not impaired because they don't have adequate spectrum. Spectrum determines whether or not a plane can land in low-visibility situations. How do I determine who gets use of that spectrum?

I have a brother-in-law in the Department of Defense. He is an army sergeant, served his country 25 years; he has 300 troops who work for him. Don't I want to make sure that they have access to

spectrum when they are out there in the field trying to protect their country, fought in Vietnam, served in Korea, now resides here in the United States, may be deployed at any moment? Do I, as a public servant, say that he and his 300 people can't have access to the best spectrum available to save their lives?

Or my brother-in-law, Mr. Chairman, who serves right outside your hometown in Houston, Texas, who is a policeman. We are trying, through the Public Safety Wireless Advisory Council, to make sure that all of our law enforcement officers—the DEA, FBI, local, and State users—all have adequate spectrum.

How do I trade off the ability of a policeman to protect our lives, our liberty, and our property versus a commercial user? I want to make sure that they both have opportunity to do the right thing for the American people. Whether it is my brother-in-law who is in the Army or my mother who is flying or my stepbrother who is a cop, I want to make sure that they can do their jobs. That is what NTIA is trying to do, and I also want to make sure that every U.S. industry is able to use spectrum for the benefit of our commercial enterprises.

These are not easy issues; public good versus revenue are never easy issues. I can't put a price tag on life. I can't put a price tag on defense. I can't put a price tag on police activities. The balancing is difficult. At NTIA we think during our history we have done a good to excellent job. We hope, with your help, we can do even better than that, and I look forward to the rest of the testimony this morning.

Thank you, Mr. Chairman.

[The prepared statement of Larry Irving follows:]

PREPARED STATEMENT OF LARRY IRVING, ASSISTANT SECRETARY FOR COMMUNICATIONS AND INFORMATION, U.S. DEPARTMENT OF COMMERCE

Good morning Mr. Chairman and members of the Subcommittee. It is a pleasure to have this opportunity to testify before you today. As the President's chief advisor on telecommunications policy and the manager of Federal Government's use of the spectrum, the National Telecommunications and Information Administration (NTIA), in the Department of Commerce, has long sought ways to promote efficient spectrum use in the United States—both by Federal and non-Federal users.

INTRODUCTION

Spectrum is a precious and finite national and international resource that must be shared by the public and private sectors. The rapid pace of technological development has caused congestion in the prime spectrum bands now in use. With the growing need to raise funds for the U.S. Treasury and to identify more spectrum for new technologies, the proper allocation of spectrum between the Federal users (under the authority of the President and managed by NTIA) and the private sector (under the jurisdiction of the FCC) has become a central issue.

The increased demand for spectrum today—and especially the potential for the FCC to auction spectrum to the private sector—makes essential reexamination of the appropriate allocation of spectrum between Federal and non-Federal users from both a domestic and international perspective. As I will discuss in more detail shortly, weighing the public benefits from spectrum-based Federal missions against the benefit of freeing up spectrum for private sector use is a complex and difficult task—but one that we must confront in deciding which spectrum uses are best for this country.

Today, I wish to describe how NTIA ensures that Federal spectrum is used efficiently and continues to identify spectrum for reallocation to the private sector. NTIA also promotes policies to ensure efficient spectrum usage by the private sector. For example, NTIA was one of the principal proponents urging Congress to give the FCC auction authority. We worked with Congressman Oxley and others to develop

such spectrum auction legislation. NTIA has also proposed a spectrum auction methodology to the FCC that would generate higher auction revenues and a more efficient assignment of licenses. NTIA believes that it can make additional contributions in this area to enhance the future revenue potential of the auction process.

I wish to emphasize at the outset, however, that to evaluate fully the potential for raising revenue from reallocation of additional Federal spectrum to the private sector, we must understand the difficult trade-offs involved. Federal agencies use spectrum to provide critical public services. And, there is virtually no prime spectrum lying fallow. In addition, international treaty allocations and obligations must be taken into account. Finding spectrum to reallocate for private sector use, where possible, requires either that Federal users become more efficient or relocate to other bands, or both. But these steps will take time and can be costly—potentially necessitating the purchase of new equipment and the outlay of substantial resources to relocate Federal operations without disrupting these important public services. As discussed below, NTIA supports proposals to permit private sector payment to Federal agencies that relocate their operations or become more efficient to free up spectrum for private sector use.

FEDERAL SPECTRUM USE IS PUBLIC USE

The Federal Government uses spectrum on a daily basis to provide critical and diverse public services, such as national defense, emergency rescue efforts, air traffic safety, law enforcement, disaster relief, energy production and distribution, space exploration, and protection of our national parks. The public benefits of Federal spectrum use deserve special mention. Not surprisingly, the Department of Defense (DOD) is the Federal Government's single largest user of spectrum: our entire defense depends on DOD having adequate spectrum for worldwide strategic communications between and among the four armed services, nuclear command and control, satellite surveillance, radar, and other critical functions. To provide just one example of how invaluable Federal spectrum use can be, Captain Scott O'Grady was rescued in Bosnia after he established communications over a military band allocated to the Federal Government.

The National Weather Service also relies on spectrum to accomplish its missions, deploying satellites and radar systems that use Federal spectrum to track weather patterns. During Hurricane Andrew, Federal spectrum was used to coordinate the establishment of a military broadcasting station for distribution of relief, assistance, and other information to the Hurricane's victims.

Federal law enforcement organizations, such as the Secret Service, the FBI, and the U.S. Capitol Police all require radio spectrum to perform their functions. Rescue efforts by Federal and local law enforcement personnel in response to the bombing of a Federal building in Oklahoma City were greatly facilitated through the use of Federally allocated spectrum and related equipment.

In the last few years, coordination of frequencies by NTIA and other Federal agencies allowed land mobile and other communications capabilities to be deployed to help fight extensive forest fires and earthquakes in the western United States. Another example of Federal spectrum use benefitting everyone in this room is our national air traffic control system. The FAA needs adequate spectrum for ground to air communications as well as radar tracking to deal with the growing demand for air travel.

All of the foregoing illustrations—in addition to myriad other Federal Government uses—have intrinsic value to the public. This value is embodied in the Federal Government's spectrum-dependent efforts in providing for a working and effective national defense and saving thousands of human lives each year. (For your benefit, a more extensive description of Federal spectrum usage has been provided in an attached report prepared by NTIA, entitled: "Federal Spectrum Management: How the Federal Government Uses & Manages the Spectrum.")

NTIA IS THE FEDERAL SPECTRUM MANAGER AND SERVES AS THE PRESIDENT'S TELECOMMUNICATIONS ADVISER

Throughout its history as the Federal spectrum manager NTIA has ensured that the existing and future spectrum needs of the Federal Government have been met. With the increasing congestion in prime spectrum bands, NTIA has focused more in recent years on ways to enhance efficient spectrum use and to accommodate the private sector's need for more spectrum. Federal spectrum efficiency and reallocation of spectrum are among NTIA's most important initiatives.

Exclusive Federal Spectrum Use Is Minimal. It is important to note that contrary to industry claims, Federal agencies do not hold vast and viable spectrum exclusively. They hold spectrum only to the extent needed to perform their missions. As

you can see on the chart, the Federal Government has access on an exclusive basis to only 1.4 percent of the spectrum allocated below 300 GHz. Non-Federal entities, on the other hand, use approximately 5.5 percent of the spectrum below 300 GHz exclusively. Federal and non Federal users share the remaining 93.1 percent of allocated radio spectrum below 300 GHz. (More detailed data regarding the actual amount of spectrum used by the Federal Government in different bands is provided in the attachments entitled: (1) "Federal Spectrum: Efficient Management and Public Benefits" and (2) "NTIA Spectrum Information Fact Sheet" and attached charts, which have all been provided to members of this Subcommittee today.)

The Federal Government Has Achieved Great Spectrum Efficiency. The Federal Government has made major strides towards achieving great spectrum efficiency. In most cases, Federal efficiency standards are more stringent than those adopted by the private sector for comparable non-Federal applications. For example, NTIA has adopted Federal standards for receivers, which play an important role in efficient spectrum use, while the private sector has declined to establish stringent receiver standards in many instances. The Government has also adopted a variety of measures to increase Federal users' spectrum efficiency. It is implementing trunking and narrowband technology, which doubles the number of channels in up to three major Federal land mobile bands and promotes sharing with the private sector.

Moreover, Federal agencies are using spectrum overlay techniques, which have permitted increased sharing between the Federal and private sector users. By allowing private industry to share previously exclusive Government spectrum, we have also facilitated the creation of new businesses. For example, garage door openers and car alarm system businesses proliferated once they could share DOD spectrum.

By integrating its research, policymaking, and standards-setting functions, NTIA continues to develop and promote the use of new technologies and techniques that allow for more efficient Federal spectrum usage. Over time, NTIA's efficiency initiatives could free up additional spectrum for FCC auctions, thereby making spectrum available to private industry and creating jobs and economic opportunity for Americans.

NTIA Has Reallocated Much Spectrum to the Private Sector. NTIA has also worked to reallocate spectrum to the private sector. When Congress in a bipartisan agreement directed NTIA in 1993 to identify 200 MHz of Federal spectrum to be reallocated for increased and exclusive private sector use, NTIA rose to the task. NTIA identified, in accordance with Congress's deadline, 235 MHz of spectrum for reallocation—almost 20% more than had been originally requested by Congress. All of this spectrum is prime spectrum, located below 5 GHz, that supports a broader range of wireless services; than higher band spectrum. Provided that uses for this spectrum meet the FCC's competitive bidding authority criteria, it could eventually be subject to auction.

While reallocation of 235 MHz is the most recent illustration of NTIA's reallocation activity, NTIA has reallocated much other Federal spectrum to private sector use. Indeed, since NTIA's inception in 1978, it has reallocated more than 5,000 MHz of Federal spectrum to allow greater private sector use, some of which has been transferred to exclusive private sector use and some of which has been made available for more sharing. This spectrum has been used to provide many types of new satellite services, including digital audio broadcast, little low earth orbiting (LEO) satellites, fixed satellite services, and more recently feeder links for little LEOs.

Presently, we are evaluating other Federal, Federal/non-Federal shared, and non-Federal spectrum for reallocation; uses of new technologies, such as narrowband and spread spectrum; and future Federal aid non-Federal spectrum needs. In the upcoming year, NTIA also plans to conduct a study to examine new approaches to Federal spectrum management. We are about to implement the use of software enabling Federal agencies to better determine their actual spectrum needs.

Federal Spectrum Management Functions Should Remain in the Department of Commerce. These important Federal spectrum management functions should remain in the Executive Branch and should not be transferred to an independent agency, such as the FCC. The FCC's experience lies in management of the private sector's use of spectrum, which requires the FCC to respond to private industry needs.

In contrast, the use of spectrum by DOD (and other Federal agencies) is critical to crucial public services and cannot be valued in financial terms. Federal spectrum management should thus be kept distinct from the decisions made by the FCC in commercial allocation matters, which may often conflict with the Federal agencies' needs. Also, assigning this function to an agency that generally operates outside the established Executive Branch coordination process could threaten important Federal missions. Further, because the FCC is an independent agency, transferring Federal

management to the FCC could raise concerns regarding interference with the President's constitutional authority over national defense.

NTIA Has Promoted Policies for Improved Private Sector Use. Complementing our spectrum management functions, NTIA continues to play a major role in developing and advocating domestic and international spectrum policy. As mentioned earlier, NTIA was at the forefront of calls for a market-based approach to spectrum management and grant of auction authority to the FCC to assign spectrum licenses and released a major report advocating spectrum auctions as early as February, 1991. Market-based approaches help provide solutions to difficult spectrum allocation questions. NTIA, for example, supported FCC efforts to authorize "voluntary reallocation" among users, which is the basis for the FCC's reimbursement policy for incumbent microwave users in the bands allocated for personal communications services (PCS).

In addition to raising significant revenue for the U.S. Treasury, auctions provide a fast and fair way for the Government to award licenses to those entities willing to make the best use of them. Furthermore, NTIA believes that more revenue could be earned if current auction rules are modified. Accordingly, fine-tuning the auction process could further serve as a means to assist with deficit reduction.

NTIA SUPPORTS PRIVATE SECTOR PAYMENT FOR REALLOCATION COSTS

The task of reallocating Federal Government spectrum to the private sector and enhancing the Government's spectrum efficiency could be made easier if the private sector is allowed to pay the costs incurred by Federal agencies when they relocate or become more spectrum efficient. The costs of relocating Federal operations are significant. For example, NTIA estimates, based on information provided by various Federal agencies, that the aggregate cost for relocation of all Federal operations from the 235 MHz spectrum band will amount to half a billion dollars. We thus believe that a mechanism allowing for private sector payment of such Federal Government relocation costs could facilitate early relocation of some Federal operations. Congress should therefore seriously consider implementing proposals that would allow private sector entities to compensate displaced Federal users for early relocation to alternative spectrum or media.

CONCLUSION

We look forward to working with Congress on the issues raised by this hearing. Improved spectrum usage by both the public and private sectors can yield great benefits in terms of services to the public and increased revenue for the U.S. Treasury. At the same time, difficult choices will be necessary in deciding on how best to allocate spectrum between the Federal and non-Federal uses in the future, while maintaining our international obligations.

[Additional material submitted by Mr. Irving is retained in subcommittee files.]

Mr. FIELDS. Mr. Irving, thank you very much.

Now we will hear from Mr. James Gattuso, vice president for policy development, Citizens for a Sound Economy.

STATEMENT OF JAMES L. GATTUSO

Mr. GATTUSO. Good morning.

Mr. FIELDS. Mr. Gattuso.

Mr. GATTUSO. I am here to speak to you this morning concerning Federal policies regarding one of America's most valuable resources, the electromagnetic spectrum. I would like to address today two major challenges based on this committee in the area of spectrum management. The first and the one that is most often discussed when the topic of spectrum comes up—and it comes up a lot at dinner parties and things I have been to, and I have ruined a few by bringing it up unexpectedly—the first is how the Government can find $14 billion in spectrum licenses in auction in order to meet the requirements of the budget resolution.

The second challenge, and I believe the more important challenge, is how the Federal Government will regulate the use of the spectrum that is so licensed.

The first source of auctionable spectrum for this committee I believe can be found in the vast amount of spectrum now allocated to Federal Government use, and, as you know, there has been a somewhat active debate of late concerning exactly how much of the spectrum is allocated to the Government, how much is available for private use, how much can be switched over.

I think I will resist the temptation to add numbers of my own to this debate and add to the general confusion, but I think the general story seems to be this. A small amount of spectrum is held exclusively for Federal use, and a small amount of spectrum is held exclusively for private use, but the bulk, most of the spectrum in the middle, is assigned to shared uses.

The problem is that a large part of this middle ground is simply not available for practical and for procedural reasons to use by the private sector. According to the NTIA itself, some 40 percent of this spectrum in the shared category doesn't even have service rules that have been developed by the FCC as of yet, so much of the spectrum just simply cannot be accounted as in the private sector right now.

Can the Government make more spectrum available for private use? Probably so. Despite 1993 legislation that mandated the reallocation of 200 megahertz to the private sector, Federal spectrum likely is still vastly underutilized and inefficiently used.

Now I don't mean to say that NTIA has been a bad manager. I think it has worked hard, especially in recent years, at improving the efficiency and the utilization of the Federal Government's allocated frequencies. Instead, the problem is systemic. Federal users have simply been insulated from the market. There is no pricing mechanism to tell users its true value or its opportunity costs involved in its use.

Now, think of a situation facing a typical spectrum manager. Say an agency has a radio communication system that uses 20-year-old technology. Newer systems in the market could do the same job for that agency using less spectrum, but that new system would cost money. Why would the manager spend much effort to get that system replaced? The cost would come out of his budget, but the savings would not accrue to him or his agency. Eventually, administrative rules and procedures could probably force an upgrade for that agency, but that would almost certainly take longer than if the agency itself had an incentive to identify and eliminate the inefficiency.

Given the systemic problem, there certainly seems to be room to increase efficiency and make more spectrum available for private sector use. The most direct way to do this would be the methods used in 1993: Simply mandate that a certain amount of underutilized spectrum be identified and turned over to the private sector.

While this would be a practical approach to the problem, it would not do anything to address the root cause of the Federal problem, the lack of incentives to use spectrum efficiently. Thus, in addition to mandated reallocation, Congress should also try to provide some market incentives to Federal managers.

One approach would be to allow Federal agencies to sell or sublease spectrum to private users and to keep the proceeds within

their own budgets. The Senate telecommunications bill, as you know, S. 652, takes a small step in this direction by allowing Federal agencies to be compensated for the cost of relocating to other frequencies and to clear up the frequencies they now use for private use. While not perfect, such market mechanisms would add a carrot to the stick of mandated reallocation.

I think this committee should look for the present purposes at putting in some provisions, some incentives to Federal managers such as those that are in the Senate bill and perhaps more and, in addition, perhaps direct NTIA to comprehensively study other available options for further increased incentives.

A second and a potentially huge source of licenses in addition to Federal frequencies that could be auctioned, I believe, is the spectrum being proposed for new advanced television systems. The FCC has already proposed to grant new, 6-megahertz blocks of second spectrum to existing television license holders, allowing them to operate at least temporarily on both their current spectrum and the ATV spectrum. Once ATV becomes established, they return their old frequencies to the Government.

The problem, however, is that there is no guarantee the old frequencies would actually be returned. Past experience has shown it is always difficult for the FCC to reclaim assigned spectrum, and this would likely be even more difficult with broadcast spectrum. As a result, broadcasters could likely end up getting their new assignments for free, to the exclusion of other users, and keeping their existing assignments.

To prevent this, the Congress should consider placing ATV spectrum licenses up for auction. As a second best alternative, Congress could immediately auction the future rights to existing broadcast spectrum.

Lastly, I would like to point out—and this is the part I wanted to stress—I know my time is running out, but I want to stress, the committee's job in this area should not stop with the reallocation of Government spectrum or the auction of ATV licenses. These steps are important, but the most important problems in today's spectrum management system lie not in the lack of licenses to auction but in what those licenses say.

As the current system of spectrum management was developed in the 1920s, it is a system where the Government determines what services are to be provided, frequencies that are to be used, and the technology in many cases that will be used. This is a classic system of central planning where a small number of regulators in Washington are charged with determining how a spectrum is to be used. The problems of this system have long been documented, going back some 30 or 40 years back to a landmark article by Ronald Coase, a Nobel Prize-winning economist.

Even more recently, I think the problems have become more pressing because of changes in communications technology that are making the central planning system more and more unworkable. New wireless technologies and services are being developed at a dizzying pace. I think Federal regulators couldn't keep up with these changes even if they had the perseverance of Cal Ripken.

Mr. FIELDS. Mr. Gattuso, could we ask you to summarize?

Mr. GATTUSO. Surely.

Mr. FIELDS. Your statement will be included in its entirety, as will all of the witnesses', in the record.

Mr. GATTUSO. Essentially, to conclude, I think the Congress has a historic opportunity to implement reform to the spectrum management system. This reform should not mean simply raising dollars for the U.S. Treasury. The goal should be to increase the efficiency with which this resource is used. The benefits of such steps could far exceed immediate gains of auction revenue.

Thank you.

[The prepared statement of James L. Gattuso follows:]

PREPARED STATEMENT OF JAMES L. GATTUSO, VICE PRESIDENT, CITIZENS FOR A SOUND ECONOMY FOUNDATION

Good morning. I am pleased to be here this morning to speak to you concerning federal policies regarding one of America's most important natural resources: the electromagnetic spectrum. By way of background, I am Vice President for Policy Development at Citizens for a Sound Economy Foundation, a 250,000-member research and education foundation that promotes market-based solutions to public policy problems.

CSE Foundation has been active in a variety of telecommunications issues since 1987. My personal involvement in this field goes back to 1990, when I served as Deputy Chief of the FCC's Office of Plans and Policy, with responsibility for a variety of spectrum management issues.

Today's topic is one of the most important, and least understood, issues facing the Congress today. It is commonplace to hear people talk about the "communications revolution" sweeping the world. Most people probably think about long miles of fiber-optics or coaxial cables when they hear of this revolution. Yet, the fastest-changing technologies in communications may be wireless services.

Twenty years ago, this massive resource played only a minor part in most people's lives. Outside of broadcast television and taxi radios, there were probably few uses of the spectrum that the average person could name. Now spectrum is being used for an enormous variety of applications—from cellular phones to wireless computer networks, from satellite TV to cordless microphones. And the list keeps growing. Yet, the way in which the federal government manages this spectrum has hardly changed. Despite the revolutionary changes in the use of spectrum, the government still uses a 1920s-vintage system of spectrum allocation. It is time for reform.

I'd like to address today two major challenges facing this committee in the area of spectrum management. The first—the one that is most often discussed when the topic of radio spectrum comes up—is how the government can find $14 billion in spectrum licenses to auction in order to meet the requirements of the congressional budget resolution. The second, and more important issue, is how the federal government will regulate the use of the spectrum that is so licensed.

As to the first issue, it appears that there are two likely sources of spectrum licenses that could be auctioned. Either (or both) of these could be employed by the committee.

Reallocating government spectrum. The first source can be found in the vast amount of spectrum now allocated to federal government use. How much spectrum does the federal government have? Estimates vary, based upon which frequencies are included, how they are counted, and what categories are employed. In fact, there has been an active debate on this point in recent months between NTIA and various outside analysts.

Rather than add to the general confusion, I'll refrain from providing any numbers of my own on this issue. In general, however, the story seems to be this: a small amount of spectrum is held exclusively for federal use, and a small amount exclusively for private use. The bulk of spectrum, however, is designated to be "shared" between federal and private users. The catch-22, however, is that the FCC has not established the necessary service rules for a large portion—perhaps 40 percent—of the "shared" spectrum. Regardless of whether this is for policy reasons or because current federal uses make the frequencies unsuitable for other users, the fact is that these frequencies are currently unavailable to the private sector.

Can the government make more spectrum available for private use? Probably so. Despite 1993 legislation that mandated the reallocation of 200 MHz to the private sector, federal spectrum likely is still vastly underutilized and inefficiently used. This is not to say that NTIA has been a bad manager. It has, especially in recent years, worked hard at improving the efficiency and utilization of the federal govern-

ment's allocated frequencies. Instead, the problem is systemic. Federal users have been insulated from the market. In short, under the current system, spectrum is a free good. There is no pricing mechanism to tell users its true value, or opportunity cost, involved in its use.

Think of the situation facing a typical federal spectrum manager. Say an agency has a radio communication system which uses 20-year old technology. Newer systems on the market could do the same job for the agency using less spectrum. But the new system would cost money. Why would the manager spend much effort to get the system replaced? The cost would come out of his budget, but the savings would not accrue to him or his agency. Eventually, administrative rules and policies could force an upgrade. But that would almost certainly take longer than if the agency itself had an incentive to identify and eliminate the inefficiency.

Given this systemic problem, there certainly seems to be room to increase efficiency and make more spectrum available for private-sector use. The most direct way to do this would be the method used in 1993: simply mandate that a certain amount of underutilized spectrum be identified and turned over to the private sector.

While this would be a practical approach to the problem, it would not do anything to address the root cause of the federal problem: the lack of incentives to use spectrum efficiently. Thus, in addition to any mandated reallocation, Congress should also try to provide some market incentives to federal managers. One approach would allow federal agencies to sell or sublease spectrum to private users. (The concept of leasing was discussed in NTIA's 1991 report on spectrum management, "U.S. Spectrum Management Policy: Agenda for the Future.)[1] While not perfect, such market mechanisms would add a "carrot" to the stick of mandated reallocation.

Auctioning ATV licenses. A second, and potentially huge, source of licenses that could be auctioned is the spectrum being proposed for new advanced television (ATV) services. The FCC has proposed to grant new six MHz blocks of spectrum to existing television licenseholders, allowing them to operate at least temporarily on both their current spectrum and the new ATV spectrum. Once ATV became established, they would return their old frequencies to the government.

The problem, however, is that there is no guarantee that the old frequencies would actually be returned. Past experience has shown that it is always hard for the FCC to reclaim assigned spectrum—it would likely be even more difficult with broadcast spectrum. As a result, broadcasters could very likely end up getting their new assignments for free (to the exclusion of other potential applicants) *and* keeping their existing assignments.

To prevent this, the Congress should consider placing ATV spectrum licenses up for auction. As a second-best alternative, Congress could immediately auction the *future* rights to the existing broadcast spectrum. This approach, proposed by Peter Pitsch of the Progress and Freedom Foundation and the Hudson Institute, would create a natural constituency for the return of the existing assignments.

Creating flexibility. This committee's job should not stop with the reallocation of government spectrum or the auction of ATV licenses. These steps, of course, are important—and should provide benefits to consumers and taxpayers. But the most important problems in today's spectrum management system lie not in a lack of licenses to auction, but in what those licenses say.

Under the current system, first developed in the 1920s, the federal government determines which services are to be provided, the frequencies on which they will be provided, and often the technology that will be used. It is a classic system of central planning, with a small number of regulators in Washington charged with determining how the spectrum resource should best be used.

As with other systems of central planning, the spectrum management system tends to result in an inefficient use of the spectrum resource. Federal regulators—rather than consumers—decide whether taxis, telephone service providers or foresters are in greatest need of spectrum. Moreover, new services are delayed for years, or even decades.

The problems of the system have long been the focus of criticism by economists and other analysts—dating back to a landmark analysis by Nobel Prize winner Ronald Coase in 1959. However, changes in communications technology are making the system even more unworkable. New wireless technologies and services are being developed at a dizzying pace. Even if the FCC were able to weigh accurately the needs and merits of the relatively few spectrum-based services that existed in the 1920's, it is simply not able to do so today. Even if it could, the lengthy delays associated

[1] A small first step in this direction was taken in the telecommunications bill passed by the Senate earlier this year (S. 652), which allows federal users to be compensated for the cost of relocation to new frequencies.

with the allocation process—perhaps acceptable in a slowly-changing world—would be seriously out of step with the fast-changing world of today.

The spectrum management system should be reformed to allow consumers—through the marketplace—to determine how this valuable resource is to be used. As a first step, Congress should prohibit the FCC from placing restrictions on the use of the spectrum auctioned under this reconciliation bill, except for those necessary to prevent interference to other users and those required by international obligations. In this way, the uses to which the frequencies are put could be decided by consumers, rather than by a few regulators in Washington.

Conclusion. This year, Congress has an historic opportunity to implement real reform of the spectrum management system. Reform, however, should not mean simply raising the maximum number of dollars for the U.S. treasury. Instead, the goal should be to increase the efficiency with which this resource is used. It should mean treating spectrum more like other resources in society—giving its holders the ability and the incentive to put it to its best use. The benefits of such steps could far exceed the immediate gains of auction revenues.

Mr. FIELDS. Thank you very much.

Dr. Charles Jackson, principal, Strategic Policy Research.

STATEMENT OF CHARLES L. JACKSON

Mr. JACKSON. Mr. Chairman, thank you for the opportunity to appear here today. Like Assistant Secretary Irving, I am an alumnus of the staff of the Commerce Committee, and it is nice to be back here. I will try to summarize quickly my written statement.

We are here today because of a weakness in the Communications Act. It does not assign ultimate authority for dividing the spectrum between FCC-regulated uses and uses by the Federal Government. Authority and responsibility is divided. This flawed system has worked well in the past, due in no small part to the diligence and common sense of those in the administration and the FCC charged with the responsibility for spectrum regulation.

However, circumstances have changed. New technologies create new demands for spectrum and free up old spectrum band. The old choices regarding the division of spectrum between the Federal and the civil jurisdictions need to be reviewed. I will just give two quick examples of this that are set out in more detail in my testimony.

In Europe, the band from 380 to 400 megahertz is being converted over time from military communications to public safety communications. If our NATO allies are using that spectrum in their civil economy, we are going to be very restricted in using it in either military exercises or in joint operations and we will need necessarily to have mechanisms to plan around the unavailability of that spectrum in joint operations. Consequently, it may be the case that that spectrum can be freed up over time for use in our civil economy.

Similarly, we have heard a lot about the new Global Positioning Satellite service, GPS, which is a technological wonder, it is great stuff, and it actually turns out to use not much spectrum. It is a widely deployed service, and it may substitute for other, much more spectrum intensive navigational systems that are out there and operating today.

The problem: This split between authority the way our system is structured today limits the review of the division between the Federal and the civil spectrum authority to hearings like this, and it is only in hearings like this and in responses to hearings like this that our society really sits down and tries to draw these lines, and consequently I commend the committee for holding this hearing.

My personal belief is that significant spectrum can be made available to the civil economy from Federal uses. Unfortunately, unlike the case with FCC uses of the spectrum, I can't get access to all the data needed to prove or disprove my belief, and quite rightly. Some of the uses of—Federal uses of the spectrum would be compromised if information about them were widely available, but many others I think would not.

I believe that if we roll up our sleeves and get to work we can find more unused or underused Government spectrum that will benefit the civil economy.

One last thought. While I applaud the use of auctions and licensing at the FCC, the need for revenue should not drive all our spectrum management decisions. Auctions are not appropriate for all spectrum use.

Thank you again for the opportunity to appear here today.

[The prepared statement of Charles L. Jackson follows:]

PREPARED STATEMENT OF DR. CHARLES L. JACKSON, PRINCIPAL, STRATEGIC POLICY RESEARCH, INCORPORATED

INTRODUCTION

My name is Charles Jackson. I am a principal in Strategic Policy Research—a consulting firm in the telecommunications industry. Our firm works with a wide range of clients in the telecommunications industry. Prior to becoming a consultant, I worked for this Committee as staff engineer for what is now the Telecommunications Subcommittee. I serve on the U.S. Department of Commerce's Spectrum Planning and Policy Advisory Committee (SPAC) and I served as chairman of Working Party 1 (Policy) of the Implementation Subcommittee of the FCC's Advisory Committee on Advanced Television. I have written and spoken extensively on spectrum policy. The views I express here today are my own.

THE BUCK STOPS WHERE?

This hearing focuses on a problem issue in our government—the division between Presidential and FCC authority for spectrum. The President is responsible for licensing federal government stations; the FCC is responsible for licensing everybody else. Neither the President nor the FCC is directly responsible for making the trade-off between more spectrum for the civil economy, with its attendant gains of a healthier economy and increased consumer benefits, and less spectrum for the federal government, with its attendant losses of a less productive federal workforce and more costly national defense. Our American pragmatism has, in large part, overcome this weakness of the Communications Act. But, this weakness remains a part of our system. Changes in technology, markets, and defense requirements all point to a need to reexamine spectrum divisions that have been made in the past. I commend the Committee for holding this hearing.

A CAVEAT

As an aside, before I get to my main point, let me offer a warning. The pendulum may have swung too far. A few years ago it appeared that auctions of radio licenses were politically unthinkable. Now, the budget process puts strong pressure on this committee to find large amounts of spectrum for further auctions. While I feel auctions are generally sound, and I applaud this Committee for its contributions in putting that policy in place, we should not let the budget process force bad spectrum policy.

There are wireless applications where auctions are inappropriate. Unlicensed bands, e.g., the unlicensed PCS band or the NII band proposed by Apple, provide one good example of a radio application where auctions are inappropriate. Let me make an analogy with real estate. It is appropriate for the government to auction off the rights to extract oil from federal land. But, it makes little sense to charge for the use of neighborhood parks and roads. In most such cases, any system of direct metering or charging for use of neighborhood roads would cost more to administer than it would return in value. The same applies to unlicensed spectrum. Another example of an area where auctions may be inappropriate is public safety spec-

trum. Here the case against auctions is more complicated. Let me list a few facts that support the case against auctions here. First, there are benefits, such as reduced equipment costs and improved interconnectability, that flow from having public safety agencies in relatively few bands. Second, the natural units of spectrum to auction off are big licenses—big in both bandwidth and geographic extent. But, many public service agencies have relatively restricted spectrum needs. Consequently, they can't bid effectively in an auction offering only big licenses. I could go on, but these points illustrate some of the problems of using auctions in public safety radio. Of course, there are arguments on the other side. I think that, on balance, the arguments against auctions in public safety radio are the more compelling.

Auctions are a valuable tool, but the need for revenue should not drive our spectrum decisions.

A FUNDAMENTAL WEAKNESS IN THE U.S. SYSTEM OF SPECTRUM MANAGEMENT

This hearing responds to a fundamental weakness in our national spectrum management system. While both the FCC and the federal executive make spectrum tradeoffs in their own areas, no one (save the appropriate congressional committees) is charged with making the tradeoff between these two disparate areas of spectrum use.

A CHANGING WORLD

Our divided system worked reasonably well in the past. A skeptic would ask me to prove this assertion. I can't. The best I can do is observe spectrum uses in other nations and point out that there are many areas where our nation led the world in the deployment of wireless technology and relatively few areas where our nation has significantly lagged the rest of the world. In spite of the various weaknesses in our system, the outcome has been relatively competitive.

But, circumstances have changed. In the old environment, radio technology was expensive and limited. When cellular radio was introduced, about a decade ago, a cellular portable cost more than $2,000. Today, a cellular portable costing about $200 (although consumer prices are frequently reduced by the cellular carriers) will support both the original AMPS standard and the more efficient digital standards. Today it is possible to buy cellular modems that are small enough to slip into personal computers.

The new technology creates new uses and opportunities for radio systems in the civil economy. At the same time, the new technology changes federal needs. For example, the Global Positioning Satellite (GPS) will make some navigational systems obsolete—perhaps freeing up spectrum for other uses. Other new technologies will create new spectrum demands for the federal government. For example, new capabilities in the field will increase federal law enforcement needs for data and image communications.

We need to review past spectrum allocation decisions in the light of the new technologies and needs.

BALANCING FEDERAL NEEDS AND THE NEEDS OF THE CIVIL ECONOMY

How do we strike the proper balance between the federal and civil uses of the radio spectrum?

Let me give an example of this dilemma.

By my best understanding, the spectrum from 380-400 MHz is used in this country by the military. In Europe, many of our NATO partners are moving to use this spectrum for police communications systems. Consequently, it would appear that our NATO partners would be more limited in their military use of these frequencies than in the past. Similarly, it would appear that use of these frequencies by our military would be limited in peacetime and training situations in Europe.

The question naturally arises: Should 380-400 MHz be reallocated to civil use in U.S.? Asking the question poses the dilemma. Who knows enough to decide? How will we decide? These frequencies appear to be well suited to public safety mobile communications. The FCC lacks both the information and the authority to decide this question. Similarly, while the Defense Department has the information needed to understand the national security implications of reallocating this spectrum to public safety, it lacks the knowledge and responsibility for public safety communications to make the decision.

A PERSONAL CONCLUSION

I believe that the federal sector is, on average, not as spectrum efficient as the civil economy. One reason for this inefficiency is that many federal uses grew up earlier than the corresponding uses in the civil economy. The military has always been able, quite properly in my opinion, to justify the development of radio systems at an earlier stage in the technology than has the civil economy. But, earlier technologies tend to be less spectrum efficient than later technologies.

I think that reallocation of spectrum from federal use to civil use or more intense civil use of nominally shared spectrum would benefit our nation. This benefit flows from the more efficient use of our resources and has nothing to do with auction revenues themselves. Auction revenues are only a side effect. I believe that substantial amounts of spectrum could be so reallocated.

The problem is, I don't know how to verify my beliefs. I could be wrong and I don't have access to the information needed to test my views. While it is necessary to limit public discussion of federal government spectrum use in some areas, most notably national security and public safety, there are many other areas where such limits are unnecessary.

We have some evidence that more spectrum is available for expanded use by the civil sector. The sky didn't fall when the "Dingell Bill," reallocating spectrum from the federal government to the FCC jurisdiction, was enacted as part of OBRA 93 and implemented by the Administration. How should we interpret the relative ease and speed with which the Administration implemented this law? One interpretation is that smart people at NTIA worked hard and did a good job. Another interpretation is that it was easy to find some spectrum, but that additional amounts will be progressively harder. These two explanations are not mutually exclusive. I think we can do it again if we roll up our sleeves and work hard at finding more unused or underutilized government spectrum. NTIA has done a fine job here in the past, and I am confident that they will perform similarly well in the future.

Mr. FIELDS. Thank you very much, Dr. Jackson.

We now turn to Mr. Dale Hatfield, CEO, Hatfield Associates.

STATEMENT OF DALE N. HATFIELD

Mr. HATFIELD. Thank you very much, Mr. Chairman. I very much appreciate the opportunity to appear before the subcommittee today to address the important issues associated with the Federal Government's management of the radio spectrum resource.

As a former Government employee and now as a consultant and part-time academic, I have been involved in various aspects of spectrum management for some 25 years now, and it is from that perspective as a participant and observer of the spectrum management process that I would offer my testimony today.

In my prepared testimony I identify two categories of activities directed at reforming the spectrum management process: those aimed at improving the existing administrative methods for allocating and assigning of the spectrum and those aimed at substituting marketplace forces for at least a part of the administrative process. For convenience, I will refer to these as the administrative approach and the marketplace approach to spectrum reform, respectively.

In the few minutes I have today, I would like to provide my assessment of the two categories of reform. Let me address the administrative approach first, and in doing so I need to distinguish between two functions that are associated with the spectrum management process.

The first function concerns such things as the actual allocation of spectrum-particular purposes and particular areas; in other words, the allocation process; and it also includes the assignment process in which a particular entity is granted authority or license to operate a transmitter on a specific channel within an allocation.

This of course represents the essence of the spectrum management problem, assuring that the spectrum is allocated and assigned to the highest value use.

The second function is the recordkeeping or bookkeeping function. It is associated with keeping track of who is licensed to use what channels, where, and for what purpose.

I should note that this recordkeeping function is required irrespective of whether resources are allocated based upon the administrative approach or the marketplace approach.

The reason I distinguish between these two functions, allocating and assigning spectrum on the one hand and recordkeeping on the other, is, I believe some people still cling to the hope that more powerful computers and more powerful databases will somehow allow a continued reliance on the administrative approach to spectrum management even in the face of rapidly increasing and changing demands for access to the resource.

However, I strongly disagree with the notion that the answer to today's problems with spectrum—namely, excessive rigidity, delays, waste, high regulatory costs, and alleged misallocation of the resource—lie in the direction of more detailed Government involvement.

Indeed, I believe it a fair reading of the record, for the past 25 years has shown that attempts to improve the administrative process through more detailed management of the resource have not been successful. In fact, I am convinced it is futile to hope that policymakers and regulators will, A, have sufficient information on the fast and rapidly evolving array of wireless services and, B, be able to react quickly enough to quickly and effectively do the job of allocating and assigning the spectrum.

Now let me turn to the other category of reform, relying upon marketplace forces for the allocation of the resources. As you know, in recent years the Federal Communications Commission has taken a number of steps to introduce marketplace forces in the process. Perhaps the most widely publicized step undertaken, with the exclusive legislative support from the Congress, was the use of competitive bidding or auctions for the awarding of mutually exclusive licenses.

However, auctioning is basically a faster and often more efficient way of assigning the license itself, but it essentially does nothing to improve the way the spectrum is allocated among services.

In my opinion, as valuable a tool as auction authority has been, the cost to society of existing misallocations of the resource vastly overshadows any potential savings or gains associated with more efficient licensing.

The Commission has also taken some other, somewhat less publicized steps to introduce marketplace's forces in the allocation process. For example, it has given certain types of wireless service providers exclusive use of their channels in a given geographic area and then given them the flexibility to change technologies or even to change the offered—change the services that they offer, all in response to marketplace forces and all without the licensing having to go back through a long administrative process.

Those of us who are involved in spectrum policy management refer to this as voluntary reallocation, and I firmly believe that sig-

nificant benefits lie in this direction; that is, in the direction of creating quasi-property rights in spectrum and then letting the marketplace work its magic through the profit motive.

Thus, I believe these efforts in the direction of placing increased reliance on marketplace forces should be supported and encouraged by the Congress.

That leads me to the issue surrounding the Federal Government's own use of the radio spectrum resource. A major problem is that, in using the spectrum resource, the Federal agencies are not subject to the marketplace forces that exist in the private sector. Thus, a cellular carrier in the private sector that introduces a more spectrally efficient technology gains the benefit of introducing that technology by additional capacity and additional profits.

On the other hand, a Federal Government agency that introduces a more efficient technology faces a situation where he may have to give up the spectrum to another agency or even see it reallocated to the private sector. This is the sort of systemic problem that Mr. Gattuso referred to.

In these situations where marketplace forces are minimal or nonexistent, special vigilance is required to assure that, on the one hand, adequate spectrum is available to the agencies to successfully perform their missions and, B, on the other hand, that spectrum is used efficiently.

Let me just close by saying that I recognize that there is considerable interest in identifying additional Federal Government spectrum that might be transferred to the private sector and then auctioned. I testified very strongly in favor of the earlier transfer of 200 megahertz of spectrum for private use but, unfortunately, have not done an analysis to be able to determine whether additional transfers in the short term would be possible.

But given the lack of incentives that I mentioned a moment ago, I would urge the committee to study closely the possibility of requiring additional shifts of Federal spectrum to the private use in the short term and to look at ways of introducing economic incentives into the process in the long term, including the possibility of reimbursement for relocation that was suggested by earlier witnesses.

Thank you very much.

[The prepared statement of Dale N. Hatfield follows:]

PREPARED STATEMENT OF DALE N. HATFIELD, CEO, HATFIELD ASSOCIATES, INC.

Thank you Mr. Chairman. I very much appreciate the opportunity to appear before this Committee today to address the important issues associated with the Federal government's management of the radio spectrum resource. As a former government employee and now as a consultant and part-time academic, I have been involved in various aspects of spectrum management for over 25 years. It is from that perspective as a long-time observer of the spectrum management process that I would like to offer my testimony today.

Interestingly, when I first became involved in spectrum management over 25 years ago, there was already widespread recognition within the technical and regulatory communities that (a) the radio spectrum resource was increasingly critical to our economic well-being, to the safety of life and property, and to the national defense and (b) the traditional processes and tools for managing the radio spectrum on a centralized, administrative basis were becoming largely inadequate in dealing with the increasing and rapidly changing demands for access to that precious resource. At about that time, there was a report published entitled "The Silent Crisis" and it spelled out in some detail the importance and difficulties associated with

management of the radio spectrum resource. It was referred to as the "silent" crisis because the role and nature of the radio spectrum resource was not well understood outside the realm of a relatively small group of specialists.

The publishing of that report, and a number of other actions at about that time, led to a series of activities aimed at reforming the spectrum management process. Looked at from the broadest possible perspective, those activities could be divided into two main categories: those aimed at improving the existing administrative processes for allocating and assigning the radio spectrum resource and those that sought to substitute marketplace forces for at least part of the existing administrative process. For convenience, I will refer to these as the "administrative approach" and the "marketplace approach" to spectrum management reform, respectively.

In the few minutes I have before you today, I would like to provide my assessment of these two categories of reform. In doing so, I will be relying, in part, upon a report I prepared under the sponsorship of the Annenberg Washington Program in Communications Policy Studies of Northwestern University. The report is entitled "Spectrum Issues for the 1990s: New Challenges for Spectrum Management."

I will address the administrative approach first. In doing so, I need to distinguish between two functions that are associated with the spectrum management process. The first function concerns such things as the actual choice of how much spectrum in what frequency range is allocated for what purpose in a particular geographic area—that is, the allocation process. It also includes the assignment process in which a particular party or individual is granted authority—or is licensed—to operate a transmitter (or system of transmitters) on a specific channel or set of channels within an allocation and under other specified conditions. This is the essence of the spectrum management problem—assuring that the spectrum is allocated and assigned to the highest value use.

The second function is the recording or "bookkeeping" function. It is associated with keeping track of who is licensed to use what channels, where, and for what purpose. This latter, record keeping, function is normally necessary in order to assure that users or licensees are operating in accordance with the rules and the terms of their license and, for example, to provide a means of locating licensees to resolve interference complaints. I should note that this record keeping or bookkeeping function is required irrespective of whether the resource is allocated based upon the administrative approach or the marketplace approach.

The reason I distinguish between these two functions—allocating/assigning spectrum on the one hand and record keeping on the other—is that I believe some people still cling to the notion—nay, the hope—that more powerful computers and more powerful databases will somehow allow a continued reliance to be placed on the administrative approach to spectrum management, even in the face of increasing and rapidly changing demands for access to the spectrum resource.

I agree that more powerful computer systems can make the record keeping or bookkeeping function more efficient, facilitate our understanding of how well and efficiently the spectrum resource is being utilized, and—through computer modeling—even suggest ways of freeing up additional spectrum for other uses in those instances where licensees do not have the economic incentives to do so themselves. But I strongly disagree with the notion that the answers to today's problems with spectrum management—excessive rigidity, delays, waste, high regulatory costs, and alleged misallocation of the resource—lie in the direction of more detailed government involvement.

In reality, I believe that a fair reading of the record for the past 25 years has shown that attempts to improve the administrative process through more detailed management of the resource by the government have not been very successful. In fact, I am convinced that it is futile to hope that policymakers and regulators will ever (a) have sufficient information on the supply and demand for the vast and rapidly evolving array of wireless services and (b) be able to react quickly enough to do a continuing good job in allocating and assigning the spectrum to its highest value use utilizing administrative processes alone. This is especially true given the rapid changes that are occurring throughout the telecommunications industry. As Chuck Jackson and I observed in recent testimony on this topic in the Senate, trying to manage a critical, scarce resource—radio spectrum—on a centralized basis is fraught with difficulties. As the Communist-block countries with centrally managed economies found to their chagrin, it is extremely difficult to allocate resources without the benefits of marketplace pressures and signals. Consequently, it should come as no surprise that allocating the increasingly valuable spectrum resource on a centralized, administrative basis should suffer from the same defects despite well meaning attempts at reform.

Now let me turn to the other category of reform—relying more upon marketplace forces for the allocation and assignment of the spectrum resource. Because of the

inertia stemming from the long history of managing the spectrum using the administrative approach and, to a certain extent, because of an initial lack of a sound theoretical research foundation, reform based upon increased reliance upon marketplace forces has been slower to develop. Nevertheless, in recent years, the Federal Communications Commission has taken a number of steps to introduce marketplace forces into the process. Perhaps the most widely publicized step—undertaken with explicit legislative support from the Congress—was the use of competitive bidding or auctions for the awarding of mutually exclusive licenses. However, auctioning is basically a faster and often more efficient way of *assigning* licenses and, by itself, it essentially does nothing to improve the way that spectrum is *allocated* among services. In my opinion, as valuable a tool as the auction authority has been, the costs to society of existing misallocations of the resource vastly overshadow any potential savings or other gains associated with more efficient licensing.

The Commission has also taken some other, somewhat less publicized, steps to introduce marketplace forces into the *allocation* process. For example, it has given certain types of wireless service providers exclusive use of their channels in a given geographic area, and then given them the flexibility to change the technology they employ and some of the services they offer—all in response to marketplace forces and all without the licensee having to go through a long administrative process (or, in some cases, without going through any additional process whatsoever). Those of us who are involved in spectrum policy matters refer to this as voluntary reallocation and I firmly believe significant benefits lie in this direction; namely, in the direction of creating quasi-property rights in spectrum and then letting the marketplace work its magic through the profit motive. Thus, I believe the Commission's efforts in the direction of placing increased reliance on marketplace forces should be supported and encouraged by the Congress.

That leads me to the issues surrounding the Federal government's own use of the radio spectrum resource. A major problem is that, in using the spectrum resource, the Federal government is not subject to even the limited types of marketplace forces that exist in the private sector. Thus, a cellular carrier in the private sector that introduces a more spectrally efficient new technology reaps the benefits—the added profits if you will—that are generated by creating additional capacity to serve more customers. But a Federal agency that voluntarily introduces a more spectrally efficient new technology may end up having to give the freed up spectrum to another agency or, in the extreme, even see it reallocated to the private sector. Essentially the same thing can be said of other government agencies at both the local and state level who utilize spectrum allocated to them by the FCC. In these situations, where marketplace forces are minimal or non-existent, special vigilance is required to assure that (a) on the one hand, adequate spectrum is available to the agencies to successfully perform their missions (or, in the alternative to assure that adequate commercial services are available from the private sector) and (b) on the other hand, that the spectrum that is allocated is used efficiently.

I recognize that there is considerable interest in identifying additional Federal government spectrum that might be transferred to private sector use and then auctioned. I testified in favor of the earlier transfer of spectrum for commercial use but, unfortunately, I have not done an analysis—nor do I have access to the necessary information to conduct such an analysis—to be able to determine whether additional transfers could be made without jeopardizing national defense and other critical goals. But given the lack of incentives that I mentioned a moment ago, I would urge the Committee to investigate closely the possibility of requiring additional shifts of spectrum to private use.

Mr. Chairman, that completes my testimony, and I would be happy to respond to any questions or comments that you or the Committee might have.

Mr. FIELDS. We will now turn to questions, and the Chair will announce that we are going to ask members to hold their first round of questions to 5 minutes, but there will be multiple rounds.

Dr. Jackson, let me just ask first of all, and if my memory serving me correctly, you are an alum of this subcommittee also?

Mr. JACKSON. Yes, I am.

Mr. FIELDS. Mr. Irving was claiming it a moment ago, and you didn't claim equal status.

Mr. JACKSON. Well, I should have mentioned it, I guess.

Mr. FIELDS. In your remarks you talked about divided responsibility, and in your statement you go perhaps a little further in

saying that it is actually a weakness, that there is a division of authority relative to the spectrum, but you don't propose a solution. Do you have a solution in mind?

Mr. JACKSON. Well, I have thought about it, and I guess in our constitutional scheme it is hard to think one through.

It seems to me that the responsibility for dividing the spectrum should ultimately reside either with the President, although to the extent that it is more a legislative function it might be more appropriate with the Congress. It is ultimately a very detailed task with a lot of administrative elements; it seems to me that it is inappropriate for the Congress to do on a day-to-day basis.

One way to create accountability would be to put all spectrum allocation authority with the President and give the President the responsibility for dividing between Federal and civil use, and therefore there would be a situation where the buck stops somewhere instead of the current situation where there is no accountability. I suspect that many people would oppose that solution—it would be hard to adopt politically.

Mr. FIELDS. Also in your statement you say that you don't believe that the Federal sector is, on average, as spectrum efficient as the civil economy.

Mr. JACKSON. That is my belief.

Mr. FIELDS. And then you say also that you need additional information to actually validate that personal belief. What information do you need? And you also said that some is not available.

Mr. JACKSON. Well, the kinds of information you need are patterns of use. One of the things, you can go to the FCC, you can look at their licensing, you can see where the stations are licensed. In the SMR industry they require loading information to be provided. Comparable information is not available from the Government, from the Federal Government uses, even for a variety of uses which are not as national security sensitive as clearly some of the military and covert uses of the spectrum.

Obviously you run into the problem that some kinds of radio systems have important national security uses which would be compromised if you discussed the design of the system, and so you have to be—you have to find a way to work around that information, and it is very constraining.

Mr. FIELDS. Mr. Irving, let me turn to you. You know, all of our witnesses have talked about the Government not being as efficient as perhaps the private sector. Mr. Gattuso said that 40 percent of the shared spectrum is not available, doesn't have service rules, and he did pay you a compliment, saying that you were a good manager, and he also talked about lack of incentives to use spectrum efficiently.

How would you respond?

Mr. IRVING. Let me take the first point first. There is a lack of hard reference information in some of the tables, which is what he is referring to, but that does not mean there are no service rules for the bands. In fact, there are bands in the table that have no reference, but by looking through the Code of Federal Regulation there are rules governing those bands which must be complied with by anybody wanting to use that, by anybody wanting a license.

There are still other bands where no rules are necessary. For example, there are 52,000 licenses granted in bands below 30 gigahertz that have no reference in the table. NTIA and the FCC are working to make sure that people understand how those bands are used. I think it is false to say 40 percent of the bands cannot be used because there are no rules. The bands aren't referenced in a table. Not being referenced in a table does not mean you cannot use the band, as 52,000 users can demonstrate.

Mr. FIELDS. Before you go to the second point, let me ask Mr. Gattuso, do you agree with that statement?

Mr. GATTUSO. Well, this might be an area that needs more information. I know that in the material that Mr. Irving is referring to, there is other material from NTIA that does say directly that I believe that 40 percent of the bands don't have service rules. Maybe there is a confusion with the terms that are being used. It certainly is an area that needs more investigation.

Mr. IRVING. Let me go to the second point with regard to efficiency. We try to be as efficient as possible in the Federal Government, and the Federal Government is not always as efficient, the Congress is not always efficient, the private sector is not always efficient. But 99 percent of the technology used by the Federal Government is a commercial, off-the-shelf technology.

But we have also been leaders in being more efficient. For example, the Federal Government has developed and championed things such as interference reduction. We are much more interference efficient than the private sector industry is. Our receiver standards are more stringent than the commercial users use. Our radar standards of the Government are better than anyones, public or private, in the world, and you talk to anybody, they will acknowledge that.

We use overland technologies so people can use their garage door openers. We are trying hard to use new technologies, to push technology out there, championing it. There may not be a marketplace incentive, but if you are a manager, a defense—Department of Defense, you want to make sure those AWACS can work up there. You have an incentive to make sure those boys and girls, men and women, up there aren't subject to any kind of interference. If you are out there trying to put out forest fires, you are not going to have any radio interference for those users out there, and you want the best technology, but it is expensive.

And let me get to one other point, Mr. Chairman. We gave up 235 megahertz of spectrum. It is going to cost the Federal taxpayer $500 million to move those people over 9 years. Most of those agencies don't have the money to move on their own; they are going to have to come back to Congress for appropriations.

That is why I am glad to hear that all of the witnesses agree that we need to talk about reimbursement, reimbursement, one, to give incentive for people to move and, two, to make sure that the taxpayer doesn't bear the burdens of these new technologies to be used by commercial interest. Commercial interest is going to benefit. Let commercial interest pay for the move. We think that is important. We are the ones who have advocated that, NTIA, in working with our friends on IRAC and other Government users, and it is very important some marketplace incentives be there.

But you can't look totally to marketplace when you are talking about lives, liberty, and property, and you have to constantly keep balancing those two factors, commercial incentives versus life.

Mr. FIELDS. Thank you, Mr. Irving.

The Chair will now recognize the distinguished member from Massachusetts, the ranking member of the subcommittee, Mr. Markey.

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

Mr. Irving, congratulations on Northwestern's victory over Notre Dame.

Mr. IRVING. I am glad that Mr. Oxley is here when you make that statement.

Mr. MARKEY. It seems to me you suffer right now from the very same problem that Northwestern does in the very near future, which is that you are invoking the old saying—I think Irving Berlin said it—which is, the problem with being a success is that you have to keep being a success, and that is ofttimes more troubling. I think it will be for the Northwestern football team, and I think that this committee is right now saying to you congratulations on your wonderful success in reallocating the spectrum in the past, now go make some more, and that is a tough job, no question about it.

We on this committee have clearly some very difficult decisions to make. There is the issue of HDTV: Should commercial broadcasters be given the spectrum worth billions and billions of dollars for free? Is it fair to simply give away a multi-billion-dollar asset while telling the public broadcasting community that times are tough and there is no money to be found for them?

And if the broadcasters, commercial broadcasters, receive this spectrum for a very nonmarketplace price because they serve the public interest, what should those public interest responsibilities entail? Should we expect more public—should we expect more children's programming from them as the price for getting this spectrum for free? What should we ask them to do for education in the school system? Should they be forced to use the digital ATV spectrum in order to serve schools, children, across this country?

I think clearly the answers to these questions have to be tied to the extent to which there is a boon which is conveyed to any of the commercial broadcasters in the country, and I think we have to work together because these are fair questions, and I think we have to get fair answers to them as well from those that are sitting out there wondering how much we would be willing to give away to them.

Now, my question to you is that a lot of people talk about how much valuable spectrum is out there. Can you give us a sense what the universe of valuable spectrum is in this world of green—and I guess it is the world of green that sits out there waiting for you to plummet, Mr. Irving.

Mr. IRVING. I wasn't going to use a lot of charts. There is one chart that shows that most of the use by both public and private is below three gigahertz. That is where most people are doing what they are doing, so that apparently is the most valuable.

However, new technologies are allowing us to use higher bands. If you look at this one, 0 to 3.1, that is where almost all of the use

by the Federal Government is. It is also where the private sector has most of its use.

Mr. MARKEY. Tell us this: How much of the spectrum is used by the Defense Department? What percentage of it?

Mr. IRVING. Right here, if you look at national defense and you go across, the total is a little bit more than 40 percent for all under 300 gigs, and it is about 40 percent for 3 gigs and under. When you get to 3 gigs to almost 6 gigs, it is about 80 percent defense, a little bit more than 80 percent defense, but you also have law enforcement. So about 20 percent in that first—in the overall and 20 percent under 3 gigahertz.

So we do have a significant—most of the use by the Federal Government is for law enforcement and defense. That is also—you know, while I believe that all men are created equal, I have got to go back to the fact that all spectrum is not created equal, and I can't take away from our Defense Department, I can't take away from our law enforcement people, and give to our commercial providers some of the spectrum.

Mr. MARKEY. Spectrum is like real estate; it is all location, location, location.

Mr. IRVING. Exactly.

Mr. MARKEY. Maybe you, Mr. Hatfield, or any of you can tell us where are the good locations, and how valuable is it to the Defense Department or law enforcement officials as opposed to the private sector?

Mr. HATFIELD. Well, I think, generally speaking, that the spectrum, as Larry has said, below 3 gigahertz is the prime spectrum, and then within that I think you want to be towards the middle of that range for a couple of reasons: One, you want to be high enough in frequency where you don't get skip and all that type of interference; you want to be above that; but you want to be low enough that the devices still are inexpensive, that the radio waves propagate well and so forth. So that prime spectrum is in that region, from a few hundred megahertz up to below 3 gigahertz; that is where the most valuable spectrum is.

I might offer one comment here. I think it is very important that we not confuse assignments with usage, and it is easy to put up tables showing how many licenses have been issued or how many assignments have been made, but that does not necessarily equate to usage, and one of the things that we need is better plain usage information; in other words, information whether the spectrum is actually being used and not just assigned.

Mr. MARKEY. And, Mr. Gattuso, if I could ask you, in your testimony you point out that a potentially huge source of licenses that could be auctioned is the spectrum being proposed for new advanced television services. Do you believe that broadcasters plan to use the digital ATV program flexibly—in other words, use it for nontraditional broadcast services, such as paging, data services, et cetera? Should nontraditional broadcasters, computer companies, for example, be excluded from obtaining such licenses as well?

Mr. GATTUSO. Yes, I do. I am glad you asked that, in fact. I used the term "advanced television services" just as a marker so people would know which bands I was referring to.

I think the FCC should not limit that band to any particular use, whether that is advanced television or paging or something we haven't even thought of yet. I think it is crucially important that we leave that open. It may be advanced television, but it may very possibly be something else entirely.

Mr. MARKEY. Thank you, Mr. Chairman.

Mr. FIELDS. The gentleman from Colorado, Mr. Schaefer.

Mr. SCHAEFER. I would thank the Chair and ask that my statement be made a part of the record.

Mr. FIELDS. Without objection.

[The prepared statement of Hon. Dan Schaefer follows:]

PREPARED STATEMENT OF HON. DAN SCHAEFER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF COLORADO

Thank you Mr. Chairman. This subcommittee has been handed the difficult task of finding $14 billion in revenue from spectrum sales. The Budget Committee has obviously placed a great deal of confidence in the value of spectrum. Ironically, this may be the result of the fine job our colleagues on the other side of the aisle did in 1993 when this Committee ordered spectrum auctions for the first time.

We now have before us a range of new options for auctioning spectrum. Included among those is auctioning private radio licenses, used primarily in intra-company communications. If this Subcommittee chooses to go that route, as chairman of the Energy and Power Subcommittee, I would like to work with you to ensure that the public safety exemptions include the appropriate utility and pipeline safety functions. I offer whatever assistance I may provide in that area.

I commend you for holding this hearing, Mr. Chairman. Thank you.

Mr. SCHAEFER. And would congratulate the Chair for holding these hearings.

We have a range of new options, no question about it, for auctioning spectrum. Included in a lot of these auctions are private radio licenses. It is used primarily for intracompany communications. So I would say to the Chair, if the subcommittee chooses to go in that direction, as the chairman of the Energy and Power Subcommittee, I would like to work with him to ensure that public safety exemptions include the appropriate utility and pipeline safety functions or whatever other assistance that we would be making.

It seems to me that we have a number of competing policy goals in this whole debate. First, we obviously need to make money for the Federal Government. At the same time, however, this committee has a strong interest in promoting competition in the telecommunications industry, as we have shown with H.R. 1555.

Current FCC authority to auction licenses is limited for initial services. However, some have advocated really auctioning licenses for current service.

In the case of new licenses being issued for a service which incumbents are already operating with free licenses, I would ask the question of the panel—and anyone could comment on this—how would auctioning the new license impact competition?

In other words, won't we really hurt competition if we force a huge new licensing cost on new competitors, thereby providing a competitive advantage to the incumbents?

Anyone comment on that, please.

Mr. GATTUSO. If I can, I don't think it would, for a couple of reasons, the first being that most incumbents across the board, no matter what service you are looking at—not every service, but the bulk of them have purchased their licenses already on the resale

market. It is very rare to find someone who is still holding an initial grant from the FCC.

So when you auction off the new services you are actually putting them on the same level as someone who has already bought their license on the resale market.

A second thing I will point out is, I think we all have to remember that the point of auctions should not be to raise money for the Government. You are right; it is a negative whenever you see money coming from the private sector to the Government.

The advantage of auctioning is that it is the most efficient way to get licenses, to get spectrum into the private sector. It took 10 years to use lotteries to get cellular services into the private sector using auctions for PCS, we have used only a fraction of that time, and that is to the advantage of the private sector, the advantage of consumers, and only coincidentally, is a big plus for the U.S. Treasury, as well.

Mr. JACKSON. I would just like to add to that, if we look, say, at PCS and cellular, the way PCS technology is developing today, it looks like it is going to be highly competitive with cellular, yet the PCS firms had to buy those licenses at auction; it would appear that people like Sprint, AT&T, and PrimeCo are well committed to going out and competing.

So I think we have an example from our recent history of where people have bought those licenses and are moving forward to compete.

Mr. SCHAEFER. Mr. Hatfield or Mr. Irving, any comment?

Mr. IRVING. I think on average we would agree that it is better to use a market solution. I think that Mr. Gattuso and Mr. Jackson have made some strong points. There are also some instances where, for example, Chairman Hunt has been a proponent at the FCC in taking some services, for example, some of the cellular licenses last year, where he wanted to auction them and he couldn't get a majority of the Commission to go along.

I think the chairman was correct. I think what he was trying to do is, if these licenses have not yet in some communes been issued, why should we, because some people got cellular licenses through a resale market or through the lotteries—why shouldn't new cellular licenses be granted via auctions? We think it makes some sense. He thinks it makes some sense. Unfortunately, the majority of the Commission didn't concur.

I don't believe that anybody would have been harmed by the chairman's suggestion. In fact, I think it would have been better policy had his colleagues agreed with him.

Mr. SCHAEFER. Mr. Hatfield?

Mr. HATFIELD. I wanted to add, in addition to auctions, the other possibility is to use a system of fees for those people who are currently using the spectrum and have not essentially paid for it previously. Some sort of system of fees would encourage them to hold on to channels they don't need and would also of course pay the public for the use of the valuable public resource.

Mr. SCHAEFER. Mr. Chairman, that is all I have right now at this point, unless I can think of something else.

Mr. FIELDS. The gentleman yields back.

The Chair recognizes the gentleman from Pennsylvania, Mr. Klink.

Mr. KLINK. I thank the chairman for yielding to me and also for holding this hearing. I think this is a very important discussion and one that I know that I personally need a lot of information on, and I welcome the witnesses here, say I have enjoyed all of your testimony; I found it to be very informative.

If I address any of my questions during my brief 5 minutes to any of you, I invite anyone who feels that they have a follow-up to just jump in, because I find this discussion very informative.

Mr. Jackson, let me just start with you. One of the things that you had said—and I think you have reiterated it in some of your responses to questions—is that auctions are not appropriate for all spectrum uses. Could I ask you to elaborate on that, and how do we differentiate when and how an auction is appropriate and when it is not?

Mr. JACKSON. Well, let me give a couple of different examples, and one example would be licensed PCS. Where firms are going to get the license, they are going to have control over spectrum over a large region. They can, inside the firm, make decisions about controlling interference, introducing new technology.

In contrast, if you think of something like cordless phones in the home, where you have literally millions of telephones across the United States—I think I read that about 40 percent of households have them; what is that, 40, 50 million cordless phones—they don't use much spectrum. If you had to go through a licensing process for each of these things, people take half an hour to fill out the paperwork, and it would be typed into some data base, all of that to manage a $100 or $200 radio transmitter; it is inappropriate.

So for something like cordless phones or unlicensed PCS—or Apple has a proposal at the FCC now for something they call the National Information Infrastructure band of about 300 megahertz up at 5 gigahertz or something like that. For services like that where no one person owns the band, it is sort of managed the same way you do a resident—a park in a neighborhood or a street in a neighborhood as distinguished, say, from a freeway or a turnpike. Using auctions would be inappropriate. There is nobody there to buy it.

Another area where I think auctions may be inappropriate, although it is a closer case, is public safety communications. For a variety of reasons, which I think I have outlined in my written testimony, I don't think that public safety entities in this country would be best served if we put them to—put their spectrum up for auction, although there are arguments on the other side in that case.

Mr. KLINK. I think you were testifying also that the spectrum from 380 to 400 megahertz are used in this country for the military, and you say that many of our NATO partners are using this spectrum for police communications systems.

If I could ask Mr. Irving: What kind of international coordination of spectrum usage should we expect to see, and what is taking place to see that that occurs?

Mr. IRVING. A large part of NTIA's job in terms of spectrum management is coordinating with other governments. We will be going

in less than a month to the World Radio Conference. Most of what we will do is talk about how we can coordinate better. Our domestic industry requires the ability; our domestic satellites, we lead the world; we require the ability to get into other markets.

NTIA, along with State and along with the FCC, is going to be arguing on behalf of our LEOs, industries, our fixed satellite industries and others, to make sure that the rest of the world understands the importance of these technologies and works with us to free up some spectrum.

One of the questions you asked about 380 to 400 megahertz—and some NATO countries are committing some noninterference usage in that band. What that means is, if you come into that band and only allowing 10 megahertz to be used—if you come into that band as a garage door opener and cordless phone and the military has to use that band and you get stomped on in terms of interference, that is your risk.

We in the United States, our Defense Department believes that because we are still the preeminent military force in the world, we need that band whole; 380 to 400 megahertz, as Dale noted, it is prime spectrum, but it is not the kind of spectrum that our defense forces feel we can give up at this point, notwithstanding the fact in NATO some are using for some purposes on a noninterference basis part of that band presently.

We are not looking at this point at giving up 380, 400 megahertz. Obviously if the Congress tells us we have to, we will, but we believe it is more important our fighting men and women have access to that band and we have a noninterference basis usage from garage door openers or cordless phones or some other such technology.

Mr. KLINK. Mr. Irving, then would you require—and I will let Mr. Jackson follow up, but would this be part of the discussions that you will be having with other countries to make sure that you can——

Mr. IRVING. 380 to 400 megahertz is unlikely to come up, but that type of discussion we will have.

What we try to do is coordinate, to make sure that, whether it is military or commercial or other uses, that everybody on a global basis is looking at these things holistically so that you don't have a problem.

Landing rights, for example: If I am going to fly a plane and it has got to be able to land using a system in the United States, well, that plane may also go to London, or it may go to Sydney, Australia, or it may go to Brazil. I have still got to be able to land that plane. We have to be able to make sure the radios in any plane, domestically and internationally, will work in any other land. We have to make sure that there are blocks for our fighting men and women. We have to make sure there are blocks for LEOs, for fixed satellites, and we do try to coordinate. In fact, a large part of our job is policy but also international coordination.

Mr. KLINK. Thank you.

Mr. Chairman, I see the red light is on.

Mr. FIELDS. The gentleman yields back.

The gentleman from Ohio, Mr. Oxley.

Mr. OXLEY. Thank you, Mr. Chairman.

Mr. Gattuso, in your prepared statement you say under auctions, ATV license, a second and potentially huge source of licenses that could be auctioned is the spectrum being proposed for new advanced television services, ATV, and it struck me that with the advent of digital it appears in the area of high-definition television we have somehow stumbled into the truth as far as providing that vis-a-vis the old analogue system which the Japanese had very much been a part of.

Based on what has occurred so far, I would like to ask any member of the panel, starting with you, Mr. Gattuso, what you see as the future of high-definition television. When it came out, or when the initial concept was there, it was ballyhooed as the next great progress going from black and white to color and then the high-definition television, the potential for job creation and economic opportunities. Are we proceeding towards that goal, or are we stuck in the mud right now in that development?

Mr. GATTUSO. Maybe I will leave some of the technical questions to the engineers on the panel.

Mr. FIELDS. Would you take the mike, please.

Mr. GATTUSO. I am sorry. Maybe I will leave some of the technical questions to the members of the panel regarding ATV.

I think the thing we most need to remember when you are dealing with any sort of consumer electronics is that advances are extremely difficult to predict. I think very few people predicted many of the systems we have out today—we would have VCR's instead of disks, at least for the time being. A lot of people thought we would have quadraphonic stereos in every home right now. It is a field, if you are making an investment and coming up with a new engineering advance, in which you are taking a gamble, and sometimes they pay off tremendously and sometimes they don't pay off at all.

I think the progress on ATV so far has been very encouraging, and it looks like it could be a very successful product, but look at what has happened so far even in the last 5 years. Our concept of what that is is vastly different than what we thought it would be 5 years ago. Five years ago, we were looking at an analogue high-definition television system. Today we are looking at advanced television on a digital basis that could provide other services at the same time. Five years from now, it could be something completely different.

So I may be punting on the question a little bit, but I think that is the crucial point; we simply don't know what is going to happen and we need to adjust our public policies to account for that uncertainty.

Mr. OXLEY. Well, that is the ultimate question. Obviously it calls for us to maybe crystal-ball-gaze a little bit as to what we might see.

Mr. Irving, you have been involved.

Mr. IRVING. I believe ATV, advanced television, is going to benefit broadcasters and consumers, if for no other reason it gives broadcasters increased flexibility. Some broadcasters are going to use digital television to provide exactly what we thought they would provide, CD quality sound, higher resolution, wider aspect ratio, and that is going to benefit some consumers. Other broad-

casters will use it for multiplexing apparently, and that can benefit consumers by giving them additional choices. Other broadcasters are going to use it in both ways, and some broadcasters may use it for PCS or cellular or data-type services, and that can benefit the consumers by creating more competition in those marketplaces.

What is important for those of us who are involved in policy is to make sure that as we are developing policies we do a couple of things: One is that we do reclaim the spectrum that was talked about earlier. If we are going to give 6 megahertz of new digital spectrum to take the 6 megahertz of analogue spectrum back and make sure that happens, we shouldn't let anybody have 12 megahertz of spectrum for free.

We should also make sure that we set some guideposts in terms of what the new responsibilities of broadcasters are going to be in this new world. Certainly this administration has said if you are going to use 6 megahertz of spectrum and you are not going to use it for broadcasting purposes, you can use it for some type of revenue raising purposes, whether it is subscription TV or PCS like services, that the taxpayer should gain some benefit from that even if it was auctioned off.

We are not promoting or advocating an auction of the digital spectrum. We are stating that the analogue-digital have to be swapped. You have to give the digital back, and then the analogue will certainly be auctioned. And we are also saying we have to have a robust debate about what the responsibilities of broadcasters will be when they receive that swapped spectrum.

Mr. OXLEY. The Chairman reminds me that is in the legislation, what you propose, although Mr. Gattuso apparently is skeptical about the ability of the FCC to take that spectrum back, if I read his remarks correctly.

Mr. GATTUSO. I think if that spectrum is not auctioned off at an early time, the politics of the situation and past experience tell us, it is unlikely to happen in the future. So if we do not auction off the digital, what I call the ATV spectrum, at the very least we should act quickly to auction off the NTSC.

Mr. OXLEY. Mr. Jackson.

Mr. JACKSON. Yes, I was just going to respond to a couple things that I heard here. One is that what we are seeing is a transition, and because of the way the broadcast system is designed with very diffuse ownership, hundreds of broadcast stations, millions of receivers in people's homes, changing standards is very difficult. And so the color TV standard in this country has been the same for almost 50 years, half a century, which is a long time for a standard in consumer electronics.

We have now seen a new approach to it developed, which I think is going to be more striking in the transition from AM to FM in oral broadcasting, and that is moving from analog to digital, and I think that the general architecture of the advanced television design, which is to go into the television band; here in Washington, DC, we use channels, say, 20, 26, and 32 are all UHF broadcast stations. Well, it turns out that you can slip in a digital station, maybe channels 23 and 29, transmit on that without creating too much interference to the existing stations, and ultimately transmission—transition to all digital transmissions.

I think that the view that you can take these digital pipes and use them for paging and PCS and actually compete with the paging and PCS companies is extremely optimistic. These systems were designed to deliver television programming, digital television programming to households, and they will do that very well.

I think that giving broadcasters the flexibility to explore other applications means the consumers have more options. I think that you will find these systems succeed at in the marketplace is delivering either multiplex—more or less standard definition television or one or two high definition pictures over that pipe—and that the other applications will be much less important.

Mr. HATFIELD. If I could just add, I spent the last quite a few years of my life chairing the FCC's spectrum analysis working party of the advisory committee, and I would like to confess that we started out looking towards high definition television. I was sort of excited, and it would be easy to get discouraged at this point, having come so far.

I think that would be a mistake, because what we have been able to do in that process is identify an enormous amount of additional spectrum that we could use that is right smack dab in the middle of the most precious part of the radio spectrum.

So now we do, it seems to me, have a real opportunity. It may not be HDTV. It may be multiple NTSC signals, maybe one perhaps dedicated to children's programming. There is an opportunity now to recapture an awful lot of spectrum that has been sitting essentially fallow for a good many years.

So it goes back to my testimony, what to do now I think is provide the flexibility, let the marketplace decide what that is used for, and of course personally I would support the notion that the broadcasters do pay for the use of that additional spectrum.

Mr. FIELDS. The gentleman's time has expired.

The gentleman from Illinois, Mr. Rush.

Mr. RUSH. Thank you, Mr. Chairman.

Mr. Irving, I am concerned about the effects to the FAA and other public safety affects. Can you describe what the possible effect of taking more spectrum away from government allocations, particularly the FAA, if allocations were reduced?

Mr. IRVING. We are going to try hard not to have any adverse effects. I don't want to do anything that would scare any would-be user. I fly a lot, as almost all of the members here. You go back to your districts. I come to your districts from time to time at your invitation and——

Mr. RUSH. We are concerned.

Mr. IRVING. Yes, I understand. I am not going to try to debate it with you or scare any would-be user of airplanes. What we are trying hard to do is make sure that we don't have those problems. We are looking at GPS as an alternative. One of my panelists mentioned that global positioning satellites may allow us to do low level, low visibility landings more safely than using the spectrum—it may. It is something that NTIA has been working diligently with the Russians, with our domestic industry, with international fora to make sure it happens. The FAA has been way out there, but it may not, and a lot of other nations don't want to use GPS; they want to use existing systems.

Mr. MARKEY. So the proposal here is preferable to the FCC procedure, which would gain 90 percent but would also be subject to litigation?

Ms. RIVLIN. That is right. And the litigation is probably the big point.

Mr. MARKEY. Yes.

Ms. RIVLIN. The dollars may differ, but the real point is this proposal is a sure thing and the other is not.

Mr. MARKEY. OK. Now, let me focus upon another issue that is raised because it is printed too often and is very deceptive. That is, that this legislation generates a floor guarantee of $400 million for the government in addition to another $100 million or so guaranteed revenues. But that is not the ceiling. As you pointed out, CBO estimates a much higher level, but that is strictly an estimate. We don't build in an estimate into our legislation, but we don't in any way inhibit our ability to reach a higher level.

As a result, is it not likely that this legislation very well could produce a billion dollars or more for the Treasury, but that you are only restricted by your ability to project. And as a result, you are just limiting it to what is guaranteed by the legislation.

Ms. RIVLIN. Well, the guarantee would be around $500 billion, and that in fact is what the CBO is saying because that is the way they score things.

We are actually estimating the $1.5 billion because we are looking at the recent experience with auctioning, and as you will remember, the estimates made by both us and CBO were very low. As the auctions developed, they brought in more money than anybody expected, and we are not being wildly optimistic here, but based on the recent experience, we think that this will be a very substantial——

Mr. MARKEY. As a rule of thumb, should the Federal Government operate under the premise that it is going after certain guaranteed dollars or speculative dollars in trying to reduce the deficit?

Ms. RIVLIN. I don't know that there is a rule of thumb about it, but common sense, and especially in this case, would, I think, lead you to believe that a certain amount rather than the risk of nothing would be prudent.

Mr. MARKEY. Thank you.

Mr. Irving, aren't we today operating under that time-honored tradition that the companies that have in the telecommunications industry try to block those that have not and could challenge them in any one of the fields that they may happen to be in?

This committee over the years has seen AT&T try to block MCI and Sprint and others getting into that business. Then the cellular industry blocking Nextel and Fleet Call, getting into that business. Now it is the RBOC's and the cellular industry blocking PCS competition, especially those pioneers that are ahead of the curve and more ready to get into the marketplace.

Could you give us a little bit of history on this subject so that we can see that it is not just about money, this debate that we have here today, and that when a single company starts to take out full-page ads in newspapers, it is not because of their concern about the Federal deficit as much as it is about their competitive posture with other companies in the same industry.

Mr. IRVING. I think it is fair that any of us who have been watching the telecommunications marketplace, it is fair to say that you do see the incumbents often trying to inhibit their would-be competitors.

I think it is particularly ironic in the case of Pacific Telesis taking out the ad in yesterday's newspaper because many of us know that Pacific Telesis received 25 megahertz of unfettered spectrum for free from this government. They made billions of dollars off of that free giveaway, and then they sold it for something between $11 and $12 billion to another company last year.

Mr. MARKEY. I am sorry. Did you say billion dollars?

Mr. IRVING. Between $11 and $12 billion.

Mr. MARKEY. The company that put the ad in the newspapers made $11- to $12 billion on the free spectrum which the government gave to them?

Mr. IRVING. And they have made no suggestion, as one of my colleagues has noted, no suggestion that they would take some of the revenues of that $12 billion and help us pay for GATT.

Mr. MARKEY. Now, can I ask one more question? We gave that spectrum, that is, the government, to that company back in 1984 or so.

Mr. IRVING. Yes, sir.

Mr. MARKEY. And we gave it to them when they were a united company with ratepayers and shareholders. Who received the benefit of the sale of that spectrum that derived $11 to $12 billion, the ratepayers or the shareholders of that company?

Mr. IRVING. To the best of my knowledge, the shareholders received the full benefit of that $12 billion sale with little, if any, benefit going to the ratepayers, those who actually owned the spectrum and those who would receive the benefits of this provision in the GATT bill.

Mr. MARKEY. And they paid absolutely nothing for it?

Mr. IRVING. Paid zero, Mr. Chairman.

Mr. MARKEY. And these pioneers, only three of them, are going to have to pay 85 percent?

Mr. IRVING. They will pay something that we estimate in the administration will be above $1 billion and they will help us pay for GATT.

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

I yield back the balance of my time.

Mr. DINGELL. The Chair thanks the gentleman.

The Chair recognizes the gentleman from Texas, Mr. Fields.

Mr. FIELDS. Thank you, Mr. Chairman.

I will ask a question I think I know the answer to. Commerce and OMB were not involved in the selection of the pioneers.

Mr. SALLET. That is correct.

Mr. FIELDS. At what point did you become engaged in the process?

Mr. SALLET. Well, Mr. Fields, as the considerations were drawn up to find financing for the GATT proposal, obviously the administration looked at sources for that funding in order to offset the tariff reductions that are also in GATT.

Mr. WHITE. Could I stop you there, Mr. Hatfield?

Mr. HATFIELD. Sure.

Mr. WHITE. Assuming you could have your perfect world and you could change it in a fundamental way that would solve the problem, do you have a suggestion to make or would you have to think about that a little more, too?

Mr. HATFIELD. I think Chuck did a good job of that. I mean, obviously you would like to have a single point of responsibility, a person or group that would have responsibility to make sure that the spectrum is allocated between the—the split between the Federal and the non-Federal is done in some sort of an optimum way.

But it seems to me this—and certainly I am not a lawyer and I am certainly not a constitutional lawyer, but it seems to me that this does raise some very fundamental separation of powers issue. I think the President does need to be able to get access to spectrum to do certain vital national interest things, and you have to, it seems to me, allow him.

On the other hand, as Chuck said so eloquently, when you look at spectrum in the broadest sense, it seems to me that is exactly the sort of thing this Congress, as our policy-making body, should really have those choices. And how one resolves that, it just seems to me like it is a fundamental dilemma and I don't see an easy way out. I am hesitant to put all the power in one place for the separation of power reasons for—if nothing else. But here again, I hesitate to answer because I am not a scholar by any means.

Mr. WHITE. You had a couple other things that I interrupted you on.

Mr. HATFIELD. Well, I just want to say, beyond that, I think my testimony is that I think we have to increasingly look to marketplace forces as a way. I just don't think, no matter how well-intended people can understand this market well enough, can collect the information they need, understand the alternatives, and do all that to be able to manage this resource centrally.

The communist countries I think found that out here a few years ago, and I don't think we have any better chance than they do of doing a good job centrally. That leads me then to say you must move in the direction of using marketplace forces. In particular, in the government thing of course, is to provide the agencies with some economic incentives to give up their spectrum.

For example, one of the things that troubles me a little bit is an agency that has an assignment, existing frequency assignment, if they are not using that assignment very much, has very little incentive to turn it back in. If they were paying an annual fee for the use of that channel, would they turn it back in? Well, perhaps. But it seems to me we need to look more toward financial incentives to get the agencies to use that resource.

Let me just add one thing. We have heard, very importantly Larry has pointed out that there is a lot of life and death and safety of life and property issues involved in this spectrum. But also the government agencies use spectrum for some more day-to-day things. The Park Service uses it to collect trash. They may have a radio in their trash collecting vehicle. And I think it is very important to distinguish between those uses which are absolutely essential to public safety, life, property, and so forth, and those issues

which could very just as well be acquired from the private sector on a commercial basis, and we ought to be urging agencies to make sure that they get those types of service from the commercial or private sector and not necessarily use spectrum that—vital spectrum otherwise.

Mr. JACKSON. Could I respond?

Mr. WHITE. I wanted to make sure you had a chance to respond since Mr. Hatfield said it was your idea.

Mr. JACKSON. I think that one of the things we will find is that auctions that place dollar values on the spectrum will allow us to get some guidance. If you are working for the Defense Department today or say 5 years ago and you are designing a new radar, you know what band it is going to go in because we have got the historical bands, and your decision is: How do I build the best radar I can with the budget and use up all the spectrum? And there is no sitting around saying, gee, if I used a little bit less spectrum, would that free up a billion dollars' worth of spectrum for some other application? There really wasn't anything to quantify that trade-off.

And now we are getting that kind of information from the FCC's auctions and I think that will feed into the decision-making process and be helpful, and I think that if the committee can encourage that kind of internalization in the administration, it would be a good thing.

The other thing, I would just like to amplify on something that Dale was saying at the end there, is that civil uses of the spectrum also save lives. People with phones in their car can call 911. The nature of the reporting of traffic accidents has changed as cellular has become more widespread. Lives have been saved with that. So it is—you know, the Federal Government doesn't have a monopoly on the use of spectrum to save lives. I could give other examples but the red light is on.

Mr. WHITE. I appreciate it.

Mr. IRVING. I would like to respond very briefly. With regard to radar efficiency, again, we are as efficient as we can be as a government. In fact, we lead the world and I know that the Defense Department talks of military applications around the world. I don't believe any Defense Department official says, "Oh, I have got all this spectrum, let me use it up."

What they are saying is, "What can I do to do the best job so the fighting men and women will have the best tools?" not, "How do I squander spectrum?"

With regard to cellular technology, that is true that 911 has saved lives. The Federal Government, including NTIA, is working to save even more lives. If your wife or sister or daughter has a problem, pick up a phone right now. If she uses a hard wire phone, she has a better chance of having police find her, or him if it is your son, than if she uses a cellular phone because we don't have the E-91 capabilities yet for cellular phones.

One of the things NTIA is doing is working with the Federal Government, and also the private sector, if there has been a cordless phone used. We use things like GPS, which our Defense Department has developed, so you will be able to use your cordless phone the same way you use a hard wire phone. If you use a cordless phone, they can find where you are.

A lot of the things you are finding in the commercial marketplace were developed, pioneered, and improved by our defense force and our law enforcement forces, by the Park Services, by Federal Government users.

There are some trade-offs here, but we are not sitting here defending the Defense Department, given my historic leanings, but I don't think it is fair to say that the Defense Department sits there and tries to figure out the most inefficient way to use spectrum just because they can.

Mr. JACKSON. I did not mean to indicate that they squandered. It is just that when they don't have a price on using the spectrum, but they have a band they go in, they build the best radar they can with the budget they have got, and spectrum is one of the things you can consume to make the radar better, and if you give them a budget for the spectrum as well, they will trade that off at the economic value it has. But if you don't put a price on the spectrum, they won't trade it off. It is the right thing for the person to do. They are doing their responsibility. I never said squander and I didn't mean to imply that.

Mr. FIELDS. The gentleman's time has expired and the Chair will now recognize the gentleman from Virginia, Mr. Boucher.

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

Mr. Irving, let me return with you to the subject of HDTV broadcast and the award of a second 6 megahertz of spectrum to the commercial television broadcasters. The goal of that proposed award is to provide a transition from the analog broadcast of today to a digital broadcasting regime.

During the transition period, we in effect would have broadcasters broadcasting on 12 megahertz. The old 6 megahertz they are using today would continue with analog broadcasts and the new 6 megahertz would accommodate digital broadcasts, and that circumstance would continue until the time that the base of television sets in the United States had been converted from analog to digital, until consumers owned digital sets, and at that point in time, the analog broadcasts on the old 6 megahertz would cease and that old 6 megahertz could then be surrendered to the government and be auctioned. I think I have fairly stated that proposal.

Now, knowing when that auction can occur requires knowing how long the transition is going to take from analog to digital television sets, and I have heard that that could be a period of about 15 years. I would welcome any information you have about how long we anticipate that transition time taking.

I would also welcome any comments that you have about the notion that perhaps we could auction that old 6 megahertz substantially in advance of the time that the transition is complete.

My own sense is that bidders would be willing to offer considerably less for spectrum that they can't use for 12 or 13 or 14 years than they would for spectrum that they could use next year, and perhaps the government would not maximize its return if we were too hasty in terms of auctioning that additional spectrum.

I have heard some witnesses today talk about the potential for early auctions of that 6 megahertz and I would like to get your response as to whether you think that makes economic sense in view of the transition time from analog to digital that we contemplate.

Mr. IRVING. I will try to go against form and be brief in my answers because I think my colleagues would like to answer this as well.

I have heard 15 years, I have heard 10 years, I have heard numbers in between. I don't think anybody can accurately reflect how fast it is going to take for the transition to HDTV to take place. No one really knows. No one can know.

If you look at PCS, if you look at the penetration of personal computers, look at VCRs, cellular, certainly new technologies are being adopted faster by consumers than ever before. The pace of PCs outpaces that of VCRs, which outpace any electronic product before that. And certainly the old maxim that work will expand to fill the amount of time available would also apply with regard to HDTV. If you are a broadcaster and you had 8 or 9 years of transition, you would start marketing HDTV faster. If you are a manufacturer, you do the same thing. If you had 15 years, you wait until year 9 or 10 before you started really marketing because you knew you had less time.

With regard to whether or not people will pay the same amount of money, I think the PCS auctions have been instructive. We had the auctions. People spent literally billions of dollars on them and they know they are not going to have access to that spectrum for several years.

We did create commercial incentives for the incumbent users to get out. I would suggest that might be something Congress might want to consider with regard to broadcasters, that they might have a commercial incentive to get out earlier.

I don't think that I can sit in 1995 and say whether HDTV is going to be fully deployed in 2010, 2005, or something short of that. Part of it is going to have to do with marketing, part of it is going to have to do with whether consumers want it.

I do think that we should try to have it done earlier rather than later because it is a more efficient use of spectrum. We would like that spectrum back. The administration has made no determination whether that should be 10 years, 5 years, or something in between. Speaking as Larry Irving, as a policy, we would want to get that spectrum back sooner. And I do think the longer broadcasters have 12 megahertz, the longer they are going to want to have 12 megahertz.

Mr. BOUCHER. You can agree, the spectrum can't come back to us until the conversion from analog TV sets to digital TV sets is essentially complete; is that correct?

Mr. IRVING. I would agree with that.

Mr. BOUCHER. All right. And that is going to take—the minimum estimate I heard you provide was 8 years. What I have heard is twice that length of time in the likelihood, and you would also agree, would you not, that we should not contemplate an auction of that 6 megahertz of spectrum until we anticipate that the government is going to have that back in its hands and we could make it reasonably available to the people who prevail in the auction?

Mr. IRVING. I agree with everything you said up until the last point because that is not administration policy and I don't want to get outside my portfolio or my mandate. Maybe if you ask those who have a different view.

Mr. BOUCHER. I wouldn't ask you to go beyond that.

Let me ask you just to comment in terms of our experience with PCS. Those auctions were completed, at least the early rounds, within the last year, and I understand that the rollout of those services is contemplated by those who succeeded in the auctions sometime next year. So we basically have a 2-year lag between the time we put the product on the market and our auction—and our spectrum was sold and the time the services can actually come in.

Mr. IRVING. It is more like 3 years because there are some incumbent users and they don't have to leave by law for 3 years. They have an incentive to get out and I know, having talked with some of the winners in the PCS auction bidding, they are trying to develop commercial incentives for people to get out. They aren't entirely successful. Some are trying to figure out ways around with interference. You want to stay, fine. I am going to work around you. It won't work as well in television because of the power of the signal, but there is a lot going on and all of those bands won't be cleared for about 3 years. It is about a 3-year life.

Mr. BOUCHER. Let me simply conclude, because my time is up, with this point and just ask if you agree, that we should not attempt to auction the 6 megahertz of spectrum at some point that is 3 years or more than that in advance of the time we actually expect that spectrum to be surrendered back to us because the value we will get for it will be substantially diminished by the time it would take to actually make it available to the people who succeeded in the auctions.

Mr. IRVING. I wish I could give you a yes or a no. I don't know that I agree with it, but I also don't know that I have authority to answer it. So for that reason, I can't give you a definitive answer.

Mr. BOUCHER. Thank you very much.

Mr. FIELDS. By the way, I don't know if the gentleman was here when the Chair made the announcement that there will be a second round of questions.

The Chair would now recognize the gentleman from Illinois, Mr. Hastert.

Mr. HASTERT. I thank the Chairman.

Previously Mr. Rush asked a question concerning the FAA spectrum, and Mr. Irving basically said that you are not planning on changing the spectrum assignments, but yet we are looking at this. The whole focus of this is how can we incentivize, I guess, Federal agencies that have spectrum to change and to give up, in a sense.

Mr. IRVING. Congressman, I hope I didn't say that. The FAA is going to be one of those bodies that will be giving up some spectrum over the next 9 years, and then what Congress tells me to do, they may have to give up more spectrum in the future.

What I said, we will do nothing in the Federal Government to compromise the level of safety the FAA has accorded the American people.

Mr. HASTERT. And I wasn't here to hear the statement and I am sure that we want to make sure the safety is there.

One of the things that we have had is a problem in safety, and is there a possibility that if we do—for instance, if the FAA does give up or is asked to give up some spectrum and the bargaining

power or bargaining tools we have with that is to maybe help the FAA upgrade, as well as move, relocate their spectrum and upgrade their equipment, would that be a possibility?

Mr. IRVING. It is a possibility, but in talking to my friends at the FAA, they said, where are we going to move to? It is not just the question of moving. Where are they going to move to that is going to give them the same level of service?

I do think we agree, and we hope the House will adopt what the Senate has adopted, and that is giving people incentives so they can get better equipment. But even if I have better equipment, I still have to have spectrum to use. That is the question.

Are there other bands that will give them the same level of service and quality of service as the bands they are in, or can they use the bands they are in more efficiently with better technology. Those are issues we are facing and we want to face and we think we can face.

Mr. HASTERT. So the question, if there is a possibility, we may want to explore that possibility. If they can move or if there is a possibility they could use spectrum that is out there that they are not at at this point, there may be some incentives to get the equipment and the expertise to make them more efficient and have better equipment at that level; is that correct?

Mr. IRVING. Yes, but they are tough issues. One of my colleagues, and I think it was Chuck, stated that 200 megahertz was difficult—235 we turned over is difficult. Anything above that is going to be even more difficult. I think he is right.

There are no easy choices here. I am not a physicist. I am not an engineer. I have a lot who work with me or for me and they tell me it is going to be a hard job for us to go back and get more. It is going to be difficult—but that doesn't mean it is impossible to do. We just want to make sure that nothing we do interferes with the ability of government users to do the job that they are paid to do.

Mr. HASTERT. Mr. Jackson, Mr. Hatfield, what do you think about incentives and trying to move people, in this specific case with the FAA? Is it a possibility?

Mr. JACKSON. Well, I think that generally the question of incentives is a good one to think about and I think I am the only one who hasn't so far endorsed having people in the private sector who get Federal spectrum reimbursed by the Federal Government for the systems that are displaced. I want to associate myself with that position.

If you think about the FAA, maybe there is—I have to confess to being kind of ignorant, and the last time I worked in navigational systems, the systems have since become obsolete.

Mr. HASTERT. The problem is the FAA is still using those systems. As a matter of fact, they are still using the vacuum tubes that we have to import from Poland to make the equipment work.

Mr. JACKSON. But I wouldn't be surprised if there are many situations where, in the process of upgrading to more spectrum efficient technology, you get other benefits as well: Digitalization, modern reliability, remote maintenance, and that there is an opportunity for—it is a necessary concomitant of buying new technology that you have to buy the latest and best, and that you may be able

to get an upgrade as well as a replacement at the same time as you get the transition.

Mr. HATFIELD. I was just going to add again that we have talked about in terms of moving from one part of the spectrum to another part of the spectrum, but with the increased deployment of fiber optics, and particularly the deployment of fiber-optic rings where that between any two points, you actually have two ways of getting there. So if there is a failure in one part of the ring, you can go around the other and still maintain communications.

With those sort of advances in the technology, it may well be that some of the things that have—some of the things that radio has been used for before, point-to-point applications, can be moved over onto the terrestrial fiber, fiber backbone.

And I think one of the things that we are saying here is that the people in the government, when they sit down to decide—should I put in a new microwave network or should I put in a new—or should I get leased fiber facilities from a carrier—that the spectrum ought to carry a price so that that is a rational decision from our economy's standpoint, that they shouldn't favor spectrum, because it is free, over fiber that is equally or perhaps even more reliable. And I think that is the important part of getting the price signals out there so that the government engineers will make the rational decision on an economic basis.

Mr. HASTERT. Thank you.

Thank the chairman, yield back my time.

Mr. FIELDS. The Chair now recognizes the gentlelady from California, Ms. Eshoo.

Ms. ESHOO. Thank you, Mr. Chairman, and it is nice to be back and see all of my colleagues. I think that September 7 is a welcomed time to have this hearing rather than August 7. I think we would have really been completely out of steam then. Thank you for holding the hearing and thank you for coming here to give us the best of what you know. I note that Mr. Hatfield has obviously an association with Northwestern. Congratulations. That was quite a game and quite a win.

To Assistant Secretary Irving, I had another question but I want to follow up on something that you said after I came into the hearing, that the process of finding excess spectrum is difficult and that, in your own words, there is a threat that muscle and bone will be cut and not just fat.

Some of my constituents which operate in unlicensed bands fear that the drive that Congress has to meet reconciliation goals will result in their losing their spectrum to auctions. Do you think that we are going too far with auctions and do you think that my constituents, especially those that are part of the Part 15 wireless communications companies which share their spectrum with other users, is it a very real fear on their part?

And then my second question that I invite anyone to address themselves to is: When do you think auctions are appropriate and when do you think they are not? But first I would like to start with Assistant Secretary Irving. Thank you.

Mr. IRVING. Thank you. It is our hope that we won't go too far and we don't believe we are going too far. Our experience with auctions is a relatively new experience. I think that the nine point sev-

eral billion dollars we saw come into the Federal treasury has driven a lot of interest in auctions. People who didn't know what an auction was in terms of spectrum all of a sudden are confirmed about its utility.

We think it is important we have a debate. We think it is helpful to push this because we think auctions in most instances are correct. We do believe that things like cordless phones, garage door openers, other Part 15 type applications are important and need to be protected and ought to be debated.

We also want to make sure, as several of my colleagues have noted, that budget doesn't drive policy. There is always a question about how—should budget drive policy. Within the administration we try to make sure budget doesn't drive policy. I think it is important for all of us to remember that we shouldn't let budget, just purely pocketbook issues, drive technology being deployed, how to be sure we maximize efficiencies of some technologies, how to make sure that public goods are still able to be provided through the marketplace.

We will certainly do everything we can to make sure that the debate is a balanced debate, that it is not just driven only toward revenue, but it is also driven toward how you maximize public welfare, and that includes some unlicensed activities; we are going to try to continue to protect those, as well as our Federal Government users, as well as the commercial interests of things like our satellite industries and our cellular industries and our PCS industries and broadcasters. All of that has to be balanced. We hope we can do a good job. We hope that one thing, dollars, doesn't drive the debate.

Ms. ESHOO. Thank you.

Does anyone want to——

Mr. GATTUSO. I think Mr. Jackson had explained very well a little bit earlier too, I want to endorse what he had said, that there are a lot of areas where you do not want to have auctions, and I think one way to think of it is essentially auctions are a way of providing—give the FCC a way to decide who gets a license when they are mutually exclusive applications.

So those are the situations when it should be used. If there aren't any mutually exclusive applications, then we shouldn't even be thinking about auctions at all.

For Part 15 devices, it is simply not a concept that is applicable. For a lot of the high frequency devices where the characteristics are such that there is a very low likelihood of interference and therefore you don't have mutually exclusive uses, there you also should not use auctions.

But whenever you do have two applications sitting before the FCC and they need to decide, auctions are just a better method of deciding than any other method we have come up with.

Ms. ESHOO. Interesting.

Mr. JACKSON. To respond, I would agree with that. I think that there are uses—like Part 15 is a good example—where it doesn't make any sense to go through a licensing process. It would be too expensive.

Ms. ESHOO. They can't afford it actually.

Mr. JACKSON. You can't really have an auction. I think another example of an area where auctions are difficult is for small mobile users. The natural units to license in spectrum are supposed to be—need to be, if you want efficient control of interference inside the firm, fairly large. The FCC, in its recent PCS licensing, granted 50 licenses across the country, or 50 geographic regions, 51, I guess, actually. Each license region is about as big as a State. That allows an awful lot of the control of interference to be done inside the firm.

But if a community wants a license for their police department or if a plumber wants a license for their firm, they can't participate efficiently in those big auctions and it is very hard to run an auction small enough to meet their needs. One way to meet their needs is of course they can buy their service from a service vendor that buys their spectrum in the larger world, but that isn't how the industry grew up historically. So we have, I think, a difficult time accommodating these small mobile users in the world of auctions and I think there will be controversy over this for some time to come.

Mr. HATFIELD. I was going to add, there are probably some scientific uses too. For example, radio astronomers depend on having certain spectrum clear to them so they can hear very weak signals, and things like that I think are probably also not appropriate for auctions as well.

Mr. IRVING. We all hear from the ham radio operators from time to time. I don't think we want to talk about auctioning ham radio spectrum either.

Ms. ESHOO. Thank you. I don't have any time to yield back. Thank you, Mr. Chairman, and thank you again to our witnesses.

Mr. FIELDS. The gentlelady's time is expired.

The Chair would now recognize the gentleman from Texas, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman. And I would probably direct my question to Mr. Irving. I hope he will talk slow enough for me to understand his answers.

Mr. IRVING. I will do my best, Congressman.

Mr. HALL. I have been listening to him for a long, long time and have been one of Larry Irving's big fans from this side of the Hill to his present position, and to the three gentlemen who are giving their time, I know it took time to prepare and time to come and time to go and for that I would say that the spectrum auctions that have taken place have been a huge success and of course my hat is off to those people that have made that happen. You are all a part of that.

The congestion, though, the rapidity I guess of development has brought about some congestion, and in reading the testimony, or scanning the testimony, not just of yours, but of others that have been before us in other days, I find that the pressure to raise funds for the treasury and increasing demands of the private and public sectors for spectrum have led to the place where we are today, brought you here to this table and brought this committee here. And I guess while the gentleman from Virginia talked about the time, distance is very important because time is money.

Bobby Rush addressed the problem of the small people. I think my problem is with the small market stations, and while you may have touched on that, I was not here. I listened to some of your answers to Mr. Rush, but the question that the proposed sale of certain spectrum now under consideration, as I understand is under consideration, could have a negative impact on certain broadcasters. And I am talking about—you know, we had talked about our own folks and certain broadcasters like Tyler or Jacksonville, Sherman, in that area, and there is a concern that it is going to be economically difficult or impossible for these small stations to bid and pay for auction spectrum and also to absorb the huge cost it is going to take to convert these broadcast operations to digital.

One, I believe the one from Jacksonville, estimated $2 million, which is big bucks in small business. As a result, I think it is possible that you are going to jeopardize a continuation of free over-the-air broadcast of news, weather, emergency alerts, sports, entertainment, and all those things that are important to people out there, that they have come to expect them, and they are going to be, I think, rather upset if they begin to lose them.

I would also say that the congestion that has thrust us to this table and the desire to raise funds for the treasury need to be coupled with promulgating fairness and nurturing competition and that is what you are going to have to do. So my concern is with what the proposed auctions are going to do to these small to medium markets.

Now, I think Mr. Gattuso addressed that on auctioning licenses and gave some good suggestions in there, but I would like to hear what you think about this. What are your comments on these views that I receive from the people that I represent from the small to medium markets? What is their place in the sun?

Mr. IRVING. Let me try answering you first. I am probably the only person at the table who has been in your district, and so I know some of the small broadcasters from my days of working at the Texas Association of Broadcasters and when I worked for Congressman Leland, and I know the people you are talking about, and the stations and the economic circumstances they find themselves in.

Mr. HALL. And the way you know them, they might have blind copied you with letters to me, but go ahead.

Mr. IRVING. They didn't, but they probably will. But having said that, I think that you have a President from Arkansas, a Vice President from Tennessee. They have the same type of experience with small broadcasters. And that is the reason we are not advocating at this point auctioning off the digital spectrum for HDTV. That is why this administration's perspective is that we should swap it out.

As long as we want broadcasters to do HDTV, we think there has to be a transition time. How long that transition time should be is subject to debate and discussion and it should be a robust one.

But certainly we think you take the six analog, swap it out to six digital. You find the transition time that makes some sense. You have auctioned off that analog and you give people time to amortize out that $2 or $3 million investment for digital technology to convert to advanced television.

That is our proposed solution. What we are trying to figure out is, what are the public users' responsibilities for broadcasters in the digital age and what should the transition time be? Those are the issues that we are trying to confront. We have already faced the issue of we don't believe we should auction off the digital spectrum. That is not the administration's policy at this time.

Mr. HALL. With time meaning money, and I understood your answer to the gentleman from Virginia that you couldn't give him any specifics on the time. No one knows, I think, was your answer there.

Mr. IRVING. We would like to do more analysis. We hope we can get to a better resolution of that issue, but as I am here before you today, I don't have a specific time that I could suggest the administration would favor.

Mr. HALL. Mr. Gattuso, you want to enlarge on what you have in your written testimony?

Mr. GATTUSO. Sure.

On the question of small broadcasters, I think there are really two questions here, and the first one is one I spent my—discussed in my testimony—is, what is best for the economy and what is best for consumers? And I think an auction of this new spectrum would be the best for both the economy and consumers. It will get you the best services. It will allow the flexibility. The number of competitors coming in would potentially be maximized.

The question you are raising, more a question of social policy, is, are there broadcasters out there, are there individuals, companies out there that deserve Federal support for the social value that they bring? Because we want the smaller entities to continue; we want these particular individuals to continue.

I think the important thing there is that if we want to provide a Federal benefit for them that they can continue, we should be very explicit about it—it shouldn't be something that should be hidden in a larger reform. I think other subsidies that the Congress provides for the most part are out in the open, are very explicitly made for the most part through direct appropriations. Maybe that is a route to go.

At the very least, if we have an auction and there is a special discount or exemption for certain broadcasters, that should be perhaps costed out separately so we know what transfer we are making.

Mr. HALL. I thank you. My time I have to yield back, but I just wanted to get the expression of these small market stations, to kick them into the computer as you are approaching this, and I thank you and thank the chairman.

Mr. FIELDS. The Chair now recognizes the distinguished ranking member of the full committee, the gentleman from Michigan, Mr. Dingell.

Mr. DINGELL. Mr. Chairman, thank you for your courtesy to me. I commend you for holding these hearings today. I have a few brief comments. Then I have some questions. I would also ask, Mr. Chairman, that I be permitted to have the privilege of directing some questions in writing to the members of the panel in view of the fact we are entering into a very complicated subject.

Mr. FIELDS. Without objection, and the Chair will also note that the record will be left open for 30 days.

Mr. DINGELL. Mr. Chairman, I believe we should be proud of the way the competitive bidding statute written by this committee 2 years ago has worked. It has raised a lot of money for the treasury; it has expedited the licensing of new services to the public. But I don't believe that the euphoria over this matter should cloud our judgment. The competitive bidding we authorized has worked well because in it we recognize there are instances where such is appropriate and there are instances where it is not.

Expanding auction authority has real potential for creating profound and unintended changes in the ability of American business to utilize radio technologies. It also affords significant opportunity for mischief being done to police, fire, and public safety, and quite frankly also to the national defense, and there could be unintended other consequences, including misallocation of the spectrum in ways which would not conform to the public interest.

I would also like to caution my colleagues that there is no painless or easy way to raise $2 billion a year for the next 7 years. While there are inefficiencies that can be recognized and realized by the use of government in its spectrum use, simply dipping into that well again may have various and dangerous effects, as mentioned earlier.

With regard to this, I would like to ask a couple questions now, if I could, please. If the Air Force were to be—and the Navy were to be compelled to reallocate and to retune their frequencies currently used just for Air Force installations alone, and such spectrum were allocated—or rather were earmarked for transfer to the FCC, how much would this cost to retune the Air Force radars? Does anybody here know?

Mr. IRVING. I can't give you a precise dollar figure. We are working on that. We are talking about something approaching billions of dollars. We have $236 billion invested today in Federal Government users of spectrum. If you are retuning and reallocating and relocating, there is a cost there. We spent a half a billion dollars—we are going to spend a half a billion dollars as a Nation. The taxpayer is going to have to compensate us in the government.

Here is the investment right now. Just for the 235 megahertz we turned over, we estimate it is at least $500 million, and that is the least painless one we are going to have. To retune all of our planes, all of our ships, all of our radios could cost a lot of money and a lot of time. We have to find new bands as well.

Mr. DINGELL. Do you think that question should be asked of each government agency and using your agency perhaps as a lead agency to see to it that the answers are properly collated and made available to this committee in good form?

Mr. IRVING. It is hard to, because unless you know what you are moving to, you can't tell exactly. But yes, we have started that process and we would not hesitate, if you asked us to, we would certainly go back to the IRA process and all the Federal Government users and talk to them about their anticipated cost. We think it is an important issue that people should know, because unless we get reimbursement or unless the taxpayers are going to pay for

it, they are going to have a hard time in these budget days moving their equipment somewhere else.

I don't want to go to the FAA and Department of Defense and say, yes, we know you have less money than you had last year but we will make you spend untold millions and billions of dollars to move so that private sector companies can benefit from that move.

Mr. DINGELL. Before this process begins, ought we not take a strong look to see what the military and the national security needs, police, fire, and public safety needs are so that we know what it is we are allocating away from essential public uses of the spectrum?

Mr. IRVING. Yes, we should.

Mr. DINGELL. Is there any such identification of those needs at this time?

Mr. IRVING. There is not a complete identification. On Monday, we will have something called the Public Safety Wireless Advisory Council which will be headed by Phil Vivere. It will start that process, but we are not close——

Mr. DINGELL. We don't have the vaguest idea of what that spectrum might happen to be?

Mr. IRVING. No, sir.

Mr. DINGELL. Now, there are a lot of public needs, just as you mentioned. The military, police, fire, and public safety are not the only public needs for radio spectrum.

Mr. IRVING. No, they are not.

Mr. DINGELL. Is that not so?

What are the changes which should be made in spectrum allocation rules with regard to the public interest with regard to the legislation before us? If we are going to allocate or reallocate spectrum, ought we not make some intelligent decisions as to what should be the proper priority in terms of the spectrum which would be made available to different users and uses?

Mr. IRVING. Yes.

Mr. DINGELL. For example, the public transmission of pornographic matter ought to be ranked somewhat lower than, let's say, police, fire, and public safety, or perhaps some other intelligent use; isn't that——

Mr. IRVING. I would concur with that view.

Mr. DINGELL. So we ought to have some intelligent judgment as to where the public needs are best served in this kind of use.

Now, how will we craft a study and who should conduct a study which would identify and answer the questions and the other questions which I have not yet been able to identify with regard to spectrum allocation here?

Mr. IRVING. We would be delighted to work with the committee in crafting such a study. I believe candidly that NTIA is the best agency to go forward because we are the manager for the Federal Government through the IRA process and our historical relation with the Federal Government users, and also public safety users.

Mr. DINGELL. Now, I had a communication Admiral Mackey, who is the Commander in Chief of our Pacific forces. He has expressed great concerns about the possibility of allocating away spectrum from military use.

We are pursuing those questions, and, Mr. Chairman, I would ask that the correspondence between Admiral Mackey and myself on this point and on other matters be inserted in the record so that the committee can have the—an awareness of the concerns of the military with regard to this question of spectrum use and how these matters should properly be dealt with so that we don't go transferring spectrum perhaps to somebody who doesn't have a great need for it from the military or from the police and fire and public safety, and I would also like to——

Mr. FIELDS. Without objection.

[The letter follows:]

COMMANDER IN CHIEF, U.S. PACIFIC COMMAND,
CAMP H.M. SMITH, HAWAII,
5 September 1995.

The Honorable JOHN D. DINGELL,
Ranking Minority Member,
Committee on Commerce,
House of Representatives, Washington, DC.

DEAR MR. DINGELL: During your visit for the World War II Commemorative in Hawaii, we discussed the frequency spectrum issue. I fully understand and support the spectrum needs of the emerging telecommunications technologies and the positive impact these technologies are having on the worldwide marketplace. However, I am concerned about the trend of chipping away at the DOD portion of the frequency spectrum.

DOD analysis of the military spectrum has primarily focused on bands below 6GHz. This includes the following bands which are critical to our military operations and must be protected:

225-400 MHz	960-1600 MHz	3100-3300 MHz
406-410 MHz	1755-1850 MHz	3500-3625 MHz
430-450 MHz	2200-2290 MHz	4400-4800 MHz
902-928 MHz	2360-2390 MHz	

These bands are not necessarily an all-inclusive list. Other bands may be identified as the analysis continues or it may be found that portions of the bands mentioned are candidates for further sharing. We cannot afford the loss of bands which are used for critical command and control communications, weapons control and guidance, radar, telemetry, and radio navigation systems. Their loss will seriously impact our day-to-day military training, plans, operations and ability to maintain the peace.

It is a forgone conclusion that there will be a more integrated government and industry use of the frequency spectrum. However, additional study is required to minimize the impact on our Armed Forces operational capability. Any study must take into account the large acquisition investment the nation has made. We must also consider the intended future use of the spectrum, the impact the loss of current spectrum will have on our military's capabilities, and the manner we want to use the spectrum in the future.

I applaud your efforts to make efficient use of the frequency spectrum and seek your help in doing it in a pragmatic manner.

Sincerely,

R.C. MACKE,
Admiral, U.S. Navy.

Mr. DINGELL. I would also like to ask the question, if I could, Mr. Irving, we have got the problem of allocating the spectrum in the broad public interest. This means that some of the old kinds of uses that were referred to in some of the excellent statements and some of the old technologies which are now applied, we have an opportunity in this reallocation to reform those uses, but it requires some kind of intelligent application to understand what the changes in those technologies should be so that we can perhaps consolidate the use of spectrum there in a better and more seemly fashion. Isn't that so?

Mr. IRVING. We agree with that.

Mr. DINGELL. How in the name of common sense are we going to do that?

Mr. IRVING. I think you need a holistic, coordinated approach to it and, unfortunately, we haven't had that to date. This debate is a good starting point. But I also think we have to recognize it is going to cost time and money, both of which this process doesn't lend itself to.

The time question is, people want the spectrum today. We have got to figure out where people can move to. They have got to figure out if it works for them. We have got to do some analysis of the spectrum. It is also going to cost money. We have got to buy new transmitters or retune the transmitters, move people, move equipment. This is not inexpensive, and in most instances, we haven't had that debate.

Mr. DINGELL. Your advice is to make haste slowly and look before we leap in this matter so we know where we are going to light when we are done; isn't that right?

Mr. IRVING. That is a perfect way of explaining it.

Mr. DINGELL. Mr. Chairman, I thank you for your kindness to me. My time is expired.

Mr. FIELDS. The gentleman's time has expired.

The Chair will now recognize himself for 5 minutes on a second round of questions.

Mr. Irving, let me just say to you that, to me, there is common sense needed on this very complex question. There are public policy questions. There are cost questions. No one wants to compromise national security, but if we could go back to your chart for just a moment, the second chart, do you have—and when you see that below the 3 gigahertz, the 40 percent that is assigned for national defense, and Mr. Hatfield made a distinction a moment ago between an assignment and actual usage, and Mr. Jackson, Dr. Jackson, talked about the lack of information to know what might be available relative to Federal usage of the spectrum. Do you have access to the information to evaluate defense usage of spectrum?

Mr. IRVING. I have access to some of that information. I can't tell you exactly all the information I have because I don't know all the information that my staff would have.

I also, with a particular regard to defense, would want to be cautious because I don't know if I would be compromising national security issues by—even if I isolate out the covert or black box issues, I don't know if I could give usage beyond that black box issue without compromising the black box issue. It doesn't make any sense.

If I know the Defense Department has a certain amount of spectrum, and I know that some of it is nonconvertible, do we want anybody else out there to know which percentage is convertible and which percentage is not convertible? That could give them some information they shouldn't have.

I want to be very careful that I do nothing in terms of making public information on national defense that could compromise our national defense, so it is a delicate balance.

Mr. FIELDS. I understand it is a delicate balance and it is a delicate question to pose to you, but there has to be some process, since you are the President's representative, in identifying spectrum that

might be available for transfer to the private sector. How do we get that information? Because when you see that much reserved for national defense, again, none of us wants to compromise national defense——

Mr. IRVING. Can I make one clarification on this chart? This chart does not mean that 40 percent of the spectrum below 3 gigahertz is used for national defense. It means of the 100 percent of government use in the bands below 3 gigahertz, 40 percent of that government use is by the Defense Department.

Mr. FIELDS. It is assigned to the Defense Department, isn't it? Does that actually mean that it is used?

Mr. IRVING. It is assigned to the Defense Department. But it is important to also note that in that band, some of that is shared, a very small portion of that is government exclusive. So even though it is 100 percent of Federal use and 40 percent and 100 percent, we don't take 100 percent of that band.

Mr. FIELDS. Perhaps we should have this discussion in private. But from my particular perspective, I would like to have some comfort level that the spectrum is actually needed, that it is not just assigned and that it is being used.

Let me also ask on the chart, relative to the resource management control, you have got 20 percent of that that is assigned to the Federal sector. What is that use for?

Mr. IRVING. That is interior, mining, park services, those types of people who manage our resources, and they have a significant number. It goes everything from trash collection, but it also has beyond trash collection, communications, wireless communications among our resource managers. I would assume that might also be part of NOAA and the Weather Services as well.

Mr. FIELDS. Let me go back and ask a question. That is the assignment.

Mr. IRVING. That is the assignment.

Mr. FIELDS. Do you know how much is actually being used?

Mr. IRVING. I don't know it right now. But certainly if the chairman wants me to find out, I will get him an answer.

Mr. FIELDS. I would like you to find out, and an evaluation of how much is needed, because again, I think there is some common sense and it is the reason to have the initiation of this particular hearing process, to get a better understanding of the spectrum that is available, the potential value of that spectrum.

Mr. IRVING. Can I make a suggestion? I understand, I think, the bottom line of what your question is, how much spectrum is the Federal Government hoarding or how much is laying fallow. We don't believe much is laying fallow but we will certainly do our best to amplify the record to demonstrate to the extent we can, without compromising law enforcement or national security or other issues——

Mr. FIELDS. I think that goes the direction of the questioning of Mr. Dingell. I think there are a number of us who would like to have that answer. How quickly do you think you could do——

Mr. IRVING. It is a very labor-intensive effort. I would like to go back and talk to my staff, talk to the affected agencies and give you a sense.

[The information appears at pg. 57.]

Mr. IRVING. Let me give you one other problem that has been pointed out in a message that my staff has sent up to me. Some of the spectrum we are using right now for defense or resource management or whatever is shared spectrum with other users. So in some instances, we are not using all of it, but we are not using all of it because we are sharing it.

So you not only have to move the Federal Government user, you then have to move the Part 15 people, you have to move the garage door opener people, you have to move the cordless phone people as well. We have to do not only an analysis of what Federal Government use is. Then I would have to go talk with my friends at the FCC and find out some of the commercial or private sector uses in order to give you a complete answer on what is happening.

I may find an instance in which the Federal Government is in a band and they are not using that band to its full extent, but the reason they are not using it to its full extent is because they are aware there are other users in that band that is sharing it. It is a time and resource exhaustive——

Mr. FIELDS. It would be interesting to me and perhaps other members to also know where those services might be privatized. I mean going back to the thrust of the statements by all of our witnesses that the Government may not be the most efficient user of spectrum, and I assume that also means that if you had a private sector, perhaps private sector company, contracting with the Government, you would also have a rollout of newer technology that may make the Government more efficient not only in the use of the spectrum but in performing service. I think that would be an important part of that particular question.

Mr. IRVING. I agree with that, but I would like to respond to that, too. While in some instances a contract with a private sector carrier may be more efficient, in many instances the technology used by the Federal Government is the best technology or is at least as good as the technology.

The other thing we have got to think about, if, based upon this conversation, I come back and tell you that yes, the Department of Agriculture could contract with a private carrier for certain services, they then have to contract for it. So instead of having an internal process where they are buying receivers, they have the spectrum, and, doing it internally, they then have a contract.

I don't know about the U.S. Department of Agriculture, but those in this Department of Commerce might feel budget constrained, and trying to go out and make a contract with a private carrier is going to cost some resources we do not presently have and the Congress isn't necessarily in a position to give.

So there are some tradeoffs here in terms of what Dale is saying, but if you did mandate that you go out and use private carriers, I hope Congress would also recognize that those users then have to have the resources to actually effectuate those contracts and use them and they are able to do the job efficiently for the American people, are able to use radio communications. Just as the public sector is using radio communications, we want the private sector to use it, use it efficiently and save money. We are trying to save money.

Mr. FIELDS. The Chair's time has expired.

The gentleman from Massachusetts, Mr. Markey.

Mr. MARKEY. Thank you, Mr. Chairman.

The point that I think is still unclear throughout the course of the proceedings thus far is how much of the spectrum the Defense Department needs, how much the FAA needs, how much the police chiefs need, and I just think that—and I might make this request, Mr. Chairman, that we have a panel with the top general or admiral in the Pentagon that is responsible for spectrum management to sit here, the top police chief in America to sit here, the head of the FAA to sit here and tell us what they need and what their transition period would be as well. And I think we have to have someone here from the broadcasters to sit here as well with the other—with the other Government witnesses. That is the central tension here. And perhaps someone from the computer industry, a software industry, that sits here as well. Then we just have the shoot-out over the spectrum and we will hear what each one of them will give us.

I wouldn't bet against the Defense Department in a shoot-out, but they haven't taken on the broadcasters and this committee yet.

So the issues are clearly such that, with tens of billions of dollars on the table, we have some questions that will have to be asked of the broadcasters especially. For example, if we give them the spectrum and don't auction it off, they are basically saying well, we will convey a public boon on the American people, the viewers, by giving them these new options.

So the question would be, what are those new options? Now, if they tell us that the new options might be paging and, you know, wireless computer opportunities, why can't the computer companies do that as well, and why can't we have that as a part of the auction process?

Conversely, if they say well, it will make it possible for us to convey more public interest benefits and that, you know, sub silentio includes kind of an assumption on our part that that includes children's television programming and things related to that subject, what do they mean? What is the commitment they are going to make? because we can't really get a commitment out of them anyway on children's television programming. What will they do for the schools of this country if we give to it them rather than make them go out and bid for it in an auction marketplace?

In other words, the reason we would treat broadcasters differently is because there would be a public interest for the viewer/taxpayer. In other words, the taxpayer wouldn't be getting this money from the broadcaster but getting something else, and I think that they would mean by that not a new paging service or necessarily another station seeing "Wheel of Fortune" reruns but something that was much more beneficial for the society if they are going to break it into four stations, five TV stations. Wouldn't one of those stations be a children's television station for each one of these broadcasters? If it is, well, I will sit over here and say well, that is a public interest.

Will there be something that will be available for all the local schools, elementary schools, in the area that they can look at as one of their five or six station? Well, I feel good about that, too.

But if it is all commercial and things that computer or software companies can do as well, well, for that I would kind of lean towards saying well, let's get money out of computer and software companies' pockets for the taxpayer side of this viewer; we are not getting that much from them. If there is something for them in his children, her children, then I am more inclined to go that way.

So it is not anything that I am married to one way or the other, I am an agnostic on this subject, but I do want each of the contestants for this very valuable property, especially those that are looking for the giveaway, to sit here and to defend it and to tell us what they are going to get, yes and no, good or bad, up or down.

But I want to hear what we get, not some speculative blue sky promise that we can't quite quantify, because clearly the dollars are quantifiable, and, God knows, I stand second to none in my commitment to balancing the Federal budget and I would just as soon just auction it off rather than just give it away, you know. Second to none, second to none. I am not conceding that position to anyone on this committee. So that is my—you know, that is my bottom line in this whole discussion.

So I will just finish with this little story that Newton Minnow reminds us of in his recent book. It is a case of Stanley S. Newberg. Mr. Newberg was an Austrian immigrant who came to the United States in 1906, succeeded in manufacturing and real estate, and when he died in 1986, he bequeathed his fortune of $5.6 million to the United States Government in deep gratitude and privilege of residing and living in this kind of government, notwithstanding its many inequities.

After Newberg's will was settled in 1994, the money went directly to the United States Bureau of Public Debt where it lasted exactly 90 seconds.

Well, we are here right now talking about huge amounts of money that can be used in different ways, and I don't mind it going in one direction or another as long as we know where it is going to be earmarked for. And I would hate to take such a vast amount of money and act as Mr. Newberg did without having had the discussion on the communications subcommittee as to what the public will receive from any decisions which we make, and, for my purposes, that means more for public education and more for children's television if in fact we are going to bequest this to the broadcasters or any other entity in the country.

I thank you, Mr. Chairman.

Mr. FIELDS. The gentleman yields back, and in the interest of budgetary responsibility, let me say to my friend that I think that there is a need for further discussion and I think that amongst the members of this committee we should decide among ourselves how we wants to proceed.

I think one thing that we do need is to get from Mr. Irving some kind of analysis and evaluation of not only what is assigned to the Government but also what is being used, and once we get that I think we can better understand how we do proceed on that particular question.

Mr. IRVING. We will do that, we will do that as rapidly as possible and efficiently and expeditiously, but there is an issue I just want to raise in the hearing.

Mr. FIELDS. You are not going to take 2,000 days.

Mr. IRVING. No, I will not take 2,132 days, I promise. With regard to the Defense Department usage—usage differs. When we went into Haiti, when we went into Grenada, now we have the Bosnian crisis, last week we were scrambling with NATO, we used the spectrum much more than we did, we will this week or next week when we do not have a crisis. I have got to find a way to measure that usage. When Oklahoma City blew up or we had the World Trade Center, law enforcement officials were using spectrum much more heavily. I have got to make sure in those kinds of instances they have the spectrum they need. And there are times when it is not used a lot. But I just want to make sure, and I want to make sure for the committee's sake, that we have to make sure that in times of crisis they have the tools, the resources they need to scramble. We hope we never have to use the go code but—I was in the armed forces. Those of you in the armed forces understand what the go code is. But when we have to use the go code, there has to be spectrum to make that go code available to every soldier deployed anywhere in this country so that they know. It can't just be how they are using it every hour, every day.

A broadcaster is going to use the spectrum a lot more. They are broadcasting 24 hours a day. A general may need to have some spectrum available so if he has got to go into Bosnia, he has to go into Haiti, he has the available resources. It will not be an apples to apples analysis but we will do the best we can to work with our colleagues to get you the best report we can as expeditiously as possible.

Mr. FIELDS. Mr. Irving, we appreciate that.

I think all of us on the subcommittee recognize the historic moment that we are in and the reason that all of these issues should be put on the table for evaluation and analysis as we are going to attempt to do.

I want to thank all of the witnesses for coming and sharing their expertise with this subcommittee, and, with that, this hearing is adjourned.

[Whereupon, at 12:10 p.m., the subcommittee was adjourned.]

[Additional material submitted for the record follows.]

PREPARED STATEMENT OF PETER K. PITSCH, ADJUNCT FELLOW, THE PROGRESS & FREEDOM FOUNDATION

It is an honor to have this opportunity to testify before this Committee on one of the most important telecommunications opportunities facing America—reforming our management of the electromagnetic spectrum. I do not come recently to this issue. I was in the thick of FCC deliberations on spectrum policy in the 1980s, first as Chief of the FCC's Office of Plans & Policy for Chairman Mark Fowler and second as Chief of Staff tax Chairman Dennis Patrick. During those years I strongly espoused reforms that would give licensees more technical and operational control over how they use their spectrum and the use of auctions for initial assignments where there are mutually exclusive applications. Since then I have consulted for various telecom companies on spectrum and other FCC-related issues.

Most recently, I and several other analysts from a wide range of think tanks helped write The Progress & Freedom Foundation's report on the FCC, "The Telecom Revolution, An American opportunity." In it, we recommended privatizing spectrum management.

The overarching goal in managing the electromagnetic spectrum should be to maximize its value to the American people. As in the rest of our economy, the best means of achieving efficient use of the spectrum is to rely principally on market forces. In my brief remarks today. I would like to catalog various types of failure

systemic to the current centrally-planned, government-run spectrum regime, then identify the two ways in which spectrum reform can be achieved, and lastly spend a few moments discussing the tremendous importance of spectrum reform to America's economic and competitive prospects.

There are three fundamental problems with the current system. They span the 60-year history of the FCC and continue to this day. They are systemic. One, the FCC like other central planners lacks the information necessary to make efficient decisions. Two, the administrative process has been used by special interests to delay competition and innovation. Three, the current system has held fallow or underutilized a substantial portion of the spectrum for government purposes.

First, determining efficient use is a complex task requiring vast amounts of continually updated information that is hopelessly beyond the abilities of an administrative process. Markets, of course, "parallel-processes" information gathered by millions of businesses and consumers to continually provide price signals on the relative usefulness of the myriad competing demands and uses of spectrum. In the case of spectrum, the information required to make the necessary tradeoffs is greater than in most other areas of the economy, because the pace of technological development has created a raft of new uses for "wireless" communications and new ways in which spectrum can be efficiently deployed.

As a result, the FCC has consistently made simplistic and overly rigid decisions that misallocated spectrum, created inefficient industry structures, and locked in outdated technical standards. For example, in the 1950s the FCC dramatically underallocated spectrum to VHF television reducing the availability of television channels and impeding the development of a third, fourth and fifth national television network. In the 1970s it long delayed and then underallocated spectrum to cellular mobile telephony, creating only two cellular companies. This delay alone cost America $85 billion dollars. Time and again it imposed a nationwide grid that did not account for local differences-underallocating forestry spectrum in Idaho and overallocating it in New York City and vice versa for taxicab spectrum. Finally, the FCC locked in an analog technical standard for cellular telephony that was 20 years old and out of date by the time the FCC got around to assigning cellular licenses.

The second systemic failure of the current spectrum regime is its susceptibility to capture by special interests opposed to innovation and competition. In the face of political pressure, the FCC has again and again delayed the allocation of spectrum to innovative new services. Examples include Direct Broadcast Television, so called "wireless cable", low power TV, VHF drop ins, new FM channels, and satellite-delivered radio service to cars. Few companies and no trade association can resist the temptation to use the current regulatory scheme to disadvantage new competition or innovation. The sad reality is that in this "regulatory game", the established concentrated economic interests typically triumph over the amorphous and diffuse interests of consumers.

The FCC's public interest standard has been used as a weapon against consumers. Regulated companies frequently have embraced special public interest obligations in exchange for protection from competitors and innovation. This "taxation by regulation" by unelected regulators, followed by the inevitable quid pro quo, has been extremely costly to consumers. Any such deals should be made explicitly and only by Congress.

The third systemic failure of the current system of spectrum management is the underutilization of spectrum by the government sector. While there is some debate on how much spectrum is effectively denied to the private sector, there can be little doubt that it is in absolute terms a huge amount. Many governmental uses of spectrum are vital; others are not. All of these uses should be justified economically. Today government users of spectrum have access to spectrum at far less cost than that available to non government users. Recall that in the recent PCS auctions the winners paid over $7 billion for 60 MHz of PCS spectrum. The government has exclusive or "shared" access to thousands of MHz.

The simple solution to the current spectrum gridlock is to give existing and new spectrum users more operational and technical flexibility to use their spectrum the way they see fit so long as they do not interfere with their cochannel and adjacent channel "neighbors." The logic of this reform is easily illustrated. Typically, a licensee has two choices: (1) use his spectrum for a narrow purpose with the specific technology that that FCC has designated or (2) give it back to the FCC. Given this choice, the current spectrum use will be economic to the licensee as long as it has any positive value. In economic terms the "opportunity cost" of the spectrum to the licensee is zero. The cost to society, of course, is any foregone alternative use that is more valuable.

Once a licensee is given the freedom to use his spectrum for a broad range of uses, however, he has a strong economic incentive to consider the relative merits of alter-

native uses. The more flexibility he has the more likely it is that his use will be the highest and best use reflecting the spectrum's true opportunity cost to society.

In "The Telecom Revolution, An American Opportunity," the Progress & Freedom working group proposed a four-part plan to reform spectrum management. For brevity sake, this plan can be reduced to two mechanisms. First, the FCC should make unallocated private sector spectrum and underutilized government spectrum available to private users. The spectrum should be structured in highly flexible parcels with minimal government constraints. These parcels should give the legal protection and freedoms that attach to property, viz., technical and operational freedom, protection from trespass or unlawful takings, and the ability to assign, lease or sell. Of course, these new users should be subject to antitrust and other laws that apply to businesses generally. Where there are mutually exclusive bids for these new parcels, winners should be selected by auctions.

A few words about auctions are in order. They are the most efficient means of assigning licenses where there are mutually exclusive applicants for three reasons. First, they make assignments more quickly than administrative hearings and lotteries. A three-year delay imposed by comparative hearings or lotteries can easily wipe out a full one-fourth of the present value of the license. Second, they assign the spectrum to those who are most likely to put them to their highest valued use. Third, they make these assignments at less cost to society. Instead, of using scarce resources in expensive lotteries and comparative hearings, applicants compete by adding zeros to the size of the transfer payment they are willing to make to the government.

Note that the primary value of auctions is not that they raise money for the government. Care should be taken that auctions do not become an obstacle to the principal goal of reducing spectrum scarcity. Spectrum should be released as rapidly and efficiently as possible, even if that reduces the government's auction proceeds, because the goal is to free up spectrum for the benefit of the American economy. Where there are mutually exclusive applicants, however, auctions will be a highly efficient way to raise government funds.

The second way to achieve spectrum reform is to deregulate or privatize existing spectrum users. As with the newly allocated spectrum, the Congress should move to give existing users full flexibility to use their spectrum subject to interference and international treaty constraints. Licensees should be encouraged to negotiate with their "neighbors" to reach mutually beneficial agreements on possible new uses of their spectrum. This approach creates a private incentive to "reallocate" spectrum and take on the vested interests that can be counted to oppose new competition and innovation. Likewise, the government agencies should be encouraged to sell or sublease their spectrum to the private sector. I applaud Senator Steven's amendment to the Senate's telecom legislation that is designed to create such an incentive for government users to free up spectrum.

Those who see privatizing existing spectrum as a government "giveaway" miss the point. The existing users have for the most part purchased their spectrum in the resale market. It is not fair, efficient or politically feasible to require them to pay for their spectrum again. Furthermore, top down grants of flexible spectrum will be difficult because the existing users will collectively oppose the release of hundreds of MHZ in flexible allocations. Privatizing existing spectrum will create a competition among existing licensees to move "beach front" spectrum from its current "land dump" uses. In this parlance, the current "beach property owners" may not appreciate these efforts, but they will not be able to stop them. Indeed, they might well choose to join them. In the end, America's "beach-consuming public" will benefit.

It should be noted that these approaches do not require all or nothing. You can do them in degree. In fact the Commission, under Chairmen Fowler, Patrick, Sikes and Hundt, has increasingly utilized the concepts of flexibility and privatization, working within the limits of the administrative process and the current law has been a difficult task and they and their fellow commissioners and many key staffers deserve credit for what they have done.

The time has come, however, for Congress to dramatically speed up this process. A centrally-planned, government-run allocation system probably never made sense. It has cost Americans billions of dollars in foregone wealth and prosperity, but the accelerating pace of technical change and the increasing complexity of the spectrum allocation decisions that have to be made make the case for dramatic reform more compelling than ever before.

We are all familiar with the rapid change in the computer industry. In the space of seven years, IBM lost roughly $70 billion dollars of market capitalization. In the same period, many small hardware and software companies grew exponentially, more than offsetting those mainframe losses. Who can seriously question that if

Apple, Intel, Compaq and Microsoft had required FCC spectrum to get to the market that the personal computer revolution would have been postponed?

In the same way, spectrum gridlock is a primary obstacle to the full exploitation of the computer revolution. Few things will promote wireless computer applications and local telephone competition as much as driving down the cost of spectrum by several orders of magnitude. Fundamental spectrum reform would build on the U.S. Is current but perishable lead in the global digital derby. America is positioned to leave other countries in a cloud of silicon dust. A regulatory framework that slows innovation in this area, despite any plausible shortrun efficiency gains it might achieve, will foreclose a tremendous opportunity for the American people.

DEPARTMENT OF COMMERCE,
WASHINGTON, DC,
December 15, 1995

The Honorable Jack Fields,
Chairman, Subcommittee on Telecommunications and Finance,
Committee on Commerce,
U.S. House of Representatives, Washington, DC.

DEAR MR. CHAIRMAN: This letter responds to a question you posed at a September 7th hearing on Federal management of the radio spectrum. Specifically, you asked how much spectrum is assigned to the Federal Government and how much is actually used. The National Telecommunications and Information Administration (NTIA), as manager of the spectrum used by Federal Government entities pursuant to 47 U.S.C. §§ 103 et seq., appreciates this opportunity to provide you with information on this topic.

As I indicated in my testimony, NTIA exclusively determines the rules for spectrum use in only 1.4 percent of the allocated spectrum bands below 300 GHz; the Federal Communications Commission (FCC) exclusively determines the rules for spectrum use in 5.5 percent of that spectrum. In the remaining 93.1 percent of allocated spectrum, NTIA and the FCC jointly determine the rules. Determining the rules for spectrum use doe not translate into exclusive use, however. In fact, both Federal and non-Federal entities use spectrum in most spectrum bands, even those where the rules are determined exclusively by the FCC or NTIA.

We have enclosed as background a number of charts that show particular types of radiocommunication services, i.e., spectrum allocations, in different bands. First, we have included a spectrum chart that provides an overview of general types of radio services as well as of Federal Government and non-Federal Government spectrum allocations. Also enclosed is a "Spectrum Use Summary," which provides an overview of radiocommunication activities in the spectrum bands between 137 MHz and 10 GHz, which are the most heavily used spectrum bands. In addition, we have enclosed "Spectrum Use Factor" charts, which show the degree of use in key land mobile frequency bands in different parts of the United States. While these charts show the allocations in these bands, actual spectrum use has many dimensions and is thus difficult to quantify. For example, due to the dynamic nature of spectrum use, many of the over 300,000 Federal frequency assignments are used to varying degrees, depending on circumstance, time, and place. A few specific examples will help illustrate this point.

The 162-174 MHz and 406-420 MHz bands are shared by all Federal agencies and are generally used for fixed and mobile services. The fixed services provided in this band include point-to-point radio communications, which are used for law enforcement and other public safety purposes by Federal, state, and local agencies. Examples of these uses are airport lighting and flood control. The mobile services provided in this band also include public safety, such as Capitol and Supreme Court police radio communications.

Notably, both Federal and non-Federal firefighters rely on land mobile services allocated in this band as an essential tool for fighting fires all over the United States and particularly in the dry Western states, where large fires frequently occur. Consequently, equipment, which has been purchased in anticipation of these emergencies, is designed to operate in these bands.

Spectrum used to fight major fires is not often in use, and some sharing with the private sector is thus possible. These bands are shared to a limited extent with the private sector for low-power uses such as wireless microphones and water resource management operations since these uses do not interfere with public safety uses. There is, however, limited private sector demand for these low-power uses. Higher-power uses in these bands are currently problematic as they could cause interference. At present, there is no way of quickly clearing these bands so that they are

available when disaster strikes. Thus, while further sharing of these bands is theoretically possible, it would be very difficult to remove or override private sector users when an emergency occurs.

In some situations, Federal agencies use spectrum constantly but must have sufficient additional capacity so that they can increase the intensity of use if necessary. Last April, Federal Bureau of Investigation agents required use of land mobile spectrum, also in the 162-174 MHz and 406-420 MHz bands, when the Federal building in Oklahoma City, Oklahoma was bombed. Immediately after the bombing, use of this spectrum was particularly intense. Even when use is less intense, however, it would be difficult to share this spectrum. As in the case of firefighting, it would be difficult to remove or override commercial operators when an emergency occurs.

Another example of the dynamic nature of spectrum use involves the aeronautical radionavigation spectrum bands. These are shared both by Federal and non-Federal airplane pilots and air traffic controllers and are used for radio navigation and air traffic control. Airports in the United States and throughout the world use specified bands, specifically the 75 MHz, 108-137 MHz, 328.6-385.4 MHz, 960-1215 MHz, 1215-1370 MHz, 2700-2900 MHz, and 4200-4400 MHz spectrum bands. The different navigational and air traffic functions provided in these bands include en route and terminal radar, marker beacons, collision avoidance and weather radar, and air-to-ground communications. Not all of this spectrum is in constant use; at certain times it is more heavily used than at others. Nonetheless, because these bands are devoted to critical safety-of-life functions, sharing with other uses is not practical. Interference from other uses in these bands would create undue risks to safety-of-life.

Moreover, use of these particular bands for other purposes is constrained by more than domestic regulation and policy. International regulations (that create treaty-like obligations) also designate this spectrum for use by aircraft and air traffic controllers. Airplane radio navigational systems used all over the world are designed to transmit and receive in these spectrum bands. Accordingly, all airplane pilots rely on the availability of spectrum in these bands. Any modification in spectrum use would require coordination with the international community; significant modification could require replacement of all these planes' navigational systems. Thus, it is important that the United States adhere to these international regulations and continue to make available adequate spectrum in these bands.

As I indicated in my testimony, the Department of Defense is the largest user of Federal Government spectrum. Common practice has designated the spectrum in the 225-400 MHz band for use by the military throughout the world (*i.e.*, a worldwide war fighting band). This spectrum was used in the rescue of Captain Scott O'Grady last June when his plane was shot down over Bosnia, for example. Satellites, airborne communication systems, and radar on ships, as well as Capt. O'Grady's land mobile radio unit and radio beacon, were all essential to his rescue. From the time Capt. O'Grady was shot down until his rescue, NATO jets flew over the area listening for Capt. O'Grady's radio signal, while satellites were positioned to listen for electronic signals from Capt. O'Grady's radio beacon. This example illustrates the complexity and interrelationship of spectrum use in military operations. Although these bands are in demand by the private sector, the government must have exclusive control over these bands not just for dramatic rescues such as Capt. O'Grady's but also for day-to-day training and deployment of U.S. military personnel both here and abroad.

In closing, I would like to assure you that NTIA places a high priority on ensuring that spectrum assigned to the Federal Government is used efficiently and only for necessary purposes. In addition, NTIA researches, develops, and promotes use of new technologies that allow for more efficient Federal spectrum use. As part of these efforts, NTIA is working with the Public Safety Wireless Advisory Committee, which was jointly chartered by NTIA and the FCC, to satisfy the radio frequency requirements of the Federal, state and local public safety community while at the same time fostering greater spectrum sharing between the private sector and that community.

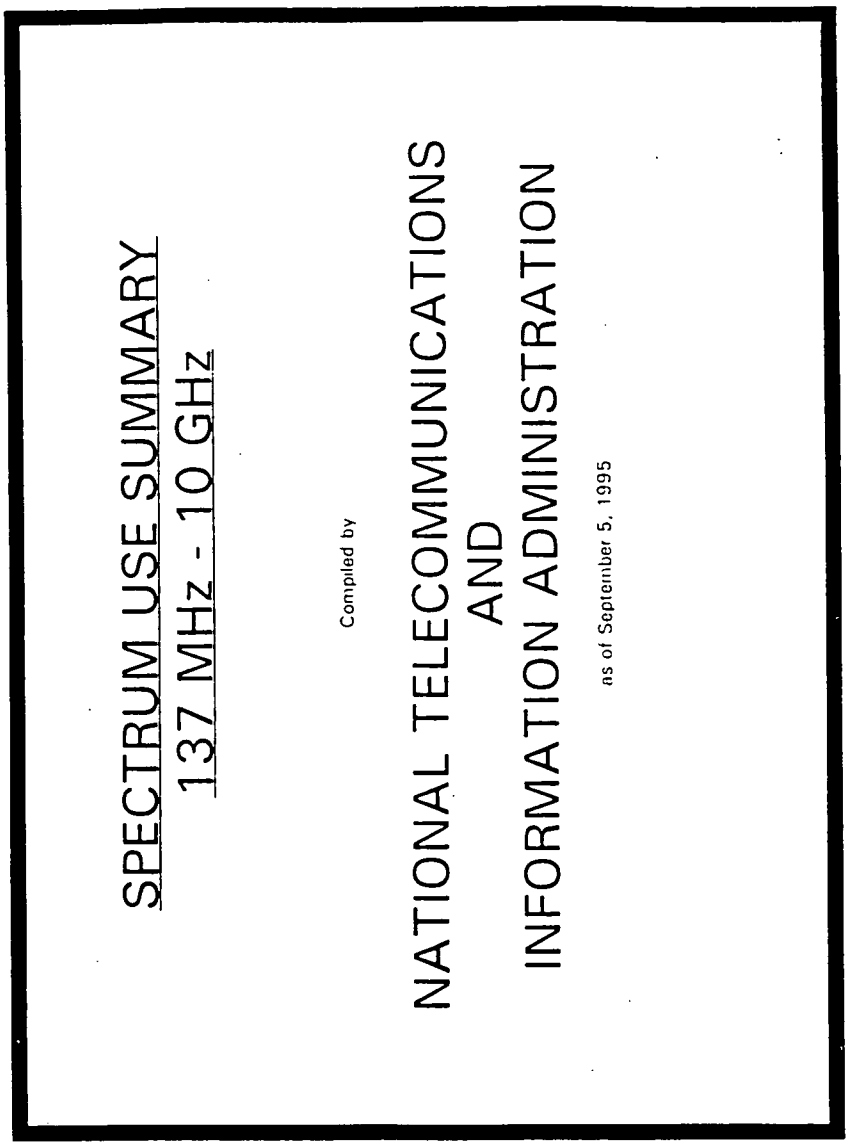
Thank you for the opportunity to provide you with this information about Federal spectrum use. We recognize the importance of spectrum to the development of telecommunications services. NTIA in conjunction with the Department of Defense would appreciate the opportunity to present a briefing on this subject to you and your staff. In that context, we could provide greater detail about specific bands and how they are used by the Federal Government.

If you would like a briefing on this subject or if you have any further questions, please call me at (202) 482-1840.

Sincerely yours,

LARRY IRVING,
Assistant Secretary for Communications and Information.

Enclosures



NOTE

This document represents an overview of Federal and nonfederal spectrum use. In order to serve its purpose as a quick reference, its length has been limited. Federal systems and missions which would have necessitated classification of the summary have been omitted, though they represent significant Federal requirements. Also, Federal agencies lease many services from private sector providers. As written, this summary indicates these uses only as nongovernment use of the frequency spectrum. Therefore, it is not all inclusive in its portrayal of U.S. spectrum requirements or its representation of the allocation table.

Uses are stated in terms of general functions and actual equipment names are usually not specified. Furthermore, no attempt has been made to evaluate the level of investment of funds in the uses that are discussed.

The summaries of Federal uses have been written to emphasize, to the greatest extent possible, the missions performed, as opposed to the agencies that perform them.

The allocation tables, presented here, reflect the PRIMARY (uppercase letters) and Secondary (lowercase letters) allocations listed in the national table and footnotes. In some cases, footnotes indicate that a band "may be used for" a certain service or that a service is "authorized" without indicating the status of that use. Such situations have been indicated with *italics*. Allocations, by footnote, to very limited locations have generally been omitted.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
137-138	METEOROLOGICAL-SATELLITE (Space-to-Earth) SPACE OPERATION (Space-to-Earth) SPACE RESEARCH (Space-to-Earth) MOBILE-SATELLITE ((Space-to-Earth) 137-137.025 and 137.175-137.825) Mobile Satellite ((Space-to-Earth) 137.025-137.175 and 137.825-138)	The FCC has allocated this band for operations using nongeostationary nonvoice mobile satellite systems (Little LEOS).	METEOROLOGICAL-SATELLITE (Space-to-Earth) SPACE OPERATION (Space-to-Earth) SPACE RESEARCH (Space-to-Earth) MOBILE-SATELLITE ((Space-to-Earth) 137-137.025 and 137.175-137.825) Mobile Satellite ((Space-to-Earth) 137.025-137.175 and 137.825-138)	Worldwide use of polar orbiting satellites for transmission of weather pictures occurs in this band via the TIROS system. The satellite also transmits tracking and telemetry information. NASA conducts satellite operations for the Advanced Technology Satellite (ATS) and High Energy Transient Experiment (HETE). Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.
138-144			FIXED MOBILE	This band is primarily used for nontactical military land-mobile communications essential to maintain DOD infrastructure-related functions. It is also used throughout the U.S. for critical military air-traffic and tactical communications. Specific functions for tactical training include air-ground-air communications for combat weapons training carried out in the vicinity of all major bases and military training areas in the U.S.. Also, this band is essential to the activities of the Air Force Auxiliary (Civil Air Patrol) and Coast Guard Auxiliary for support of search and rescue operations.
144-146	AMATEUR AMATEUR-SATELLITE (144-146)	Weak signal modes (144-144.3). Repeaters and other modes (144.3-147.99) Active use by amateur satellites worldwide (145.8-146)		
146-149.9	MOBILE-SATELLITE (Earth-to-space)	The FCC has allocated this band for operations using nongeostationary nonvoice mobile satellite systems (Little LEOS).	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	This band is primarily used for nontactical military land-mobile communications essential to maintain DOD infrastructure-related functions. It is also used throughout the U.S. for critical military air-traffic and tactical communications. Specific functions for tactical training include air-ground-air communications for combat weapons training carried out in the vicinity of all major bases and military training areas in the U.S.. A TIROS command link operates in the band in accordance with Footnote 608. NASA conducts satellite operations for the Advanced Technology Satellite (ATS). Also, this band is essential to the activities of the Air Force Auxiliary (Civil Air Patrol) and Coast Guard Auxiliary for support of search and rescue operations. Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.
149.9-150.05	RADIONAVIGATION SATELLITE MOBILE-SATELLITE (Earth-to-space)	The FCC has allocated this band for operations using nongeostationary nonvoice mobile satellite systems (Little LEOS). Commercial shipping makes extensive use of TRANSIT-SAT signals for radionavigation.	RADIONAVIGATION SATELLITE MOBILE-SATELLITE (Earth-to-space)	TRANSIT-SAT (polar orbiting satellite) downlink transmissions in this band support worldwide navigation. Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.
150.05-150.8			FIXED MOBILE	This band is primarily used for nontactical military land-mobile communications essential to maintain DOD infrastructure-related functions. It is also used throughout the U.S. for critical military air-traffic and tactical communications. Specific functions for tactical training include air-ground-air communications for combat weapons training carried out in the vicinity of all major bases and military training areas in the U.S..

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
150.8-156.2475	LAND MOBILE	Land transportation (150.8-150.98, 152.255-152.465), Public safety (150.98-151.4825, 154.6375-156.2475), Industrial (151.4825-151.4975, 152.465-152.495, 152.855-153.7325, 154.4825-154.6375), Industrial and Public safety (151.4975-152, 153.7325-154.4825), Domestic public (152-152.255, 152.495-152.855), Earth telecommand (154.2)		
156.2475-157.0375	MARITIME MOBILE	In accordance with international agreements, this band is used worldwide for maritime communications.		
157.0375-157.1875			*MARITIME MOBILE*	*This band is critical to national VHF distress system communications associated with* response to distress signals.
157.1875-157.45	MARITIME MOBILE	In accordance with international agreements, this band is used worldwide for maritime communications.		
157.45-161.575	LAND MOBILE	Land transportation (157.45-157.725, 159.48-161.575), Public safety (158.715-159.48), Industrial (157.725-157.755, 158.115-158.475), Domestic public (157.755-158.115)		
161.575-161.625	MARITIME MOBILE	In accordance with international agreements, this band is used worldwide for maritime communications.		
161.625-161.775	LAND MOBILE	Remote pickup broadcast		
161.775-162.0125	MARITIME MOBILE	In accordance with international agreements, this band is used worldwide for maritime communications.		
162.0125-174	FIXED (173.2-173.4) Land Mobile (173.2-173.4) *Fixed (US13* hydrological and meteorological data - designated frequencies)	Industrial, Public safety, Police radio for stolen vehicle recovery systems (173.075).	FIXED (162.0125-173.2 and 173.4-174) MOBILE (162.0125-*173.2 and* 173.4-174)	This band supports many Federal nontactical fixed and land-mobile uses. These uses are critical to Departments of Agriculture and Interior fire fighting, FAA windshear reporting, NOAA weather radio, Department of Interior land and resource management, including flash flood warning, and law enforcement activities throughout the Federal Government. Law enforcement applications include land-based and maritime operations. Use of this band will *be shifted to narrowband* technologies in 1995.
174-216	BROADCASTING	This band is used for VHF TV channels 7-13. Also, wireless microphones and auxiliary broadcasting systems operate on a secondary basis.		
216-220	MARITIME MOBILE Fixed Land Mobile Aeronautical Mobile Amateur (219-220)	This band is used on inland waterways by Automated Maritime Telecommunications Systems. The FCC has set aside the 218-219 portion of this band for the interactive video data service (IVDS). Amateurs use this band for fixed point-to-point digital message forwarding systems.	MARITIME MOBILE Radiolocation Fixed Aeronautical Mobile Land Mobile	Though allocated secondary, there continue to be critical Federal radiolocation requirements in this band. The U.S. Navy operates the SPASUR system in the band 216.88-217.08 MHz at several locations in the southern U.S. for the purpose of detecting Earth orbiting satellites. Assignments to the *fixed and mobile service may be made on condition of no* harmful interference to the SPASUR system (US229).
220-222	LAND MOBILE	Various trunked and conventional data users operate mobile systems. The band is broken into 200 5 kHz channel pairs.	LAND MOBILE Radiolocation	This band has recently been allocated to land mobile. It will be shared by the Federal Government and private sector for narrowband technologies. Though allocated secondary, there continue to be critical Federal radiolocation requirements in this band.
222-225	AMATEUR	Weak signal modes (222-222.15), repeaters, packet radio *and other modes (222.15-225)*	Radiolocation	Though allocated secondary, there continue to be critical Federal radiolocation requirements in this band.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
225-328.6 and 335.4-399.9			FIXED (G27 military only) MOBILE (G27 military only) MOBILE-SATELLITE (G100 235-322 and 335.4-399.9, military only)	These bands are heavily used throughout the U.S. for critical military air-traffic control and tactical training communications. Specific functions of tactical training include air-ground-air communications for combat weapons training carried out at and in the vicinity of all major air bases and military training areas worldwide. Tactical and strategic military satellite communications, essential to linking the activities of ground, air, surface, and subsurface mobile platforms, are conducted in this band under G100. Also, rocket test and test data telemetry operations are performed in this band.
328.6-335.4	AERONAUTICAL RADIONAVIGATION	Commercial aircraft use the Instrument Landing Systems (ILS) glideslope for approach and landing.	AERONAUTICAL RADIONAVIGATION	This band is set aside on a worldwide basis for operation of aircraft ILS glideslope signal and serves as a critical part of the National Airspace System. ILS service to international carriers is required under agreements with the International Civil Aviation Organization (ICAO).
399.9-400.05	RADIONAVIGATION SATELLITE MOBILE-SATELLITE (Earth-to-space)	Commercial shipping makes extensive use of TRANSIT-SAT signals for radionavigation.	RADIONAVIGATION SATELLITE MOBILE-SATELLITE (Earth-to-space)	TRANSIT-SAT (polar orbiting satellite) downlink transmissions in this band support worldwide navigation. Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.
400.05-400.15	STD FREQ & TIME		STD FREQ & TIME	This band is set aside on a worldwide basis for distribution, via satellite, of standard time and frequency signals used for purposes such as industrial and scientific research. There is presently no use within the U.S.
400.15-406	METEOROLOGICAL AIDS (Radiosonde) SPACE RESEARCH ((space-to-Earth) 400.15-401) SPACE OPERATION (primary 401-402, secondary 400.15-401) MOBILE-SATELLITE ((space-to-Earth) 400.15-401) Meteorological satellite (401-403) Earth Exploration Satellite ((Earth-to-space) 401-403)	Meteorological radiosondes and satellites The FCC has allocated this band for operations using nongeostationary nonvoice mobile satellite systems (Little LEOS).	METEOROLOGICAL AIDS (Radiosonde) SPACE RESEARCH ((space-to-Earth) 400.15-401) METEOROLOGICAL-SATELLITE ((space-to-Earth) 400.15-401) Meteorological-satellite ((Earth-to-space) 401-403) SPACE OPERATION (primary 401-402, secondary 400.15-401) MOBILE-SATELLITE ((space-to-Earth) 400.15-401) Earth Exploration Satellite ((Earth-to-space) 401-403) Fixed (G6 military 403-406) Mobile (G6 military 403-406)	This band is extensively used worldwide for gathering meteorological data for weather prediction, severe storm warning, public safety and research. The data is gathered by three technologies: satellite imagery, radiosondes, and wind profiler radars. The Department of Commerce operates the GOES and TIROS-N satellites used for weather tracking and prediction. This information is essential for severe storm notification and public safety, and is used daily in TV and radio broadcast weather reporting to the public. The DOD plans to implement Defense Meteorological Satellite Program (DMSP) downlinks to furnish weather data to light-weight, highly transportable DOD terminals intended for a variety of tactical missions. Radiosondes are operated nationwide by numerous Federal agencies to gather local weather data. These small, inexpensive transmitters are attached to balloons and provide wind velocity, temperature, atmospheric pressure and humidity at various altitudes. Their availability is essential to aviation activities, as well as space launches. The data gathered by radiosondes are exchanged internationally for worldwide weather prediction and research. Government use of the mobile-satellite service is limited by US319 to earth stations operating with nongovernment satellites.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
406-406.1	MOBILE SATELLITE (Earth-to-space)	Emergency position beacons	MOBILE SATELLITE (Earth-to-space)	Emergency position beacons are operated in this band on a worldwide basis, supported by the joint U.S. SARSAT/Soviet COSPAS satellite network for worldwide air, sea, and land *rescue.*
406.1-420	RADIO ASTRONOMY (406.1-410) Fixed (US13 hydrological and *meteorological data* - designated frequencies)		FIXED MOBILE RADIO ASTRONOMY (406.1-410) Space Research ((space-to-space) 410-420)	This band is one of the principal bands supporting Federal land-mobile communications. Important functions include law enforcement, protection of the President and other dignitaries, resource management, *disaster and emergency response, security alarms,* command destruct of launch vehicles to avoid loss of life and property, and support for public health and power generation activities. This band will accommodate future growth from the very congested 162-174 MHz band. Communications using trunking techniques are being implemented by many agencies to ensure efficient spectrum use. Fixed links are used in this band for transmission of airport windshear data, flood warning *and other environmental data, for law enforcement,* for public dissemination of weather warning and disaster information, and for other critical activities. There are also radio astronomy observations at several sites across the U.S.
420-450	Amateur *Amateur Satellite* (FN664 435-438)	Amateur weak signal modes (432-433), television (420-432, 438-444), repeaters (442-450), auxiliary links (433-435). *There is also some use of spread spectrum and other modes.* Amateur satellite activities are conducted (435-438) under RR 664. Land mobile systems are operated along the Canadian border in accordance with US 230.	RADIOLOCATION	This band is used for long-range surveillance on land-based, ship, and airborne platforms. These uses are essential to the nation's early warning capability, law enforcement, and tracking objects in space. These systems operate with very high power and wide bandwidths. This band is becoming increasingly important for detection of low observable targets. This *band is the only military radiolocation* band currently available for this frequency sensitive function. The frequency 449 MHz has been authorized for nonmilitary use of wind profilers. Rapid implementation of this use is expected. NASA and military use of telemetry and telecommand is also extensive.
450-470	LAND MOBILE Earth Exploration-Satellite (US201 460-470) *Space Research and Space Operations (FN668 450 MHz)*	Remote pickup broadcast (450-451, 455-456) Public safety, industrial, land transportation (451-454, 456-459, 460-462.5375, 462.7375-467.5375, 467.7375-470) Domestic public (454-455, 459-460) Personal (462.5375-462.7375, 467.5375-467.7375)	Meteorological Satellite (460-470) *Earth Exploration-Satellite* (US 201 460-470) *Space Research and Space Operations (FN668 450 MHz)*	GOES and TIROS satellite downlinks for integration of data collection platforms operate in this band. *Veteran's medical programs depend* upon the use of biomedical telemetry and telecommunications in conjunction with nongovernment medical activities.
470-512	BROADCASTING LAND MOBILE	TV channels 14-20, Public safety, Industrial, Land transportation, Domestic public		
512-608 and 614-806	BROADCASTING	TV channels 21-36, and 38-69, Auxiliary broadcasting		
608-614	RADIO ASTRONOMY		RADIO ASTRONOMY	There are few Federal assignments in this band for other than experimental use. However, radio astronomy usually involves passive operations that do not require an assignment. This band is used for international collaborations in Very Long Baseline Interferometry and will continue to be used for this purpose as the VLBA antennas come on line. The band is also used for observations by the Air Force Radio Solar Telescope Network.
806-902	LAND MOBILE	Private land mobile (806-824, 851-869, 896-901) Domestic public land mobile (824-849, 869-894) Aeronautical public correspondence-airphone (849-851, 894-896) General purpose mobile (901-902)		This band is used for high-power U.S. Navy shipborne long-range search radars under footnotes US268 and G2. These radars serve a critical role in defense of the fleet.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
902-928	Amateur	Amateur weak signal modes (902-904), digital communications, repeaters, spread spectrum and other modes (904-928). Automatic vehicle monitoring (902-912 and 918-928 as authorized by FN US218), ISM, and Part 15 spread spectrum devices. This band is also used for a variety of ISM applications, particularly industrial heating and food processing.	RADIOLOCATION Fixed (G11) Mobile (G11)	This band is used predominantly for military radiolocation systems. These include low-power devices, such as those for tactical and nontactical intrusion detection at military facilities, and high-power radars used for long-range search, many of which are employed on U.S. Navy ships and aircraft or at shore stations. These radars serve a critical role in defense of the fleet. Federal mobile communications applications include video surveillance for law enforcement missions, transmission of infrared scanner imagery during overflights of disaster areas, and use of high power packet radio systems. Fixed use includes point-to-point TV links for monitoring unmanned ports of entry along borders. Though most low capacity links will be moving to the 932-935 MHz and 941-944 MHz bands, this band will continue to be used for a variety of resource management, power administration and law enforcement purposes, as necessary.
928-929	FIXED	Private fixed microwave, Domestic public land mobile, Private land mobile. Systems in this band provide one way and two way interrogate/response data transmission services such as: remote control of electric power networks, burglar and fire alarm monitoring, and other telemetry applications. For two way systems, the band is paired with 952-953 MHz band.		
929-932	LAND MOBILE	Domestic public land mobile, Private land mobile		
932-935 and 941-944	FIXED	This band is paired with the 941-944 MHz band and channelized for point-to-point voice and data services. The 932-932.5 MHz end of the band is used for the single channel response from a remote location for point to multipoint multiple address services.	FIXED	The 932-935 MHz and 941-944 MHz bands are shared by government and nongovernment fixed service users. It has recently been allocated for Federal use. Use for low-capacity fixed systems is anticipated. Many Federal agencies expect heavy government and nongovernment use for point-to-point and point-to-multipoint communications. Functions include support for aviation activities, remote meter reading for electric power marketing, and light route radio relay. The latter includes reaccommodation of light route systems from higher bands.
935-941	LAND MOBILE	Private land mobile trunked and conventional systems in 12.5 kHz channels paired with 896-901 MHz.		
944-960	FIXED	Auxiliary broadcasting, Domestic public fixed, International fixed public, Private fixed microwave. The 944-952 MHz is portion is used primarily for radio broadcast stations studio-to-transmitter links (STLs) and intercity relays. These carry frequency modulated stereophonic audio program material, plus ancillary carriers for remote control of transmitters and Subsidiary Communications Authorization (SCA) channels. The 952-953 MHz portion is used in combination with 928-929 MHz. The 953-960 MHz portion is primarily used for fixed point-to-point communications. The band is segmented as 953.00-956.15 MHz for go and 956.55-959.75 MHz for return operation.		

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
960-1215	AERONAUTICAL RADIONAVIGATION	This band is heavily used for safety-of-life services within the national and international airspace systems. Nearly all aspects of aircraft identification, tracking, control, navigation, collision avoidance, and landing guidance are carried out. Major aeronautical radionavigation systems in this band include the Distance Measuring Equipment (DME/P), Air Traffic Control Beacons (ATCRBS), Mode-S, and the Collision Avoidance System (T-CAS). All systems support civil and military aircraft. Systems in this band are developed internationally and agreed to by Civil Aviation Organization for standardization of air travel throughout the world.	AERONAUTICAL RADIONAVIGATION	This band is heavily used for safety-of-life services within the national and international airspace systems. Nearly all aspects of aircraft identification, tracking, control, navigation, collision avoidance, and landing guidance are carried out. Major aeronautical radionavigation systems in this band include the Distance Measuring Equipment (DME/P), Air Traffic Control Beacons (ATCRBS), Mode-S, the military's tactical air navigation system (TACAN) and IFF/SIF systems, and the Collision Avoidance System (T-CAS). These aeronautical systems are not only essential to civil and military aircraft, but also to special users such as the U.S. Space Shuttle Program. These systems are used throughout the world under International Civil Aviation Organization agreements. Under US224, the military departments are using this band for integrated communications and navigation through the Joint Tactical Information Distribution System (JTIDS) on a non-interference basis. JTIDS is part of an updated NATO system that provides highly secure, jam resistant communications in a hostile environment.
1215-1240	Earth Exploration-Satellite and Space Research (FN713 using radiolocation)		RADIONAVIGATION SATELLITE (space-to-Earth) RADIOLOCATION Earth Exploration-Satellite and Space Research (FN713 using radiolocation)	The frequency 1227.6 MHz is designated for the Global Positioning System (GPS) as part of the radionavigation satellite service. This is a multisatellite system (up to 24 are planned) with large numbers of U.S. and international users. This band is jointly used by the FAA and DOD for radiolocation performing long-range air surveillance and safety-of-flight enroute air-traffic control under Joint surveillance System agreements. The military services make use of the band for high-power long-range surveillance radars on land and ships in support of national defense missions. The DOD and FAA are implementing a joint program to field a modernized Air-Route Surveillance Radar Model 4 (ARSR-4) in this band for air-defense, drug interdiction and air-traffic control. A recent radiolocation application, having high national priority, is the use of radar equipment in support of drug interdiction efforts. In this application, radar equipment is mounted on tethered balloons along the southern border of the U.S. to detect low-flying aircraft entering U.S. airspace. Data is relayed to ground and appropriate action taken. Space research and earth-exploration satellite activities for microwave sensor measurements of ocean wave surface are performed by NASA.
1240-1300	Amateur *Amateur-Satellite (FN664 1260-1270)* Earth Exploration-Satellite and Space Research (FN713 using radiolocation)	Amateur television (1240-1246, 1252-1258, 1276-1282), weak signal modes (1296.8-1297), other modes through the band. Active use of amateur satellite (Earth-to-space) in accordance with Footnote 664.	RADIOLOCATION AERONAUTICAL RADIONAVIGATION (FN714) Earth Exploration-Satellite and Space Research (FN713 using radiolocation)	This band is used heavily for radiolocation and radionavigation performing long-range air surveillance and enroute air-traffic control functions. The FAA and aviation users depend upon air-route surveillance radars (ARSRs) to obtain aircraft position information in support of enroute air-traffic control. The military makes use of it for high-power long-range surveillance and air-traffic control in support of national defense missions. A recent radiolocation application, having high national priority is the use of radar equipment in support of drug interdiction efforts. In this application, radar equipment is mounted on tethered balloons along the southern border of the U.S. to detect low-flying aircraft entering U.S. airspace. Data is relayed to ground and appropriate action taken. NASA radiolocation activities in the 1240-1300 MHz band are for an experimental multi-spectral imaging radar using synthetic aperture (side-looking) techniques. NASA also uses this band for space research and earth-exploration satellite in conjunction with microwave sensor measurements of ocean wave surface.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1300-1350	AERONAUTICAL RADIONAVIGATION		AERONAUTICAL RADIONAVIGATION Radiolocation	This band is used heavily for radiolocation and radionavigation performing long-range air surveillance and enroute air-traffic control functions. The FAA and aviation users depend upon air-route surveillance radars (ARSRs) to obtain aircraft position information in support of enroute air-traffic control. The Air Force and Navy make use of it for high-power long-range surveillance radars and air-traffic control radars, in support of national defense missions. The DOD and FAA are implementing a joint program to field a modernized Air-Route Surveillance Radar Model 4 (ARSR-4) in this band for air-defense, drug interdiction and air-traffic control. A recent radiolocation application, having high national priority is the use of radar equipment in support of drug interdiction efforts. In this application, radar equipment is mounted on tethered balloons along the southern border of the U.S. to detect low-flying aircraft entering U.S. airspace. Data is relayed to ground and appropriate action taken. Radio astronomy observations of highly redshifted hydrogen atoms occur in the 1330-1350 MHz band.
1350-1400			FIXED MOBILE RADIOLOCATION AERONAUTICAL RADIONAVIGATION (FN714 1350-1370) FIXED SATELLITE (G114 1381.5) MOBILE SATELLITE (G114 1381.5) Earth Exploration-Satellite and Space Research (FN720 1370-1400)	This band is heavily used for various military radiolocation applications for high-power long-range surveillance radars. The DOD and FAA are implementing a joint program to field a modernized Air-Route Surveillance Radar Model 4 (ARSR-4) in this band for air-defense, drug interdiction and air-traffic control. GPS operates on 1381.05 to relay data on nuclear bursts detected by orbiting satellites. GPS is a multisatellite system with large numbers of U.S. and international users, however this specific requirement is limited to U.S. satellites. Radio astronomy observations of highly redshifted hydrogen atoms occur in this band. Knowledge of other galaxies and the early universe comes from these observations. NASA performs passive space research and earth-exploration satellite observations. This band is seeing increased use for fixed links and mobile links, since the Federal fixed and mobile service allocations were upgraded to primary in 1989. DoD uses this band for drone telecommand at military test ranges. NTIA has reallocated the 1390-1400 MHz portion of this band for nonfederal use after January 1999.
1400-1427	RADIO ASTRONOMY EARTH EXPLORATION SATELLITE (Passive) SPACE RESEARCH (Passive)		RADIO ASTRONOMY EARTH EXPLORATION SATELLITE (Passive) SPACE RESEARCH (Passive)	This band has been set aside nationally for passive operations and no stations are *authorized to transmit. There are no Federal assignments* in this band. Radio astronomy including the spectral line observations of neutral atomic hydrogen, continuum observations and Radio Solar Telescope Network observations allow study of the structure of our galaxy as well as others. NASA performs passive space research and earth-exploration satellite observations. This band is extremely important for measurements of land moisture and salinity, and ocean surface characteristics.
1427-1435	SPACE OPERATION (Earth-to-space) 1427-1429) Land Mobile Fixed	Private land mobile, Satellite communications	FIXED MOBILE SPACE OPERATION (Earth-to-space) 1427-1429)	This band is used to support a variety of military fixed and mobile applications. Functions include tactical/training operations, light route radio relay, telemetry and telecommand including command of missiles and RPVs, and automatic target scoring. There are also some fixed operations planned for use in Federal resource management programs. NTIA has reallocated the 1427-1432 MHz portion of this band for nonfederal use after January 1999.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1435-1530	MOBILE	This band is heavily used for aeronautical telemetry and telecommand. This is crucial to industry research, development, and testing of aircraft and missile systems.	MOBILE	This band is heavily used for aeronautical telemetry and telecommand. This is crucial to NASA, and DOD research, development, and testing of aircraft and missile systems. Many of the assignments in the 1435-1525 MHz band are for missile test telemetry. The use of small devices with omnidirectional antennas require frequencies below 3 GHz. Aeronautical telemetry needs extensive spectrum, and minimal in-band and adjacent band interference. Equipment using this band have been built into many missile and aircraft platforms and have been tailored to those specific electromagnetic environments. This band is congested in many areas and new systems are being moved to 2360-2390 MHz. Also, DOE uses the band for telemetry in nuclear research and development efforts. Use of this band is dictated by the need for equipment mobility and small antennas.
1530-1544	MARITIME MOBILE SATELLITE (space-to-Earth) Mobile (aeronautical telemetry 1530-1535)	The major use in this band is for INMARSAT downlinks providing distress, safety, and general communications. This system is used currently by 17,000 ships throughout the world, including extensive operations within inland waterways for ship-to-shore communications. The number of users is expected to reach 40,000 within the next 10 years. Its use for distress and safety communications is part of the Global Maritime Distress and Safety System (GMDSS). This international application is tied to and required by international treaty resulting from the Safety of Life at Sea (SOLAS) Convention. INMARSAT also provides satellite supported aeronautical public correspondence and some land mobile satellite service downlinks.	MARITIME MOBILE SATELLITE (space-to-Earth) Mobile (aeronautical telemetry 1530-1535)	Federal vessel operators participate in the use of the INMARSAT/GMDSS system. The Navy uses the INMARSAT system for international communications in ocean areas from its Military Sealift Command vessels operated by civilian crews. The Air Force and Navy use the 1525-1535 MHz portion of this band for aeronautical telemetry on a secondary basis when such operation does not conflict with the primary operation.
1544-1545	MOBILE SATELLITE (space-to-Earth)	Solely used for distress and safety.	MOBILE SATELLITE (space-to-Earth)	This band is used by SARSAT for a downlink to relay satellite EPIRB transmission.
1545-1559	AERONAUTICAL MOBILE SATELLITE (R) (space-to-Earth) MOBILE SATELLITE ((space-to-Earth) primary 1549.5-1558.5, secondary 1545-1549.5)	This band will be used for the downlink for the nationwide mobile satellite system authorized by the FCC. This system will be operated by the American Mobile Satellite Corporation, a consortium of eight U.S. companies. Mobile satellite services are expected to grow rapidly. Included within this frequency range is the internationally allocated 1545-1555 MHz AMS(R)S allocation (space-to-Earth) to support the worldwide interoperable AMS(R)S through a number of satellites. In accordance with US308, AMS(R)S has priority and real-time preemptive access in this band segment.	AERONAUTICAL MOBILE SATELLITE (R) (space-to-Earth) MOBILE SATELLITE ((space-to-Earth) primary 1549.5-1558.5, secondary 1545-1549.5)	Federal agencies will make use of mobile satellite operations in this band.
1559-1610	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION SATELLITE (space-to-Earth) *Aeronautical Mobile (US260)*	Private sector use of GPS is extensive for land, sea, and air radionavigation. Other uses of GPS include surveying, aircraft landing aids, position location, traffic management, and scientific research.	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION SATELLITE (space-to-Earth) *Aeronautical Mobile (US260)*	The Global Positioning System operates on a center frequency of 1575.42 MHz in this band as part of the radionavigation satellite service. This is a multisatellite system with large numbers of U.S. and international users. ICAO has recognized the GPS and GLONASS as the two principal candidates for the Global Navigation Satellite System.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1610-1626.5	AERONAUTICAL RADIONAVIGATION AERONAUTICAL RADIONAVIGATION-SATELLITE (FN732) RADIO DETERMINATION-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY (1610.6-1613.8) Mobile-Satellite ((space-to-Earth) 1613.8-1626.5) *Aeronautical Mobile (US 260)*	There is one active private sector RDSS systems. However, the FCC has granted two applications for low-earth and geostationary orbit mobile satellite systems to provide voice and high data rate communications (Big LEOS).	AERONAUTICAL RADIONAVIGATION AERONAUTICAL RADIONAVIGATION-SATELLITE (FN732) RADIO DETERMINATION-SATELLITE (Earth-to-space) MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY (1610.6-1613.8) Mobile-Satellite ((space-to-Earth) 1613.8-1626.5) *Aeronautical Mobile (US260)*	This band has been reserved on a worldwide basis for development and use of airborne electronic aids to air navigation. Recent changes were made to allocate this band to radiodetermination satellite service uplinks on a primary basis. Federal agencies have begun leasing access to systems in this service and increased use is expected. Radio Astronomy observations of the OH radical are carried out between 1610.6 and 1613.8 MHz. The OH line observations are crucial to understanding interstellar medium and star formation. Government use of mobile-satellite and radiodetermination-satellite services is limited to earth stations operating with nongovernment satellites.
1626.5-1645.5	MARITIME MOBILE SATELLITE (Earth-to-space) MOBILE SATELLITE (Earth-to-space)	A major use of this band is for INMARSAT ship earth stations. These systems are used currently by 17,000 ships throughout the world, including extensive operations within inland waterways for ship-to-shore communications. The number of users is expected to reach 40,000 within the next 10 years. Its use for distress and safety communications is part of the Global Maritime Distress and Safety System. This international application is tied to and required by international treaty resulting from the Safety of Life at Sea (SOLAS) Convention. INMARSAT also provides satellite supported aeronautical public correspondence and some land mobile satellite service downlinks.	MARITIME MOBILE SATELLITE (Earth-to-space) MOBILE SATELLITE (Earth-to-space)	Federal agencies make active use of the mobile-satellite operations for land, air, and maritime communications. The Navy uses the INMARSAT system for international communications in ocean areas.
1645.5-1646.5	MOBILE SATELLITE (Earth-to-space)	Solely used for distress and safety.	MOBILE SATELLITE (Earth-to-space)	There are no operational Federal assignments in this band; however, this band is used for distress and safety operations. Plans exist for satellite EPIRBS and relay of distress and safety signals between satellites.
1646.5-1660.5	AERONAUTICAL MOBILE SATELLITE (R) (Earth-to-space) MOBILE SATELLITE ((Earth-to-space) primary 1651-1660, secondary 1646.5-1651) RADIO ASTRONOMY (1660-1660.5)	INMARSAT II operates 1646.5-1649.5 MHz This band is used for the uplink for the nationwide mobile satellite system operated by the American Mobile Satellite Corporation, a consortium of eight U.S. companies. Mobile satellite services are expected to grow rapidly.	AERONAUTICAL MOBILE SATELLITE (R) (Earth-to-space) MOBILE SATELLITE ((Earth-to-space) primary 1651-1660, secondary 1646.5-1651) RADIO ASTRONOMY (1660-1660.5)	This band is used for the uplink for the nationwide mobile satellite system operated by the American Mobile Satellite Corporation, a consortium of eight U.S. companies. Mobile satellite services are expected to grow rapidly, including many Federal users. Included within this frequency range is the internationally allocated 1646.5-1656.5 MHz AMS(R)S allocation (Earth-to-space) to support the worldwide interoperable AMS(R)S through a number of satellites. In accordance with US308, AMS(R)S has priority and real-time preemptive access in this band segment. Passive radio astronomy observations of the redshifted spectral line of the OH radical, essential for understanding interstellar medium and star formation in other galaxies, are carried out in this band.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1660.5-1670	RADIO ASTRONOMY SPACE RESEARCH ((Passive) 1660.5-1668.4) METEOROLOGICAL AIDS ((Radiosonde) 1668.4-1670)		RADIO ASTRONOMY SPACE RESEARCH ((Passive) 1660.5-1668.4) METEOROLOGICAL AIDS ((Radiosonde) 1668.4-1670)	The 1660.5-1668.4 portion of this band has been set aside nationally for passive operations and no stations are authorized to transmit. There are no Federal assignments in this range. Passive radio astronomy observations are performed under the protection of US246 (transmissions prohibited). Observation of the two spectral lines of the OH radical (1665.402 and 1667.359 MHz), essential for understanding interstellar medium and star formation in other galaxies, are carried out in this band. The band is also used for continuum observations. Radiosondes are operated nationwide by numerous Federal agencies to gather local weather data. These small inexpensive transmitters are attached to balloons and provide wind velocity, temperature, atmospheric pressure and humidity at various altitudes. The availability is essential to aviation activities, as well as space launches. The data gathered by radiosondes are exchanged internationally for worldwide weather prediction and research.
1670-1710	METEOROLOGICAL AIDS (Radiosonde) METEOROLOGICAL SATELLITE (space-to-Earth) Fixed (1700-1710) Earth Exploration-Satellite (FN671 1690-1710)		METEOROLOGICAL AIDS (Radiosonde) METEOROLOGICAL SATELLITE (space-to-Earth) FIXED (1700-1710) Earth Exploration-Satellite (FN671 1690-1710)	This band is extensively used worldwide for gathering meteorological data for weather prediction, severe storm warning, public safety and research. This data is gathered by two technologies: radiosondes and satellite imagery. NTIA has reallocated the 1670-1675 MHz portion of this band for nonfederal use after January 1999. Radiosondes are operated nationwide by numerous Federal agencies to gather local weather data. These small inexpensive transmitters are attached to balloons and provide wind velocity, temperature, atmospheric pressure and humidity at various altitudes. The availability is essential to aviation activities, as well as space launches. The data gathered by radiosondes are exchanged internationally for worldwide weather prediction and research. Also, NASA uses this band for transmission of meteorological data from tethered balloons. The Department of Commerce operates the GOES and TIROS-N satellites used for weather tracking and prediction. This information is essential for severe storm notification and public safety, and is used daily in TV and radio broadcast weather reporting to the public. Most of the meteorological satellite users are earth stations that receive the satellite data. The assignments in this band for earth terminals are primarily for fixed locations; however, over 40 are planned for shipboard use in the U.S. coastal waters. Some agencies have begun using the 1700-1710 MHz band for fixed line-of-sight data communications as the 1710-1650 MHz band gets crowded.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1710-1850	Radio Astronomy (US256 1718.8-1722.2)		FIXED MOBILE SPACE OPERATION ((Earth-to-space) G42 1762-1842)	1710-1850 MHz is the predominant Federal medium-capacity line-of-sight fixed service band. Fixed links are operated by Federal agencies for voice, data, and/or video communications where commercial service is unavailable, excessively expensive, or cannot meet required reliability. Applications include law enforcement networks, and control links for various power, land, water, and electric-power management systems. Other specialized fixed links include video relay, data relay, and timing distribution signals. Growth averages about 400 new assignments per year.
			Radio Astronomy (US256 1718.8-1722.2)	*Specific agency applications of the fixed service include; FAA remote data transmission of* critical flight safety data in support of essential aeronautical services, Army tactical radio relay systems, Department of Agriculture and Interior backbone links for control of land mobile radio systems necessary in fire fighting, law enforcement and disaster control within national forests and for provision of voice and data connections between sites where commercial service is not available, and Departments of Treasury and Justice microwave links related to law enforcement.
				One example of a wide area fixed network is the Department of Energy's use of this band for supervision, control, and protection of power administration operated electrical power transmission systems and activities supporting nuclear weapons development. Power administration microwave must be capable of carrying hundreds of radio channels per system. The channels are used for high speed relaying, supervisory control, load control, telemetering, data acquisition, land-mobile radio dispatching, operations and maintenance. The nuclear test facilities backbone microwave systems serve sites at greater than 10 miles and are more efficient in this band than in lower or higher bands. This band also allows for a greater range capability for robot control and video requirements. The present system connects all Federal power marketing control facilities in the western half of the U.S. Common equipment exists with the nongovernment sector allowing interconnectivity for critical communications dealing with all aspects of generating and distributing power.
				This band is also used for a variety of mobile applications, including airborne telemetry, telecommand, video and data links automated target scoring, and air combat maneuvering instrumentation. Many military aeronautical mobile systems depend on frequencies in this band. Border surveillance through the use of aerostats is supported by narrowband uplink and downlink telemetry transmissions.
				The Air Force and Navy also use the band for space telemetry, command and control. Uplink frequencies between 1761 and 1842 MHz are heavily used in certain locations in *conjunction with a 2200-2290 MHz downlink. Use of these systems has national security* implications. Telemetry, and telecommand and control of the NASA Space Shuttle is conducted on space-to-space links in this band.
				This band is also used by the USCG for vessel traffic safety systems, the VHF National Distress System and remote distress and safety communications and control networks.
				Radio astronomy observations are made of the 1720.530 MHz spectral line of the OH molecule. These observations are crucial to understanding the interstellar medium and star formation.
				NTIA has reallocated the 1710-1755 MHz portion of this band for nonfederal use after January 2004 under conditions that will permit some Federal systems to continue to operate.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
1850-1990	MOBILE FIXED	The FCC has reserved the 1850-1990 MHz band for personal communications services on a coprimary basis with fixed services. The band has been divided between frequencies used for metro trading areas, basic trading areas, and nonlicensed use (1910-1930). Private fixed microwave. This band is used to provide fixed point-to-point voice, data, telemetry and control services for private (non-common-carrier) companies. Typical users include electric and gas utilities, police and fire departments, and local governments. Most of these uses are being moved to other frequency bands within the next few years to allow development of PCS.		
1990-2110	FIXED MOBILE Space Research and Earth Exploration-Satellite (US90 2025-2110)	Auxiliary broadcasting, Cable television, Domestic public fixed. This band is heavily used by TV broadcasters for one way transmission services such as: portable van and helicopter mounted transmissions of video from remote news events; studio-to-transmitter links; and, intercity relay of video programming.	Space Research and Earth Exploration-Satellite (US90 2025-2110)	NASA's global ground network and TDRSS operations from 2025-2110 MHz are essential to NASA Earth exploration, space operations, and space research activities. This use includes Earth-to-space and space-to-space transmissions. Over 50 U.S. space missions, and, consistent with international agreements, additional foreign missions will be supported by NASA in the next five years. There will be varying degrees of support from launch and orbital transfer to full-time data relay. These telecommunications links are made available to private sector expendable launch vehicle operations. 123 satellites from nine countries are planned for or are operational in the 2025-2110 MHz and 2200-2290 MHz bands. These missions comprise 341 planned or existing assignments, not including earth stations. This band is also used for uplinks for the GOES weather satellite, supporting weather prediction efforts.
2110-2200	FIXED MOBILE	The 2110-2130 MHz portion, paired with 2160-2180 MHz, is used by common carriers for "light-haul" radio relay routes, for control and repeater links used with land-mobile base stations, and by cellular telephone companies for cell site-to-cell site links. The 2130-2150 MHz portion, paired with 2180-2200 MHz, is used by private companies (non-common-carriers) for applications similar to those in the 2110-2130 MHz band. The 2150-2162 MHz portion is used for omnidirectional transmission of point to multipoint video signals. This band is congested in many of the urban areas. The FCC has reserved the 2110-2150 and 2160-2200 MHz band for future emerging technologies on a coprimary basis with fixed services.	Space Research (US252 2110-2120)	NASA uses the 2110-2120 MHz portion of this band for Deep Space Network Earth-to-space command links. These activities support or will support Pioneers 6 through 12, Voyagers 1 and 2, MAGELLAN, GALILEO, and ULYSSES.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
2200-2290	Space Research, Space Operations, and Earth Exploration-Satellite (US303 2285-2290)		FIXED MOBILE SPACE RESEARCH (space-to-Earth, space-to-space) SPACE OPERATIONS (space-to-Earth, space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth, space-to-space)	This band is predominantly used for Federal terrestrial and space telemetry systems. Space applications include the NASA Tracking Data Relay Satellite System (TDRSS) and the Air Force Space Ground Link Subsystem (SGLS). These two systems provide the telemetry, telecommand and control for all Federal satellite systems and some activities with national security implications. Telemetry, tracking and control functions for a new satellite ALEXIS will be performed in this band as part of U.S. treaty verification efforts. Terrestrial telemetry is predominantly air-to-ground links for various operational and experimental systems. Growth averages about 60 new assignments per year. TDRSS operations from 2200-2290 MHz are essential to NASA Earth exploration, space operations, and space research activities. This use includes space-to-Earth and space-to-space transmissions. Over 50 U.S. space missions, and, consistent with international agreements, additional foreign missions will be supported by NASA in the next five years. There will be varying degrees of support from launch and orbital transfer to full-time data relay. These telecommunications links are made available to private sector expendable launch vehicle operations. 123 satellites from nine countries are planned for or are operational in the 2025-2120 MHz and 2200-2290 MHz bands. The band also supports similar space-to-Earth and space-to-space telemetry, telecommand and control for military satellites through the Air Force SGLS system. Terrestrial telemetry is heavily used in this band for such purposes as nuclear testing, airborne weapons testing, aircraft flight testing, and a wide variety of experimental and research projects. Most of this equipment was moved to this band during the 1970's, at significant expense to the Federal Government, to reaccommodate requirements in lower bands for other uses. Other mobile applications include narrowband uplinks and downlinks in conjunction with radar laden tethered balloons. These balloons are used in law enforcement and drug interdiction missions. Fixed microwave systems are also in this band for control of land-mobile radio systems to provide voice and data connections between sites where commercial service is not available, and where the 1710-1850 MHz band is saturated.
2290-2300	SPACE RESEARCH ((space-to-Earth) deep space only)		SPACE RESEARCH ((space-to-Earth) deep space only) FIXED MOBILE	NASA uses this band for Deep Space Network space-to-earth telemetry. These activities support or will support Pioneers 6 through 12, Voyagers 1 and 2, MAGELLAN, GALILEO, and ULYSSES. Radio Astronomy observations are also conducted in this band.
2300-2310	Amateur	Amateur weak signal modes (≈ 2304), other modes throughout the band.		
2310-2360	BROADCASTING SATELLITE Mobile	The FCC has allocated this band for Broadcast-Satellite for high quality radio.	Radiolocation Mobile Fixed	

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
2300-2390	MOBILE	This band is used for telemetry and telecommand for expendable and reusable launch vehicles.	MOBILE RADIOLOCATION Fixed	This band is used for telemetry and telecommand for expendable and reusable launch vehicles. The Air Force and Navy use this band for aeronautical telemetry. Aeronautical telemetry needs extensive spectrum, and minimal in-band and adjacent-band interference. The 1435-1525 MHz band is filled and new systems are being moved into this band. The Air Force uses the band for high-power long-range surveillance radars and air-traffic control radars, while the Army and DOE use it for air/ground ranging system tracking. NASA uses this band for the Venus Radar Mapper (VRM) synthetic aperture radar and associated telemetry. The National Science Foundation and NASA use planetary radars in coordination with research universities. Observations at the National Astronomy and Ionospheric Center (Arecibo) occupy 20 MHz centered around 2380 MHz.
2390-2450	AMATEUR (primary 2390-2400, 2402-2417, secondary 2400-2402, 2417-2450) Amateur Satellite (FN664)	Amateur mixed modes (2390-2400, 2410-2450). Amateur satellite operation (space-to-Earth) occur in accordance with FN664 from 2400-2450 MHz. This band is also used for microwave ovens (approximate operating frequency 2450) and a variety of industrial processes.	RADIOLOCATION (2417-2450)	The Air Force uses the band for high-power long-range surveillance radars and air-traffic control radars. However, because of the operation of tens of millions of microwave ovens and other industrial, scientific, and medical (ISM) equipment little use is made of this band and little growth is expected. There is some packet radio development by the Army going on in this band.
2450-2483.5	FIXED MOBILE Radiolocation	This band is used for fixed and portable transmission of video by TV broadcasters for remote news events. In addition, the band is used for private company fixed service radio relay transmission of voice and data transmissions by private companies. This band is also used for microwave ovens (approximate operating frequency 2450) and a variety of industrial processes.	Radiolocation (FN41)	The U.S. Customs Service (Treasury) uses this band on a secondary basis for law enforcement related radiolocation.
2483.5-2500	RADIO DETERMINATION SATELLITE (space-to-Earth) MOBILE SATELLITE (space-to-Earth)	Though this is the downlink band for the Radiodetermination Satellite Service, private company fixed stations and TV broadcaster portable stations that were in operation prior to 1986 may continue to operate on a primary basis. These are multichannel equipment having 10 channels.	RADIO DETERMINATION SATELLITE (space-to-Earth) Radiolocation (FN41) MOBILE SATELLITE (space-to-Earth)	
2500-2655	BROADCASTING SATELLITE FIXED Space Research and Earth Exploration-Satellite (FN720 2640-2655)	Auxiliary broadcasting. The 2500-2686 MHz portion of this band is used for omni-directional transmission of point to multipoint (multipoint MDS) that can be contained within 6 MHz channel bandwidths. Portions of the band are allocated to be used for pay television distribution, transmission of educational lectures by school systems (ITSF), and private video teleconferences.	Space Research and Earth Exploration-Satellite (FN720 2640-2655)	NASA performs passive space research and earth-exploration satellite observations that allow measurement of soil moisture and of coastal ocean salinity.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
2655-2690	BROADCASTING SATELLITE FIXED Earth Exploration Satellite (passive) Radio Astronomy Space Research (Passive)	Auxiliary broadcasting. Private fixed microwave (above 2680 MHz). There are also fixed multipoint MDS and instructional television operations in this band.	Earth Exploration Satellite (passive) Radio Astronomy Space Research (Passive)	This band is used in the U.S. and other countries for radio astronomy continuum measurements. It is used in addition to the 2690-2700 MHz band, which is too narrow to conduct some measurements. NASA performs passive space research and earth-exploration satellite observations. These observations allow measurement of soil moisture and of coastal ocean salinity.
2690-2700	RADIO ASTRONOMY EARTH EXPLORATION SATELLITE (Passive) SPACE RESEARCH (Passive)		RADIO ASTRONOMY EARTH EXPLORATION SATELLITE (Passive) SPACE RESEARCH (Passive)	This band is used extensively in the U.S. and other countries for radio astronomy. It is an excellent band for continuum measurement, because the galactic background continuum radiation is low. Observations of galactic and extragalactic radio sources at these frequencies help to define their spectra, which gives information on the physical parameters of the radiating source. The band is also being used by the U.S. Naval Observatory Interferometer at Green Bank, WV. This program is used for accurate position determinations by the Navy. The band is also used for solar observations by the Air Force Radio Solar Telescope Network. NASA performs passive space research and earth-exploration satellite observations protected under Footnote US246. These observations allow measurement of soil moisture and of coastal ocean salinity.
2700-2900			AERONAUTICAL RADIONAVIGATION METEOROLOGICAL AIDS Radiolocation	This band is used predominantly for air-surveillance radars. It is a critical safety-of-flight *band for airport surveillance radars (ASRs) to provide aircraft position information for air-*traffic control in the vicinity of airports. Similar use is for military Ground Control Approach radars (GCAs). The Air Force and Navy use it for high-power long-range surveillance radars and air-traffic control radars. NEXRAD is also being used here when not in conflict with the ASRs. Weather radars are also operated in this band in support of flight safety. NASA uses the band for tracking for range safety purposes (radiolocation), and for atmospheric research (meteorological aids).
2900-3100	MARITIME RADIONAVIGATION Radiolocation	This band is primarily used for maritime radars and radar beacons (racons). Radars of this type are required on cargo and passenger ships by international treaty (SOLAS) for safety purposes. Racons operate in conjunction with maritime radars to provide electronic markers to identify maritime obstructions and navigation points.	MARITIME RADIONAVIGATION Radiolocation	Federal agencies use this band heavily for shipborne radionavigation radars, vessel traffic systems, and racons. The military uses this band for high-power 3-D long-range surveillance radars and air-traffic control radars. Also, NEXRAD operates from 2900-3000 MHz. NASA performs airborne measurements of rainfall rates over selected ocean areas.
3100-3600	Radiolocation *Space Research and* Earth Exploration-Satellite (FN713 3100-3300) Amateur (3300-3500)		RADIOLOCATION AERONAUTICAL RADIONAVIGATION ((Ground-based) 3500-3600) Space Research and Earth Exploration-*Satellite (FN713* 3100-3300)	This band is primarily used for military radiolocation, including several multi-billion dollar defense radar systems. Use of this band for these systems is considered critical to national defense. The high-power mobile radars include airborne, land-based, and shipborne applications.
3600-3700	FIXED SATELLITE Radiolocation	INMARSAT and INTELSAT have limited use for fixed satellite service earth stations. Each site must be actively coordinated with the U.S. Government with supporting EMC analysis.	AERONAUTICAL RADIONAVIGATION (Ground-based) RADIOLOCATION	The principal Federal use of this band is to support a Navy radar used for landing operations on aircraft carriers. This high-power radar is operated on Navy ships and at certain shore locations for training. *NTIA has reallocated the 3650-3700 MHz portion of this band for shared nonfederal use after January 1999.*

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
3700-4200	FIXED FIXED SATELLITE	Domestic public fixed, Satellite communications		
4200-4400	AERONAUTICAL RADIONAVIGATION	This band is heavily used for radar altimeters on board nongovernment fixed-wing and rotary aircraft.	AERONAUTICAL RADIONAVIGATION	This band is heavily used for radar altimeters on board government fixed-wing and rotary aircraft, as well as spacecraft. Methods for reducing the bandwidth necessary to perform this function are being studied within the ITU-R; however, some altimeter functions may not be able to be provided in a reduced bandwidth. Also, significant capital has been invested in current equipment.
4400-4990	FIXED SATELLITE (space-to-Earth) 4500-4800) Radio Astronomy (US203 4825-4835, US257 4950-4990) Space Research and Earth Exploration-Satellite (FN720 4950-4990)		FIXED (4400-4660, 4685-4990) MOBILE (4400-4660, 4685-4990) Radio Astronomy (US203 4825-4835, US257 4950-4990) Space Research and Earth Exploration-Satellite (FN720 4950-4990)	This band is heavily used by the military services for tactical communications, both line-of-sight and troposcatter. In addition to extensive transportable fixed service use, the DOD operates air-to-ground data links, drone command and control systems, air-defense, and many other systems in this band. The DOD anti-air warfare systems employ high power spread spectrum techniques in a distributed network among ships, aircraft, and land forces. Additional uses are for emergency incident response for the Nuclear Emergency Search Team, and target scoring and control. Narrowband and wideband uplinks and downlinks operate in conjunction with aerostats used in law enforcement and drug interdiction missions. The National Science Foundation performs some continuum observations in the 4950-4990 MHz portion of the band when the 4990-5000 MHz band does not provide adequate bandwidth. NTIA has reallocated the 4635-4660 MHz portion of this band for nonfederal use after January 1997.
4990-5000	RADIO ASTRONOMY Space Research (Passive)		RADIO ASTRONOMY Space Research (Passive)	This band is used extensively in the U.S. and other countries for radio astronomy. It is an excellent band for continuum measurement, because the galactic background continuum radiation is low. Observations of galactic and extragalactic radio sources at these frequencies help to define their spectra, which gives information on the physical parameters of the radiating source.
5000-5250	AERONAUTICAL RADIONAVIGATION AERONAUTICAL MOBILE (R) (FN733) Fixed Satellite and Inter-Satellite (when in conjunction with Aeronautical Radionavigation or Aeronautical Mobile (R) FN797)		AERONAUTICAL RADIONAVIGATION AERONAUTICAL MOBILE (R) (FN733) Fixed Satellite and Inter-Satellite (when in conjunction with Aeronautical Radionavigation or Aeronautical Mobile (R) FN797)	The Microwave Landing System is being deployed in the 5000-5150 MHz portion of this band as one of two internationally recognized systems for precision landing of aircraft.
5250-5350	Radiolocation		RADIOLOCATION (G59 nonmilitary secondary)	This band is used for high-power DOD radar systems. NASA is performing experiments with spaceborne radar systems in this band in accordance with FN713.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
5350-5460	AERONAUTICAL RADIONAVIGATION (FN799 airborne radars and associated radar beacons only) Radiolocation	The 5350-5470 MHz band is used for airborne weather radars for storm avoidance. Some ground based weather radars operate in this band to provide weather information for state and local governments, universities, and broadcast stations.	AERONAUTICAL RADIONAVIGATION (FN799 airborne radars and associated radar beacons only) RADIOLOCATION (G56 nonmilitary secondary)	The Navy operates its primary surface search radar in this band. The 5350-5470 MHz band is used for airborne weather radars for storm avoidance.
5460-5470	RADIONAVIGATION (FN799 aeronautical radionavigation limited to airborne radars and associated radar beacons only, US65 maritime radionavigation limited to shipborne radars) Radiolocation	Ship radars operate in this band to provide coastal navigation information. Some ground based weather radars operate in this band to provide weather information for state and local governments, universities, and broadcast stations.	RADIONAVIGATION (FN799 aeronautical radionavigation limited to airborne radars and associated radar beacons only, US65 maritime radionavigation limited to shipborne radars) Radiolocation (G56 nonmilitary secondary)	Ship radars operate in this band to provide coastal navigation information. The Navy operates its primary surface search radar in this band.
5470-5600	MARITIME RADIONAVIGATION (US65 limited to shipborne radars) Radiolocation	Ship radars operate in this band to provide coastal navigation information.	MARITIME RADIONAVIGATION (US65 limited to shipborne radars) Radiolocation (G56 nonmilitary secondary)	Ship radars operate in this band to provide coastal navigation information. The Navy operates its primary surface search radar in this band. Above 5500 MHz, this band is used heavily for test range instrumentation radars.
5600-5650	MARITIME RADIONAVIGATION (US65 limited to shipborne radars) METEOROLOGICAL AIDS Radiolocation	Ship radars operate in this band to provide coastal navigation information.	MARITIME RADIONAVIGATION (US65 limited to shipborne radars) METEOROLOGICAL AIDS Radiolocation (G56 nonmilitary secondary to military)	Ship radars operate in this band to provide coastal navigation information. The Navy operates its primary surface search radar in this band. Terminal doppler weather radars provide windshear information in support of air-traffic control activities. This band is used heavily for test range instrumentation radars.
5650-5850	Amateur Amateur Satellite (FN664 (Earth-to-space) 5650-5670, FN808 (space-to-Earth) 5830-5850)		RADIOLOCATION (G2 limited to military)	The Navy operates its primary surface search radar in this band. This band is used heavily for test range instrumentation radars.
5850-5925	FIXED SATELLITE (Earth-to-space) Amateur		RADIOLOCATION (limited to military G2)	This band is used heavily for test range instrumentation radars used to track missiles and other airborne targets and is used to safeguard range personnel and surrounding civilian communities. This band is also used to control airborne target systems that help maintain air-defense and combat readiness.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
5925-7075	FIXED (5925-6425, 6525-6875) FIXED SATELLITE (Earth-to-space) MOBILE (6425-6525, 6875-7075)	This fixed service bands within this range are heavily used for common carrier fixed links. The fixed satellite service uplink in this bands corresponds to the downlink in the 3700-4200 MHz band.		
7075-7125	FIXED MOBILE			
7125-7250	SPACE RESEARCH ((Earth-to-space), US252 deep space only 7145-7190)		FIXED SPACE RESEARCH ((Earth-to-space) 7190-7250) and (US252 deep space only 7145-7190)	This band is used for fixed microwave links associated with control of power distribution and dam flood gates, remoting of weather data, remoting of vessel traffic information, remoting of air-traffic control radar data, and military test range communications.
7250-7750			FIXED (primary 7300-7750, secondary 7250-7300) FIXED SATELLITE ((space-to Earth) G117 military only) METEOROLOGICAL SATELLITE ((space-to-Earth) 7450-7550) MOBILE SATELLITE ((space-to-Earth) primary 7250-7300, secondary 7300-7750, G117 military only)	This band is used for fixed microwave links associated with control of power distribution and dam flood gates, remoting of weather data, remoting of vessel traffic information, remoting of air-traffic control radar data, and military test range communications. The band is used for Defense Satellite Communication Systems (DSCS) downlinks to provide secure voice and data communications to globally deployed military units, and for FLTSATCOM telemetry.
7750-7900			FIXED	This band is used for fixed microwave links associated with control of power distribution and dam flood gates, remoting of weather data, remoting of vessel traffic information, remoting of air-traffic control radar data, and military test range communications.
7900-8025			FIXED SATELLITE ((Earth-to-space) G117 military only) MOBILE SATELLITE ((Earth-to-space) G117 military only) Fixed	This band is used for fixed microwave links on a secondary basis. The band is also used for Defense Satellite Communication Systems (DSCS) uplinks that provide secure voice and data communications to globally deployed military units including mobile earth terminals, and for FLTSATCOM uplinks for fleet broadcasts.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
8025-8400	EARTH EXPLORATION *SATELLITE* (Space-to-Earth US258)	This band is used for land remote-sensing operations within the Earth exploration-satellite service (space-to-Earth).	EARTH EXPLORATION SATELLITE (space-to-Earth) FIXED *FIXED SATELLITE* ((Earth-to-space) G117 military only) *METEOROLOGICAL* SATELLITE ((Earth-to-space) 8175-8215) Mobile Satellite ((Earth-to-space) no airborne transmissions, G117 military only)	This band is used for fixed microwave links associated with control of power distribution and dam flood gates, remoting of weather data, remoting of vessel traffic information, remoting of air-traffic control radar data, and military test range communications. The band is used for Defense Satellite Communication Systems (DSCS)and FLTSATCOM uplinks that provide secure voice and data communications to globally deployed military units. This band is used for land remote-sensing operations within the Earth exploration-satellite service (space-to-Earth).
8400-8500	SPACE RESEARCH ((space-to-Earth) 8450-8500)		FIXED SPACE RESEARCH *(space-to-Earth deep* space only, 8450-8500) SPACE RESEARCH (space-to-Earth, 8400-8450)	Magellan Deep Space Network activities are conducted at the Goldstone facility in California.
8500-9000	Radiolocation	The 8750-8850 MHz band is used for airborne weather radars for storm avoidance.	RADIOLOCATION (G59 nonmilitary secondary to military)	The 8750-8850 MHz band is used for airborne weather radars for storm avoidance. There is also increasing use for ground-based missile defense. NASA operates its Goldstone Solar System Radar at 8510 MHz.
9000-9200	AERONAUTICAL RADIONAVIGATION (FN717 ground-based *radars and associated* transponders only) Radiolocation		AERONAUTICAL RADIONAVIGATION (FN717 ground-based *radars* and associated transponders only) Radiolocation (G19 military only)	This band is used extensively for military precision approach radars. There is also increasing use for ground-based missile defense systems.
9200-9300	MARITIME RADIONAVIGATION (FN823 limited to shore-based radars) Radiolocation		MARITIME RADIONAVIGATION (FN823 limited to *shore-based radars)* Radiolocation (G59 nonmilitary secondary *to military)*	There is increasing use for ground-based missile defense systems in this band.

FREQUENCY (MHz)	NONGOVERNMENT ALLOCATION	NONGOVERNMENT USE	GOVERNMENT ALLOCATION	GOVERNMENT USE
9300-9500	RADIONAVIGATION (US66 aeronautical radionavigation - airborne radars and associated airborne beacons only, ground-based permitted 9300-9320) Meteorological Aids (US67 ground-based radars only) Radiolocation	Ship radars operate in this band to provide coastal navigation information. These radars employ wide bandwidths for high resolution. Also, radar transponder beacons (RACONs) identify maritime hazards search, and search and rescue transponders (SARTs) identify people in distress at sea. This band is used by civil aircraft for airborne weather radars for storm avoidance.	RADIONAVIGATION (US66 aeronautical radionavigation - airborne radars and associated airborne beacons only, ground-based permitted 9300-9320) Meteorological Aids (US67 ground-based radars only) Radiolocation	Ship radars operate in this band to provide coastal navigation information. These radars employ wide bandwidths for high resolution. The Coast Guard operates vessel traffic system radars for controlling ship movement around harbors and coastal areas with high ship traffic. Also, radar transponder beacons (RACONs) identify maritime hazards, and search and rescue transponders (SARTs) identify people in distress at sea. This band is used for airborne weather radars for storm avoidance. There is also increasing use for ground-based missile defense systems.
9500-10000	Radiolocation Meteorological Satellite (FN828 9975-10025 for weather radars)		RADIOLOCATION Meteorological Satellite (FN828 9975-10025 for weather radars)	This band is used extensively for military airborne radars. There is also increasing use for missile defense systems.

EXCERPT FROM "LAND MOBILE SPECTRUM PLANNING OPTIONS," NTIA Special Publication 95-34 (October 1995)

Figure 2-1 shows the approximate amount of spectrum allocated to various land mobile services. Cellular and PCS allocations account for nearly 60 percent of the allocated land mobile spectrum. Many public safety organizations have indicated that the 23 MHz of spectrum allocated to the non-Federal public safety services is insufficient and that additional spectrum will be needed for basic voice dispatch and other current public safety spectrum needs.

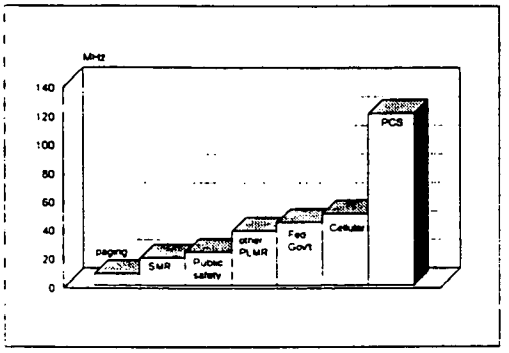


Figure 2-1. Land mobile service allocations.

The general consensus within the land mobile community is that the demand for land mobile services exceeds the amount of spectrum that is currently allocated in many geographic areas. License data indicates that the number of private land mobile transmitters is increasing at a rate of nearly eight percent per year.[1] Further, Federal frequency assignment records show that Federal land mobile assignments are increasing as much as 12 percent per year.[2]

To provide relief, significant effort is being focused on technology as a means to increase spectrum efficiency and capacity. As was discussed earlier, both NTIA and the FCC have embarked on ambitious plans to narrowband their land mobile bands. The cellular industry is implementing digital multiple access techniques that will further increase spectrum efficiency. The public safety community formed the Association of Public-Safety Communications Officials-International, Inc. (APCO) Project 25 to develop standards for equipment which will ensure a graceful migration between techniques and intercommunications between the products of different manufacturers. These systems will use 12.5-kHz channels, with a full range of digital data and vocoder features, including encryption.

NTIA noted in the *NTIA Requirements Study* that although technology will provide some relief, it is no panacea for the current congestion that the land mobile services are experiencing. This congestion is particularly heavy in major metropolitan areas where, according to APCO, it is becoming increasingly difficult, if not impossible, to find enough channels to satisfy the demand. This is also true for Federal operations.

To show the degree of usage of a frequency band, NTIA developed the Spectrum Use Measure (SUM) Model.[3] The SUM is a computer model that uses either the Government Master File (GMF) or FCC data base for input data. The SUM provides a technique for estimating the extent of the use of the radio frequency spectrum in a given frequency band. An output of the SUM model used herein is the Spectrum Use Factor (SUF). SUF measures the probability that spectrum is not available for additional use in a given location because of existing users. The SUF is a value ranging from 0 to 1 that represents the percent of spectrum resources used in a particular location, zero representing the least spectrum resources used. For example, a SUF value greater than "0.8" indicates that greater than 80 percent of spectrum resources are used in that particular location.

Figures 2-2, 2-3, 2-4, 2-5, and 2-6 illustrate areas of the United States with various ranges of SUF values for the 150.8-174 MHz, 162-174 MHz, 450-470 MHz, 851-866 MHz, and 866-869 MHz bands, respectively. Data used to generate these figures was extracted from the GMF or the FCC license database, which were current as of July 1995.

It should be noted that the SUF figures provided do not reflect records whose latitude and longitude were not specified, aeronautical stations, fixed assignments, or experimental and nationwide assignments Therefore, the bands are generally more heavily used than indicated in the SUF plots. Nationwide assignments are particularly important for law enforcement activities for the Departments of Justice and Treasury SUF values of "0 8" and greater indicate that the bands are currently congested in these urban areas

The SUM program uses data from computer files for the analysis Only stations with land mobile station classes were used for the analysis Frequency bands containing other allocations, such as fixed, will show a lower station density on the SUF plots than actually exists. Any data file with missing data, particularly latitude and longitude data, will be ignored. Because data files often contain errors or missing data, this results in plots that generally understate the actual density of station operations. However, a relative sense of station density across the nation can be obtained from these plots.

Figure 2-2 is the SUF plot for the frequency ranges 150 8-156 2475 MHz, 157 45-161.575 MHz, 161 625-161 775 MHz, and 173 2-173 4 MHz (labeled 150 8-174 0 MHz) FCC license data was used for this plot and it shows non-Federal Government use only It should be noted that the fixed service is also allocated in the 172 3-173 4 MHz band. Only station locations for the land mobile service were plotted The New York City area shows SUF factor values above 0 8 and is considered to be congested The area around Las Vegas, Nevada contains factor values of 0 6 to 0 8 and is considered to have heavy usage Other areas are below 0 6 and considered to show light to medium usage

SUF FACTOR VALUES

0 8 and Above	Congested, not necessarily saturated
0 6 to 0 8	Heavy Usage
0 4 to 0 6	Medium Usage
0 2 to 0 4	Light Usage

Figure 2-3 is the SUF plot for the frequency ranges 162.0125-173 2 MHz and 173.4-174 0 MHz (labeled 162 0 to 174 0 MHz) The Government Master File data was used for this plot and shows Federal Government use only It should be noted that the Federal allocations for these ranges include both fixed and mobile allocations, with many fixed assignments Again, only land mobile station classes were selected for plotting, resulting in a lower density of assignments than if all assignments, including other mobile, were plotted. The plot shows that in many urban areas indicated by the 0 6-0 8 color that heavy use is being made of the band Because of nationwide assignments, these SUF values should not be compared with plots using FCC data.

Figure 2-4 is the SUF plot for the frequency range 450 0-470.0 MHz. FCC license data was used for this plot The plot shows SUF factors above 0 8 for large areas of the country, particularly the eastern half of the United States and the three westernmost states, indicating that spectrum is congested.

Figure 2-5 is the SUF plot for the 851 0-866 0 MHz band. FCC license data was used for the plot This band is allocated for conventional and trunked land mobile systems, and is used by the base stations for the systems SUF values above 0 8 are pervasive over much of the country and indicate the spectrum is congested

Figure 2-6 is the SUF plot for the 866 0-869 0 MHz public safety band. FCC license data was used for this plot This is a relatively new band for public safety operations, but shows that the band is congested in some of the major urban centers SUF values above 0 8 are shown for areas including New York City, Chicago, Dallas/Fort Worth, Los Angeles, San Francisco, and southeastern Florida.

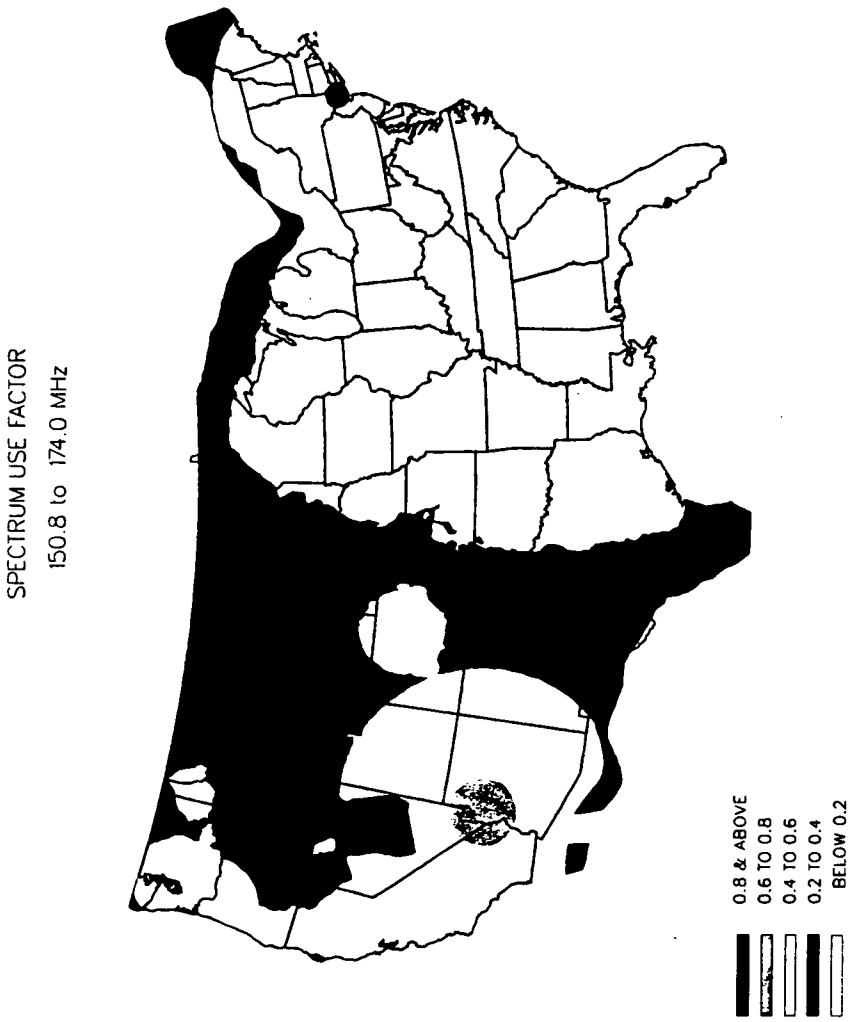


Figure 2-2. Spectrum Use Factor for the 150.8 - 174.0 MHz band.

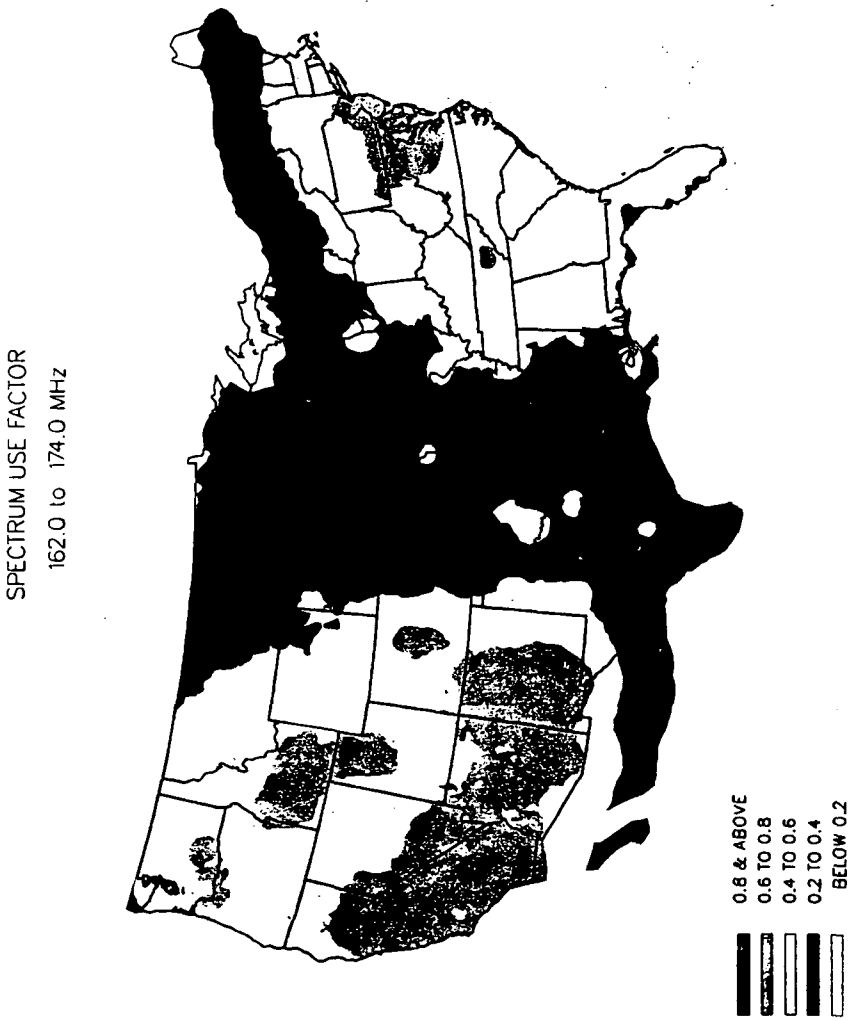


Figure 2-3. Spectrum Use Factor for the 162.0 - 174.0 MHz band.

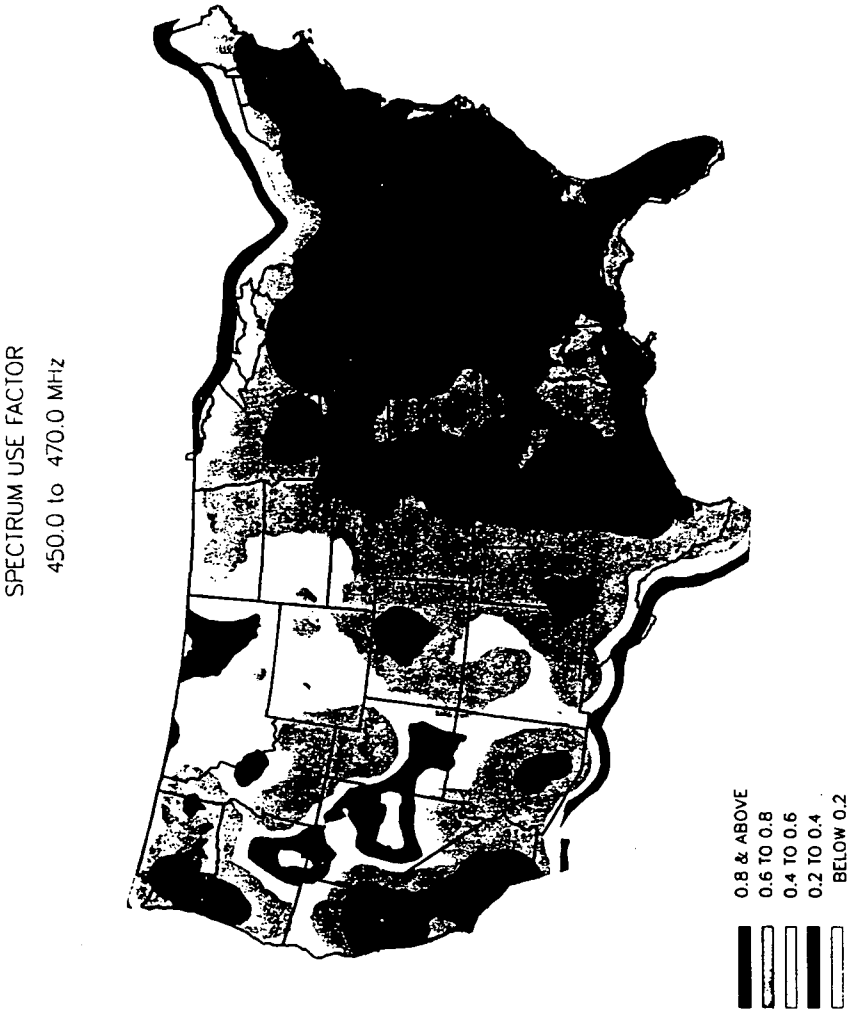


Figure 2-4. Spectrum Use Factor for the 450.0 - 470.0 MHz band.

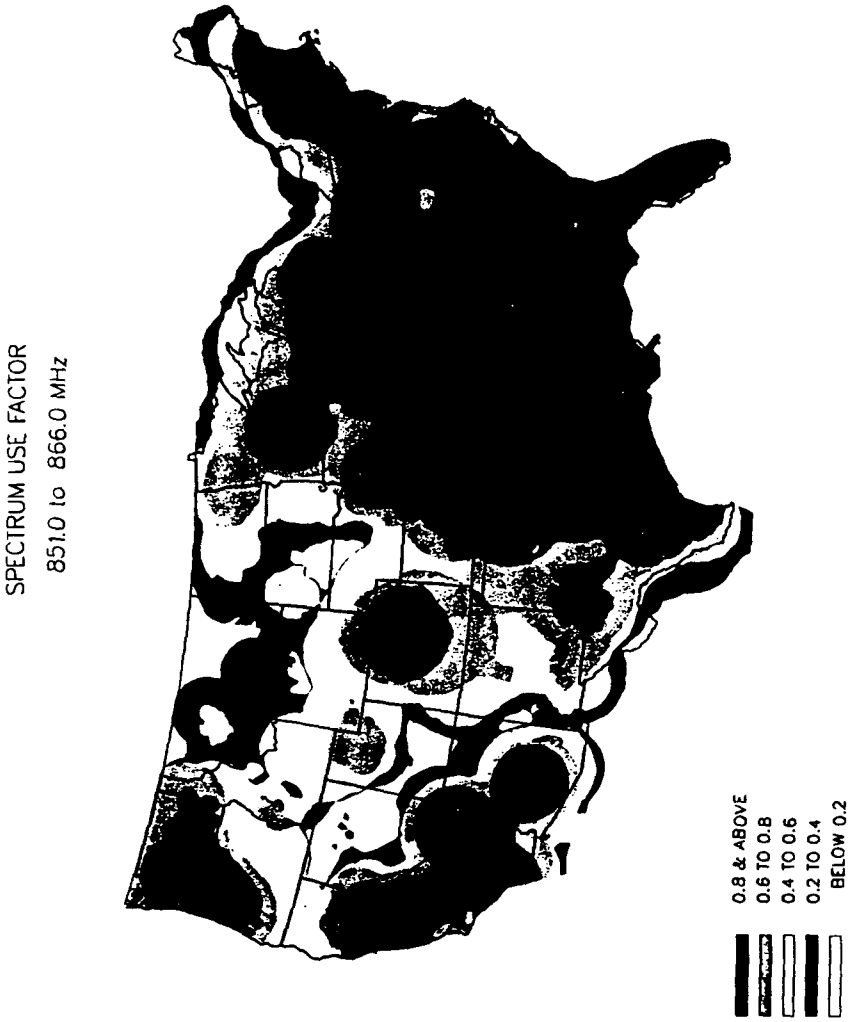


Figure 2-5. Spectrum Use Factor for the 851.0 - 866.0 MHz band.

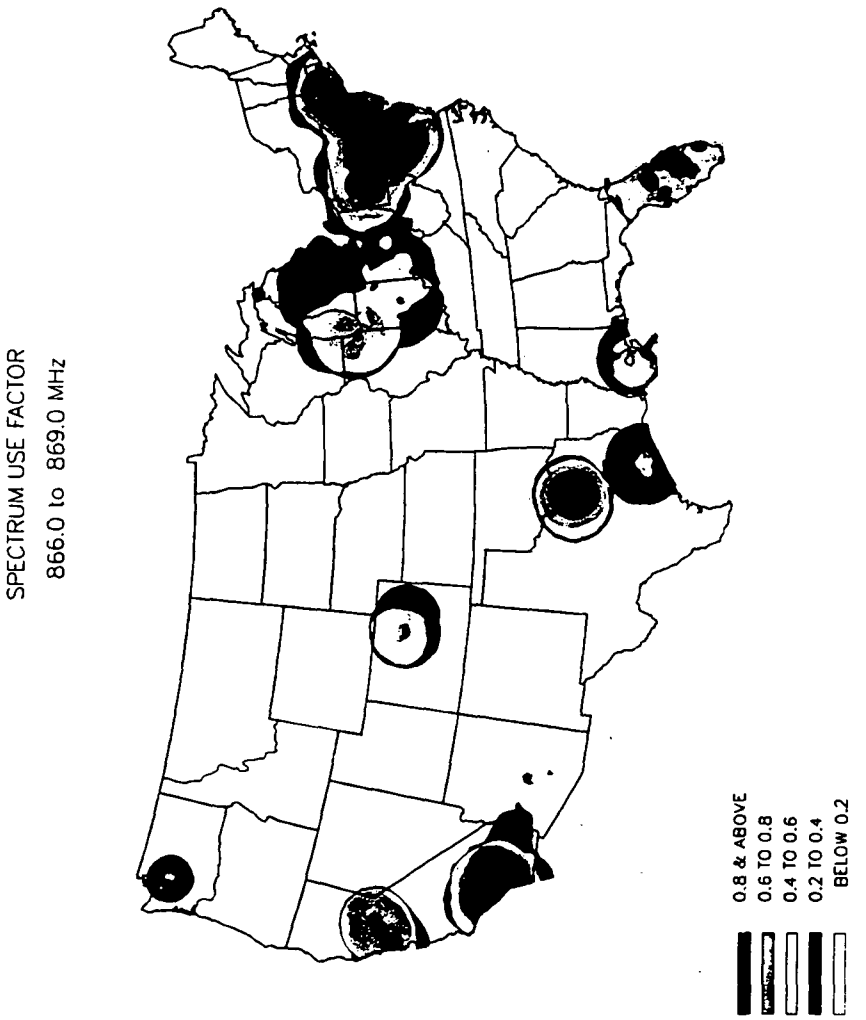


Figure 2-6. Spectrum Use Factor for the 866.0 - 869.0 MHz band.

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