UNITED STATES
FEDERAL COMMUNICATIONS COMMISSION

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SPECTRUM AGREEMENT EN BANC HEARING

Commission Meeting Room
Federal Communications
Commission
445 Twelfth Street, S.W.
Washington, D. C.

Volume: 1

Pages: 1 through 187

Place: Washington, D. C.

Date: April 6, 1999

HERITAGE REPORTING CORPORATION
Official Reporters
1220 L Street, N.W., Suite 600
Washington, D.C. 20005-4018
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445 Twelfth Street, S.W.
Washington, D. C.

Tuesday, April 6, 1999
9:10 a.m.

BEFORE COMMISSIONERS:

WILLIAM E. KENNARD, Chairman
HAROLD FURCHGOTT-ROTH, Commissioner
GLORIA TRISTANI, Commissioner
SUSAN NESS, Commissioner
MICHAEL POWELL, Commissioner

SPECTRUM MANAGEMENT EN BANC HEARING

April 6, 1999

(9:10 a.m.)

CHAIRMAN KENNARD (Presiding): Good morning, welcome to this Spectrum Management En Banc.

In March of 1996, just over three years ago, the Commission held an en banc hearing to examine policy issues associated with our management of the radio spectrum resource.

Since that time, much has happened in terms of spectrum options, technological developments, the demand for additional spectrum and expanding globalization of the telecommunications marketplace.

Moreover, as currently composed, this Commission has only limited opportunities to review our approach to spectrum management on a broader basis outside the context of specific proceedings.

Last September, Commissioner Ness proposed that the Commission hold another en banc hearing on the subject of spectrum management in order to gain information to better assess how we are doing in terms of our stewardship of the spectrum resource and to gather suggestions from the public users, providers, manufacturers, academics, and other government agencies on how we might improve the overall process.

I resoundingly seconded the idea so under the able leadership of Commissioner Ness, and with the concurrence of all the Commissioners, we've organized this hearing to provide insight on current spectrum management policies and practices from the viewpoint of users, and to identify options for developing future spectrum management policies.

I wish to take this opportunity to state, however, that the focus of today's hearing is on our overall spectrum management responsibilities, and we don't intend to focus today on specific proceedings.

This is an opportunity for us to sit back and look at our spectrum management obligations in sort of the broader focus so that we can take a little bit of time and reflect on where we should be going from a broader policy perspective.

So today we're going to have three panels.

Panel 1 is composed of our government experts who will discuss spectrum management fundamentals.

I'll briefly introduce the panelists at the beginning of each panel.

Panel 2 will consist of representatives of current users who will discuss what is working well with the

Commission's current spectrum management process, and what is not working.

Panel 3 will discuss potential new approaches to spectrum management, including addressing alternative, perhaps revolutionary and out-of-the-box approaches.

Unfortunately, we have a very tight time schedule today, a lot of witnesses that we've packed into this morning's panel, so we will not have time for questions for Panel 1.

Following brief presentations by each of the panelists on Panels 2 and 3, we will pose questions to the panelists aimed at eliciting information on some of the fundamental issues that we face in spectrum management and focusing the panelists' attention on the challenges we face in trying to accommodate more and more uses and users in a limited amount of spectrum.

By keeping the panelists focused on a broad view of spectrum management, we hope that by the end of the day, we will have a better understanding of the policy options available to us as we had into the next millennium.

I'm pleased to have a very distinguished group of government panelists who are well-known to this Commission. They should be. Most of them work here.

(Laughter.)

CHAIRMAN KENNARD: We have our own Dale Hatfield, who is Chief of the Commission's Office of Engineering and Technology and a mentor to all of us on engineering and technology matters to all the Commissioners.

We also have Bruce Franca, who is Deputy Chief of OET here at the Commission.

We have our Wireless Bureau Chief, Tom Sugrue, who came to us not long ago, and has had a very distinguished career in government, having been a deputy administrator at NTIA.

Tom Tycz, who is Chief of our Satellite and Radio Telecommunications Bureau. Tom has been described by this Commission as an national treasure and he's been invaluable to the FCC on a range of important satellite issues.

Or as Commissioner Powell likes to point out, when Tom is referred to as a national treasure, Commissioner Powell likes to point out that the Corn Palace is also a national treasure.

(Laughter.)

CHAIRMAN KENNARD: The Corn Palace, that's right, somewhere in the midwest.

Tom has been invaluable to the FCC on a number of important issues.

I'm also pleased to announce that Tom will be receiving an important award this year from the Personal Communications Industries Association. They give an award every year to someone who has been key to the wireless industry in advancing telecommunications policy. It's called the Bohler Award, and Tom will be receiving that next month.

(Applause.)

CHAIRMAN KENNARD: Also on this panel is Bob Pepper, Chief of the Office of Plans and Policy, who has been a key planner and visionary for the FCC on spectrum policy for many years.

And finally, we're pleased to welcome our distinguished colleague from the NTIA, William Hatch, Acting Associate Administrator in the Office of Spectrum Management.

Before we proceed with the panelists, though, I would like to invite my colleagues to make any opening remarks that they'd like.

Commissioner Ness?

COMMISSIONER NESS: Thank you, Mr. Chairman.

I also want to thank my colleagues for agreeing to dedicate this morning to what I hope will be an informative and provocative examination of our radio spectrum management policies.

The idea for the spectrum en banc originated actually in 1996 from my concern that the Commission was forming spectrum policy based on a record that was focused narrowly on one spectrum band at a time.

Yet, these decisions have precedential value for other bands. We need to be thinking about where our spectrum policy would be leading us.

We've made enormous progress revamping our spectrum management policies over prior decades, as evidenced by a multitude of FCC decisions.

We've established very flexible service rules for PCS so that licensees would not have to come back to the FCC for approval to adapt to a changing marketplace.

We instituted auctions to assign licenses. We privatized laborious coordination tasks. We streamlined the application process. We have declined to adopt specific technical standards, preferring instead to let the marketplace dictate design.

We established an Interagency Spectrum Coordinating Committee to ensure that a consistent policy would be derived among all of the bureaus and offices dealing with spectrum.

Were we headed in the right direction?

What was working? What was not?

The 1996 Spectrum En Banc provided Commissioners and Staff, as well as the public, with a much better understanding of spectrum policy issues.

But we are today at the epicenter of a technology revolution and much has transpired in the three years since we last held that forum, including an entire -- well, almost entire change in the composition of the Commission.

Moreover, global markets for wireless and satellite communications have erupted with lightening speed.

The WTO Basic Telecom Services Agreement, which went into force just over a year ago, has unleashed competition for wireless services and with it, newly-minted spectrum licensing policies.

Spectrum management has also clearly caught the attention of the international community. The dynamics of the 1995 World Radio Conference were vastly different from the dynamics of the 1997 Conference.

VU is also assessing its spectrum policies through the issuance of green paper, so spectrum, once the backwater of government agencies, has finally taken its rightful place as an essential ingredient in national and international products and services. The stakes are enormous.

How do our policies benefit the public and businesses that are competing globally?

So let's luxuriate for just a moment, away from the daily press of business, and focus on cross spectrum bands and into the technology of the future.

Are spectrum policies adaptable for the new millennium.

I have certain precepts in this debate.

First, spectrum is an amazing national resource, unlike mineral deposits or natural resources, rather unlike mineral deposits which are depleted when they're used, spectrum can be consumed all day long without diminishing the amount left for tomorrow.

And unlike mineral deposits again, failure to use spectrum is to waste it.

Second, spectrum is a national resource and the FCC is its steward, charged with assuring the efficient use of spectrum for the benefit of the American public.

Third, misguided allocation policies can impair efforts to develop flexible service rules for the use of the spectrum. Poorly designed or overly-restrictive service rules can render spectrum valueless.

Fourth, it is possible to have flexibility without efficiency, efficiency without flexibility, and both without serving the public interest.

Fifth, we should not have a one-policy-fits-all approach to spectrum management. While auctions are particularly well-suited for rapid deployment of spectrum for commercial use, I remain a very big fan of auctions, ample spectrum must be made available for unlicensed uses. These bands are test beds for innovative technologies and services, and there must be adequate spectrum for public safety and for private use, providing that the public is adequately compensated.

Sixth, we must more readily embrace experimental licenses and streamline our procedures, so that the excruciatingly long lag time between concept and deployment is considerably reduced.

Finally, we've got to recognize the relationship of our domestic policies to international spectrum policies, acknowledge the very real differences between one spectrum band and another, understand the consequences of our actions on real world inventors and investors, and appreciate the differences between deregulation and disorder.

So I look forward to today's very engaging discussion and I want to thank all those participating for their willingness to come out and participate today.

Thank you, Mr. Chairman.

CHAIRMAN KENNARD: Thank you, Commissioner Ness.

Commissioner Furchtgott-Roth?

COMMISSIONER FURCHTGOTT-ROTH: Thank you, Mr. Chairman.

I particularly want to thank Commissioner Ness for her guiding leadership in arranging this hearing today.

I think I speak for all my colleagues in thanking you for having shown the determination and the energy that's been necessary to put this together.

We are all very thankful for it.

I view this as spectrum management 101 and we are the students, and you, Professor Ness, have assembled the leading experts to educate us and I will try to be a good student today and learn a lot.

Thank you, Mr. Chairman.

CHAIRMAN KENNARD: Thank you.

Commissioner Powell?

COMMISSIONER POWELL: I have nothing to add, only that I'll also offer my personal thanks to Commissioner Ness and others who have taken a leadership role in expanding our horizons and understanding the spectrum, national treasures, people in the backwaters, everybody.

(Laughter.)

COMMISSIONER POWELL: With particular thanks to all those people assembled at the table.

I'd also like to single out Dan Connor whom I know, working with Commissioner Ness, has done a lot of work to organize this hearing as well.

CHAIRMAN KENNARD: Ditto.

Commissioner Tristani?

COMMISSIONER TRISTANI: Thank you, Mr. Chairman.

I'd first like to thank all of our panelists for sharing their time and expertise, and I appreciate

Commissioner Ness' foresight in calling for and planning for this en banc. Thank you.

This is a rare opportunity, it is an opportunity to step back and consider the broader implications of the decisions we make on a daily basis to follow or diverge from allocations pursued internationally, to segment one particular band and to impose sharing on another, to adopt more flexible or more stringent technical rules.

Each of these decisions is a marker charting us on a course of what we hope is effective and efficient spectrum management.

So I look forward to the insights that you can lend.

Our starting point is Section 1 of the Communications Act. Section 1 reminds us that our core function is to make available, to all Americans, a rapid, efficient, and worldwide radio and wire communications service.

In recent years, before I arrived here, the Commission committed itself to a largely market-based approach in the management of the spectrum.

Auctions have helped us to quickly and efficiently get the spectrum in the hands of those who will provide services that the public desires, and flexible technical and service rules have freed service providers to determine how best to meet their customers' needs.

This market-based approach clearly has benefitted the American consumer.

However, I remain concerned that some needs may go unmet. I am particularly eager to hear any thoughts on this issue.

For example, recently my fellow Commissioners and I attended hearings in New Mexico and Arizona on the dearth of telephone service on Indian Reservations.

I would ask whether there are policies or principles we might incorporate to promote service to unserved areas.

Another example, public safety services are a public good that may be under produced by market forces.

How can we ensure that we provide sufficient spectrum for these critical services?

With these questions raised, I am eager to hear our panelists.

CHAIRMAN KENNARD: Thank you very much, Commissioner Tristani.

Our first panel will be led by Dale Hatfield, head of our Office of Engineering and Technology.

And as I look at this panel of distinguished experts, I feel very confident that the spectrum management at this Commission at this time is in very good hands.

So I'm delighted that we can showcase some of our own talent at one of our en bancs.

Dale?

STATEMENT OF DALE HATFIELD, CHIEF, OFFICE
OF ENGINEERING AND TECHNOLOGY, FCC

MR. HATFIELD: Thank you, Mr. Chairman, Commissioners.

I will begin this panel with a short overview of spectrum fundamentals.

The thought was that spectrum management is a fairly technical topic, and it might be therefore useful to those attending if we began with some fundamental notions and definitions, and that's what I would like to do.

If I could have the next slide, please?

(Slide.)

This just provides an overview of what we provided in this first panel, so I'll skip over it, and go to the next slide, if I could.

(Slide.)

Let's start out by talking about what is spectrum. We use the term everyday but let's be a little bit more formal about it.

Spectrum is a conceptual tool used to organize and map a set of physical phenomena. Electric and magnetic fields produce electromagnetic waves that move through space at different frequencies, and the set of all possible frequencies is called the electromagnetic spectrum.

Next slide.

(Slide.)

The subset of frequencies between 3000 hertz and 300 gigahertz is what we refer to as the radio spectrum. Note that the radio waves do not require a medium, per se. That is, radio waves can travel through a vacuum, for example, outer space.

As we'll hear in a little bit more detail in a moment of course, the radio spectrum can be shared in frequency time and the space dimensions, and in theory at least, additional users can always be accommodated.

But of course, there are practical considerations including cost and complexity that tend to limit the number of users that can be accommodated in a given geographic area.

(Slide.)

In that sense, the spectrum is a scarce resource. On this next slide, I've just shown a very simple radio system consisting of a radio transmitter and receiver and of course radio transmitters are what generate the electromagnetic waves that I spoke of a moment ago.

It's somewhat similar to what happens of course when you drop a stone in a pond. It generates waves that propagate outward from the place where you dropped the stone in the water.

The same way here. The electromagnetic waves are generated at the transmitter, or radio waves, as we call them, and when they strike a receiving antenna, a small amount of electric current is caused to flow, and that is what's picked up by the receiver.

And of course, by changing the amplitude or frequency or phase of the transmitted wave, we're able to convey information from one location to another on a wireless basis.

(Slide.)

One of the fundamental characteristics of a radio wave, of course, is its frequency, and I've already used that term. And on this next slide, I've just illustrated two waves.

And of course when we talk about frequency, it's just a measure of the number of times that the wave goes through one complete variation per unit of time or per second. Therefore, we call the frequency the number of complete variations that we get in a unit of time.

The frequency, or we measure it in hertz where one hertz is equal to one cycle per second. It's sometimes confusing because us engineers talk about frequency and wavelength, and we sort of do it interchangeably.

The reason we do so is that there is a direct relationship between frequency and wavelength.

The best way to think about that is if you were observing the ocean with its waves, you can measure the distance between the crests of the waves, and that would be the wavelength, the difference from one crest to another.

Now imagine that you were sitting in a small boat on the ocean itself, if the crests are close together, in other words, the water is choppy, you would bob up and down very fast. In other words, the frequency of your motion would be very high.

On the other hand, if the distance between the crests are very large, it would be relatively smooth, and of course you would move up and down in the boat relatively slowly.

So you can see there's a direct relationship, if you will, between the frequency and wavelength, so that's the reason we engineers sort of interchangeably talk about frequency and wavelength, because there's a one-to-one correspondence between the two.

If I could have the next slide.

(Slide.)

I'm not sure how legible this slide is, but what I've tried to do here is show the characteristics of different frequency range, and particularly that different frequencies propagate differently.

Because of the difference in propagation characteristics, different frequency ranges are better suited for certain purposes.

I don't have time to go into details, but generally speaking, as we go higher in frequency, or as I talked about a moment ago, as the wavelength becomes shorter, the radio waves behave more and more like light waves, so they tend to be obstructed by buildings or natural barriers.

On the other hand, as the frequencies go higher and the wavelengths get shorter, antennas can more easily focus the energy. We can direct the energy in particular directions much easier.

Just like the headlights on your car. What do they do? They just beam the light towards the highway in front of you, rather than scatter it all over in different directions.

So we can use the antennas to direct the energy in a particular direction.

Next slide.

(Slide.)

Here, all I've done in this next slide is, since we're talking about spectrum management, I have more formally defined it as all the activities associated with regulating the use of the radio spectrum.

It includes the structure and processes for allocating, assigning, and licensing this scarce resource, as well as enforcing the associated rules and regulations.

Commissioner Ness already spoke to some of the unique characteristics of the radio spectrum. I won't say any more about that. But it goes almost without saying, of course, that the management of a scarce resource has an enormous impact on our economic and social well being.

Next slide.

(Slide.)

The basic steps in spectrum management, and here this morning you'll hear us talking about the different steps, but there are four fundamental steps when you sort of break it down.

There's the allocation process, developing the service rules, the assignment process, and then enforcement, and of course, by allocation, we're referring to the type of use that is allowed on a particular block or band, and of course it's a critical component of spectrum management.

Service rules define the regulatory parameters within the broad allocation, for example, a maximum transmitter power that can be employed.

Assignment then refers to the process of granting authority, a license, for a specific party or individual to operate a transmitter on a particular channel or set of channels and its specific locations under the conditions specified in the service rules.

Enforcement refers to making sure that licensees and other users of spectrum obey the rules, and it reflects our need to protect the radio environment from harmful interference and pollution.

I might just add parenthetically, sometimes I think we forget that the enforcement activities are a very critical part of the overall spectrum management process.

(Slide.)

Here of course I go to the point. Radio waves don't respect international boundaries so our domestic decisions must be made within the context of international allocations made under the auspices of the International Telecommunications Union.

Tom Tycz, to my left, will speak to these international dimensions, so I won't say any more.

Domestically, of course, the spectrum is divided between what we regulate on the non-federal government side, and what NTIA administers on behalf of the federal government on the federal government side.

Bill Hatch is going to talk, in a few moments, about spectrum management on the federal government side, and of course, a lot of the spectrum we share.

(Slide.)

The next slide just mentions a couple of terms of art. We talk about service definitions in terms of things like fixed and mobile services, broadcast services, and so forth, and we also talk of course about the status of services within allocations.

We talk about primary where the service should not receive interference from other services in the same range.

And of course, secondary means that you can operate in the band, but you cannot cause interference to primary users, and you must accept interference from other primary users.

(Slide.)

The next slide here just talks about the things that in the past, if you look traditionally at how the Commission allocated spectrum, traditionally, we've taken into account public need and benefits, technical characteristics -- that's the things like the differences in spectrum that I referred to before -- and apparatus limitations.

This is the fact that receivers in fact are not perfect and you need to take that into consideration when you develop your service regulations.

(Slide.)

Let me conclude by just offering a personal opinion that between auctions and the automated licensing proceedings, I think we're doing a pretty good job of handling the assignment process.

Our challenge, I think, as a Commission is in the allocation area; namely, continuing to accommodate additional users and users in the scarce spectrum resource.

With that, I'll turn the microphone over to my colleague and deputy, Bruce Franca, who will address techniques for finding spectrum for new uses.

Bruce?

STATEMENT OF BRUCE FRANCA, DEPUTY CHIEF, OFFICE OF ENGINEERING AND TECHNOLOGY, FCC

MR. FRANCA: Good morning, Mr. Chairman, Commissioners.

I've been asked to explain briefly how spectrum can be provided for new services, and a little bit about Part 15, Unlicensed Operations.

(Slide.)

Finding spectrum so that new uses can be made available to the American public is one of our most important and fundamental spectrum management tasks.

The radio spectrum is an important resource and under the Communications Act, the Commission is tasked to make sure that it is used efficiently and effectively.

One of the ways that spectrum can be made available for a new service is through spectrum sharing, that is, the new service can use the same spectrum that is already being used by other existing services.

This can be done when the use of the spectrum by the new service is compatible with the existing service. The risk of interference between uses is minimal or the uses can be coordinated with one another.

(Slide.)

A simple example of spectrum sharing is the use of the same marine VHF channels by ships and trains. Here, the same spectrum can be used because both operations are geographically separated.

(Slide.)

Another example of sharing is where the uses can be coordinated through technical means such as antenna discrimination.

Today, thousands of fixed satellite uplink facilities and point-to-point microwave operations share the spectrum in this manner.

Tom Tycz is going to show how this gets a little bit more complicated when satellites are non-geostationary.

(Slide.)

Another way in which spectrum can be made available is through improvements in technology.

Advancements in technology can make more efficient use of the spectrum so that less spectrum is needed to provide a specific level of service or serve the same number of people.

Improvements in technology can also make use of higher frequency bands practical. For example, recent developments in digital technology and digital processing and gallium arsenide integrated circuits have made mobile operations above 1 gigahertz possible.

The Land Mobile Service provides a good example where technology has been used to find new spectrum.

(Slide.)

Since the 1970s, there has been significant improvements in spectrum capacity and efficiency in this service. For example, the amount of spectrum needed to support a single voice communication has been reduced by almost a factor of ten over this time period.

(Slide.)

Trunking and cellular architecture have also provided spectrum efficiencies. Trunking technology allows less spectrum to be assigned to a service. Not every user needs a dedicated channel.

Cellular architecture permits more frequency reuse and allows more spectrum to be dedicated to higher use areas.

(Slide.)

Another way spectrum can be freed up for new services is through band clearing. Under this approach, spectrum that is lightly used, perhaps because the service was unsuccessful or has been replaced by newer technologies, is reallocated to other new, higher value uses.

The existing services are required to move to other bands, generally over a sufficient period of time so that they can amortize any recent investments.

(Slide.)

This approach was used very successfully to create the cellular and SMR and other radio services from TV channels 70 to 83 in the 1970s, and in the 1980s to create the direct broadcast satellite service in the 12.2 to 12.7 gigahertz band.

(Slide.)

Digital television is an example of both implementing a major technological improvement through a much more spectrum-efficient DTV transmission system and a band clearing approach with regard to channels 60 to 69.

(Slide.)

Today, however, there is very little of the spectrum that is lightly used. At the same time, the Commission is seeing ever-increasing demand for new services and spectrum to support them.

This means that the spectrum that needs to be freed up for a new service. To do that, we're required to relocate a substantial number of existing operations.

(Slide.)

In order to minimize the impact of this type of relocation, the Commission, in 1992, established its Emerging Technologies Policy.

Under this policy, the new service provider who is given access to the spectrum is responsible for the relocation of existing users on that spectrum.

Parties are permitted to negotiate financial arrangements and the new service provider must either move existing operations or protect them from interference. This policy was used in the relocation of spectrum for fixed microwave to PCS.

(Slide.)

One of the areas that's often overlooked in any spectrum discussion is Part 15, Unlicensed Operations.

Part 15 devices make use of spectrum that is primarily not used or allocated for communication purposes, such as the microwave oven frequencies or these devices operate throughout the spectrum at such very low power levels that they do not cause interference to licensed operations.

(Slide.)

No FCC license is required to operate a Part 15 device, and only minimal technical regulations apply.

The basic premise of Part 15 is that these low-powered devices cannot cause interference and must accept any interference they receive.

Despite these limitations, millions and millions of Part 15 devices are in use today in the home and in businesses. Cordless telephones, wireless speakers, home security systems, wireless LANs, inventory control systems, utility use monitoring, traffic light controls, and back haul links for licensed services such as cellular and PCS, all successfully operate using Part 15 devices and with a minimal impact on other users of the spectrum.

Thank you for your attention. That ends my part of the presentation.

CHAIRMAN KENNARD: Thank you, Bruce.

Tom?

STATEMENT OF TOM SUGRUE, CHIEF, WTB

MR. SUGRUE: Thank you, Bruce.

Good morning, Mr. Chairman, Commissioners.

It's a pleasure to be here today. When Dale Hatfield was organizing this panel, he described the goal as providing a primer on spectrum basics.

I said, you mean sort of a spectrum management for dummies, and Dale said, Tom, in your case, that's just about right. So I appreciate the endorsement from my friends in OET, as usual.

(Slide.)

But I am pleased to be here today on this panel of distinguished experts, not to mention national treasures, so that's a particular thrill of mine.

(Laughter.)

MR. SUGRUE: In one sense, you know, you need experts to understand spectrum management, because in one sense, you can't begin to answer these questions without understanding a lot of technical details about propagation characteristics and bandwidth and interference contours and modulation techniques, not to mention economic concepts and game theories that underlie our auction process.

But on another level, spectrum management really isn't all that different from managing any other scarce resource, a situation we all encounter frequently in everyday life.

I thought a simple parable could illustrate this point. Let's call it the parable of Portals parking.

By the way, any resemblance between this parable and actual events or people is strictly intentional.

But our story begins a long time ago in a galaxy far, far away.

(Slide.)

There's a small, yet elite federal agency that moved to a new home across town called The Portals. And despite some initial trepidations, the agency liked most things about its new home, especially those who drove because there was plenty of free parking and the agency allowed open entry at no charge to anyone who had a permit verifying employment at the agency.

(Slide.)

But then as more people started moving down, the lot started getting crowded. Soon it appeared demand would outweigh supply. The agency did a number of things to address this problem.

First it focused on the demand side. It started charging $100 a month to park. And some people who wanted to park, when it was free, decided it really wasn't worth the price when there was a charge.

Second, it provided a $45 a month subsidy to employees who would take public transportation. So an alternative to using this scarce resource became more attractive.

Third, the agency sought better to manage supply. First, it made more spots available by using those that were formally used as staging areas by some contractors. And second, it used the existing space more efficiently by hiring car jockeys who would increase the capacity by stack parking in areas so that, in effect, two or three cars could share the space where only a single car was parking before.

(Slide.)

Well, the good news was demand no longer exceeded supply and peace ruled throughout the Portals.

(Slide.)

But the bad news was that the month of April came and more people came and with more cars, 500 employees applied for the 300 spots.

How did the agency handle these competing applications?

One might call them mutually exclusive applications.

(Slide.)

Well, in the short run, the agency set forth an administrative assignment system that reflected certain values. Parking spots were set aside for people with disabilities, car poolers and senior executives, a noble class certainly, in that order.

(Laughter.)

MR. SUGRUE: The remaining slots were assigned on the basis of seniority. The agency also announced a new sharing policy that allowed all employees working over time to park in the garage during non-busy hours, that's after 6:00 p.m. and during the weekends.

(Slide.)

In the long run, the agency is looking at measures to increase and more efficiently manage supply once again.

For example, the number of spots will increase as more contractor spots become available and they move out, a sort of spot-clearing approach.

The agency may also repaint the lines making the parking spots closer together, thereby squeezing out up to 15 percent more spaces, a sort of narrow band parking solution.

(Laughter.)

MR. SUGRUE: But if, despite these adjustments to supply, the demand continues to outweigh the number of spots, what additional steps could be taken?

Those who are not favored in the current administrative assignment system are bandying about alternative mechanisms for mutually exclusive applications.

Why not allow the Commission to charge the market clearing price, which apparently is somewhat higher than $100 a month, based on nearby alternatives, or why not auction the spots. maybe with bidding credits for certain GS levels.

Or perhaps we should hold comparative hearings to take into account each individual circumstance.

Or maybe we could hold lotteries so that all interested employees have an equal chance at getting these spots. Or perhaps we can privatize the parking function and let an entrepreneur decide how best to balance the supply and demand.

(Slide.)

Now that I've spent almost all my allotted time on this parable, what does this have to do with spectrum assignment?

Well, I guess it's obvious, but it turns out that fundamentally the Commission uses the very same types of tools for spectrum management as this mythical agency does to assign parking spots.

If we are going to meet all our needs to manage spectrum, we're going to have to do it efficiently and wisely, and consider all the tools at our disposal.

For example, we can make more spectrum available by moving existing operations, and Bruce made some mention of those examples.

We can promote efficiency through car jockey solutions and line-painting engineering approaches that encourage sharing, multiplexing, and narrow band techniques that allow multiple users to operate in common frequencies.

We can allow sharing or other uses during non-busy times or in non-busy areas.

(Slide.)

Where we cannot avoid mutually exclusive applications, we need to focus on the demand side. We can do that by assigning spectrum as efficiently as possible, taking into account any special values Congress has identified, such as promoting opportunities for small businesses.

For example, we have found that auctions do a better job than comparative hearings in assigning spectrum to those who value it most and who use it most efficiently.

So many issues in parking and spectrum management are similar.

For example, whether there should be greater reliance on pricing mechanisms in shortage situations and the efficiency versus equity concerns that those approaches raise, or the use of administrative mechanisms to assign scarce resources or how much sharing can be done without degrading the use of the resource and at what cost.

Later today, and already today you've heard about all kinds of exciting new technologies and sophisticated economic and legal theories.

Despite all this sophistication, those interested in spectrum can learn something from the Portals parking problem.

And perhaps those who are trying to solve the parking problem can learn something by attending this en banc.

I hope Andy Fisher is out there somewhere.

Thank you.

CHAIRMAN KENNARD: That's great, Tom. Thank you very much.

Tom?

STATEMENT OF TOM TYCZ, CHIEF, SATELLITE AND RADIOCOMMUNICATIONS DIVISION, IB, FCC

MR. TYCZ: Good morning, Mr. Chairman, and Commissioners.

I don't know what to say about the national treasure, but I hope my remarks live up to at least the Corn Palace.

CHAIRMAN KENNARD: Just be thankful you have a parking space.

(Laughter.)

MR. TYCZ: That I am. Thank you very much.

This morning I would like to do three things.

First, address briefly assignment methods used for satellite services, second, show a series of videos to illustrate different types of satellite constellations, and third, address tensions that affect many spectrum decisions.

(Slide.)

Let me first turn to assigment methods. We have conducted successful auctions in two different satellite services: direct broadcast satellite service, DBS, and digital audio radio service, DARS. Both services involve spectrums that could be uniquely identified as U.S. spectrum by the I.Q. Radio Regulations.

In other satellite services, we have taken a different approach in light of international concerns. As the Commission has recognized, auctions for international global satellite systems may be present unique problems, such as sequential auctions.

Consequently, satellite authorizations here in the U.S. are typically issued as a result of processing rounds in which the applications for particular frequency bands are considered simultaneously.

We undertake substantial efforts through engineering solutions, et cetera, to resolve any potential, mutual exclusivity among these systems.

Once licensed, each licensee is given a fixed amount of time in which to construct, launch, and operate the system.

Let's go to the video.

(Slide.)

In the first video you will see represented a geostationary fixed satellite system, as viewed from above the orbit. Geostationary means that the satellite remains fixed relative to the earth, approximately 36,000 kilometers above the equator.

Fixed satellite service means that the location of the earth station is fixed on the earth. And in this video, you can see that the earth stations are in the four corners of the contiguous United States.

The satellites are separated by five degrees of longitude. It's also possible to have the earth stations, or in this case, handsets or mobile terminals, move in the geostationary system, either along the earth, or in the case of the aircraft, through the air.

Until recently, domestic U.S. commercial providers exclusively used this type of satellite system.

Second video.

(Slide.)

In this video, we see a non-geostationary fixed satellite service constellation. The earth station is again fixed on the earth, but as you can see, the satellites are no longer stationary with respect to the earth.

The altitude of this particular constellation is about 1500 kilometers or four percent the size of the geostationary altitude in the previous video.

(Slide.)

In the third video, the satellites are again in motion, illustrating the sweeping movement of the beams across the surface of the earth and across national boundaries.

We also show the satellites communication with fixed and mobile earth stations. In this video, you can see the communications links from the mobile terminals to the fixed stations through the satellites.

(Slide.)

While the first three videos illustrated the various components of the current spectrum management situation, this last video puts the components together, adding in the complexity of sharing between geostationary and non-geostationary constellations.

We see the beams from the geostationary constellations with fixed stations and beams from the non-geostationary one with fixed and mobile stations.

At this point, if you can envision, as well, the situation that Bruce Franca mentioned about threshold services underlying all of those beams in these frequency bands, then you'll get an idea of what the spectrum management situation we are really dealing with in shared frequency bands.

I'll leave this video up through the rest of my presentation.

(Laughter.)

MR. TYCZ: Bearing in mind its complexity, I would like to turn next to the tensions that affect our spectrum management decisions.

As we turn to the tensions, I wish to emphasize the goal to act as quickly as possible, to get spectrum in the hands of users to allow market forces to decide what business models survive, and to allow innovation to thrive.

The first layer of tension is international spectrum policy versus domestic spectrum policy.

While there is some commonality of use from nation to nation, there are often substantial differences, even where service allocations are compatible across national borders. There can be conflicts due to competing national assignment requirements.

As a result, our ability to meet domestic policy goals may be constrained.

Further, because of the World Trade Organization Treaty and other market-opening initiatives, such as some of the protocols we've entered into, it is no longer possible to make spectrum decisions solely based on domestic factors.

These international agreements have increased the tension involved in providing spectrum to satisfy, for example, foreign licensed satellite requests to access the U.S. market.

The second layer of tension is government and non-government use of spectrum. The goals of government and non-government frequency users will not always be the same.

A non-government user's objective to have maximum spectrum flexibility to meet changing market demands may not coincide with government user's objective to protect national security or safety or life.

These sometimes conflicting objectives make coordination between the two groups difficult, both for domestic decisions and when developing U.S. positions for international conferences.

The third layer of tension is at the allocation layer. Here, the questions are focused on how to allocate terrestrial, wireless, and broadcast and satellite services, and whether spectrum should be allocated on an exclusive basis or a shared basis.

Mr. Hatfield and Mr. Franca have discussed this to a much greater extent. However, these are also issues we face in the international arena.

World radio conferences are held every two to three years to discuss allocations and procedures for coordination, sharing methods and criteria, et cetera to respond to new requirements for spectrum.

The fourth layer of tension is the assignment layer. Here the basic questions are who should get frequency assignments and what should be the conditions of licensing.

Are there constraints that should be adopted, for example, to facilitate sharing and allow market forces to operate, but yet do not constrain innovation.

Internationally, satellite and terrestrial coordination and notifications are used to protect existing services and are also a critical component of these assignment decisions.

In conclusion, with progressive market opening decisions of the recent past, including the WTO and the protocols, the days of making spectrum decisions mainly based on domestic considerations are over.

We are committed to timely action in making spectrum management decisions but our spectrum management tasks must evolve to reflect the new requirements of a more open global economy.

Thank you.

That's the end of my presentation.

CHAIRMAN KENNARD: Thank you, Tom.

Bill?

STATEMENT OF WILLIAM T. HATCH, ACTING ASSOCIATE ADMINISTRATOR, OFFICE OF SPECTRUM MANAGEMENT, NTIA

MR. HATCH: Mr. Chairman, Commissioners, it's a pleasure to be here today to participate in the discussions of one of the most important topics associated with radio communications, the management of the spectrum.

(Slide.)

This is an issue that has both national and international implications, as you've heard, both of which must be addressed by NTIA and the FCC in a coordinated and cooperative manner.

Through various Executive Orders and Department of Commerce Orders, the Office of Spectrum Management within NTIA has been delegated the responsibility for managing the government use of the radio frequency spectrum.

Today, I would like to briefly address the spectrum management functions of NTIA, the very important coordination process between NTIA and FCC, as well as some of these spectrum issues that we face today.

If I could have the second slide, please.

(Slide.)

NTIA draws upon the advice of the Interdepartment Radio Advisory Committee to perform its spectrum management functions. The IRAC provides advice in all aspects of government use of the spectrum, assigning frequencies, developing and executing policies and procedures, developing technical criteria on the allocation, management, and use of the spectrum.

There are currently, as shown on this slide, the membership consists of 20 of the most active federal users of the spectrum.

It's covered up by the captioning, but one of the important points that I'd like to make on this slide is that the FCC also is a liaison representative on the Interdepartmental Radio Advisory Committee.

It is through this FCC liaison representative, presently within the Office of Engineering Technology, that we initiate our coordination process with the FCC on joint spectrum management issues.

This coordination, then, is extremely important when you consider that approximately 90 percent of the spectrum that Dale was referring to is shared between government and non-government uses.

The majority of that sharing is in the higher frequency bands where we are seeing now the newer systems being developed.

However, in the spectrum below 3 gigahertz, we have approximately 20 percent of the spectrum is government exclusive, 40 percent is non-government exclusive, and 40 percent of the spectrum is used on a shared basis.

So again, I think that points out the importance of this coordination process between NTIA and the FCC.

If I could have the next slide, please.

(Slide.)

I'd like to just briefly describe two of the subcommittees we have in the NTIA because these are the committees that do most of the coordination between the NTIA and the FCC and the private sector.

The first is our Frequency Assignment Subcommittee assists in assigning or coordinating the frequency chosen by the government radio station, and also coordinating the non-government requests for frequency assignments in the shared spectrum.

The next one is the Radio Conference Subcommittee.

(Slide.)

That assists in preparing for ITU conferences and developing U.S. proposals and positions. These are coordinated with the FCC and provided to the FCC Advisory Committee for consideration, similar to the proposals from the FCC Advisory Committee coordinated through the FCC, IRAC, and to the RCS.

If I could have the next slide, please.

(Slide.)

Let me talk about some of the spectrum issues, and in particular sharing between government and non-government systems.

As we've alluded, we have a lot of sharing between our systems. We still run into some difficulties, especially when we try to do sharing between our high-powered government systems, such as radio location, radio navigation systems, and sharing with the private sector.

We have difficulty both in our co-channeling with our adjacent band channel sharing, and later on, I will talk about steps that we're taking to try to improve that process.

The difficulty with sharing in these high powered systems, whether they are terrestrial, airborne and shipborne, they use large geographical areas that are denied to other services, including government services.

And we need to maintain the flexibility to address new threats and develop systems, especially in the military, for these new low observable targets.

Military systems are always difficult to share with. They are tactical systems, they invoke national security, so in those instances, it's been very difficult to effect any sharing.

Let me talk a little bit about public safety. We have recently had a Memorandum of Understanding between the Department of Defense and the State of Wisconsin to cosponsor a joint pilot trunking system near Madison, Wisconsin, that will be shared between the state and local and all federal public safety agencies.

This should provide valuable information on the interoperability of these agencies and the joint use of this spectrum.

And I think that this information will be very useful to both NTIA and the FCC in addressing future joint systems for the public safety service.

We look forward to working with the FCC, the state and local government, to develop procedures for these interoperability and joint use systems for the public safety service.

Another issue that we have is the government agencies are beginning to use non-government fixed satellite services in an increasing manner.

At the present time, the spectrum for that is non-government exclusive spectrum, and the government's first stations are operating on an unprotected basis.

We're working with the FCC to develop a set of procedures that the government earth stations are taking into account in the coordination process to try to avoid interference to government earth stations from the new terrestrial services.

The space science services seem to be working very well in our coordination process with the FCC and in the work preparatory process. It's a complex but seems to be a very manageable problem at this time.

Let me address very briefly the co-channel and adjacent channel interference and the steps we're taking to try and enhance this sharing.

To address potential interference between the government systems and the non-government systems and adjacent bands, we're working with the Commission to identify technical characteristics of the government systems, and their out-of-band emissions.

The intent is to provide this information to the private sector for their consideration in the development of their systems and their operational deployment of these systems.

We hope that that will help eliminate and either reduce and/or eliminate potential interference problems.

Where practical, we're also trying to provide the areas of operation of our government systems, again to try to avoid potential interference problems and to enhance sharing.

Let me just briefly now, if I could have the next slide --

(Slide.)

-- talk about our coordination process between NTIA and the FCC.

There's increasing demands for spectrum and the pressure to satisfy these demands has reduced the time that's available for us to coordinate these shared bands between the government and non-government users.

In some instances, this has resulted in some proceedings from the FCC being released without prior coordination or completion between NTIA and the Commission.

This is something that we need to address.

An exclusive spectrum government coordination between the NTIA and the FCC must be completed before any action is taken. Although very rare, this has occurred, and this is an issue again that will need further discussion between our agencies.

We need these further discussions for a number of reasons, to try to improve the process, to improve the efficiency of the process, and to assure that the requirements of both the private sector and the federal government are satisfied in a timely and efficient manner.

Where the government has new or expanded spectrum initiatives, such as in our navigation systems for the air traffic control, our military systems, and as I say, developing new radar systems for these low detectable targets and public safety or increased protection for our systems.

I think we, on the government side, need to do a better job briefing the Commission and the Commission Staff on those requirements so that you have the opportunity to understand and appreciate these requirements.

We will work with you and your staff to bring this about.

We look forward to working closely with the

Commission to improve this spectrum management process and to provide spectrum to satisfy both the government and non-government present and long-term spectrum requirements.

I thank you for the opportunity to speak at the en banc hearing on spectrum management issues.

CHAIRMAN KENNARD: Thank you very much. You certainly have our commitment to continue working closely with you to resolve any of these issues.

Dr. Pepper?

STATEMENT OF DR. ROBERT PEPPER, CHIEF, OPP, FCC

DR. PEPPER: Good morning, Mr. Chairman, Commissioners. I've been asked this morning to wrap up the first panel and summarize what you've heard.

I think it can be characterized, as Commissioner Ness pointed out in her opening remarks, that we've been engaged in an experiment for the last decade, or a little bit more than a decade, moving from a traditional command and control approach to spectrum management to one that's much more based on market forces.

Economists predicted that relying more on market-based approaches would be more compatible with the world of dynamically changing technology and markets, and would enable the expansion of supply of usable spectrum, as opposed to an old system in which government decisions, often at the request of incumbents, created and maintained artificial scarcity.

The new approach is characterized by changes, sometimes people though at the time, fairly radical in virtually every aspect of spectrum management.

So, for example, as Commissioner Ness pointed out, in the allocation and allotment approach, we moved from site licenses to geographic licenses.

We moved from very narrow channelization and definitions of what people could do to more block allocations.

On service rules, we moved from narrow, specific service rules, to more general and flexible service rules.

For example, the old Part 22 Cellular Licenses, we defined cellular as a mobile service. We used to joke that since we didn't foresee miniaturization, longer-life batteries, digital technologies that allowed people to use pocket phones, everybody thought this was going to be in cars, and so we used to joke that when you got your pocket phone, because it was a mobile service, if you wanted to use it in your office, you had to walk around and not sit down.

(Laughter.)

DR. PEPPER: We actually had rules that said you couldn't use it as a fixed service.

Well, along comes PCS, along comes market demand, along comes the fact that we now have close to 70 million commercial wireless users, much more than the 900,000 predicted in the early days, and everything's changed.

So we changed our rules so that now PCS and cellular essentially have the same rules and, in fact, you can sit in your chair and talk on your cell phone.

PCS and cellular now are not only mobile, but it's also being used for portable services as well as fixed operations.

On the technology side, we moved from specific inputs, in defining what we used to joke as tower and power requirements, to more functional outputs, interference protections, in-band and out-of-band protections, and allowing the operators to figure out how to determine how they're going to protect against interference, as opposed to our telling them.

On the assignment side, we moved from beauty contests that we used to call comparative hearings, to random lotteries to auctions. But we also have brand new technologies and new unlicensed operations.

We have, using some of the new shared technologies and some of the things you'll hear about later this morning with the ultra wide band technologies, so there's some questions about how do we, in the future, provide service to these operators who don't need exclusive licenses, even in terms of moving incumbents from old spectrum, so that we could use the old spectrum for new services with higher values.

In the old days, we used to have a forced march with the fixed microwave users that we cleared out for DBS. That didn't happen for another six to eight years, but with a great deal of cost and dislocation imposed on the users.

We just said, move, right.

We've changed that. We are beginning to use more market-oriented approaches such as the ones we developed in the emerging technologies band for PCS in which we're allowing negotiations, payment, and compensation for incumbents, when they move, and they are compensated by the new entrants based upon how soon the new entrants need them to move.

So we're using more market forces there. So if you take a look across the changes that we've put in place over a decade, and we're now saying today, how have we done, and that's in part what we're looking at in terms of the next several panels.

I think we can say that the policies that we've instituted have been, frankly, to a very large extent, enormous successes. Faster buildouts, faster licensing, better services for users/consumers, lower prices. The bottom line is competition works, but we still have challenges.

Most of the questions relating to these challenges relate to the questions of allocation allotments, requests for more spectrum, the things that Dale talked about.

Demand is increasing, but we're not creating more spectrum at the most desirable lower band frequencies. New entrants want to come in and incumbents say, well, gee, we're not sure we want to move. And in fact, some incumbents historically argued, we don't need more competition.

But we know better than that now.

So issues, most of these go to the question for spectrum for new services. There's government versus non-government users that Bill talked about. Government reallocation versus voluntary reallocation with service flexibility. A good example is MMDS.

MMDS was designed initially as a one-way analog service for television. It would be a wireless cable.

We then went from analog to digital and we've now allowed it to be two-way, and we're now beginning to see MMDS operators convert themselves into, if you believe the trade press, two-way wireless internet access providers, and they're essentially voluntarily reallocating themselves because we're giving them the flexibility.

There are other tensions having to do with government standards versus industry standards, satellite versus terrestrial allocations, domestic versus international, commercial, and private licenses to exclusive licenses versus unlicensed shared spectrum.

So the key question here is how do we meet the increasing demand and while the market-based approaches and policies have worked as predicted, the question is, how do we capitalize on those and move forward, at the same time taking into account, users who traditionally have not benefitted by pure market approaches, such as public safety users, amateurs, radio astronomy, radio location, and so on.

I think Tom Sugrue got it exactly right. And that is, we need to address both the demand as well as the supply side questions as we go forward in formulating spectrum policies for the future.

And as we go forward, I think it's important to keep in mind that the primary lesson from the last decade's experiment is that, as a general matter, relying more on market forces, while not perfect, have actually served us and the country very, very well.

Thank you.

CHAIRMAN KENNARD: Thank you very much, Dr. Pepper.

That concludes our first panel.

I had stated initially that I didn't think we'd have time for questions, but I can't let this distinguished panel leave without at least inviting questions from my colleagues.

Any questions from the bench?

COMMISSIONER TRISTANI: I do have one question, Mr. Chairman.

I liked your parable. I'm sure Andy Fisher or someone here has a list of who is using every parking space that's available.

I'm not sure, I really don't know whether the Commission has an adequate inventory of current spectrum usage.

If that's the case, is it something that would be useful in the discussions that we're having today?

MR. HATFIELD: I might start by saying that I have been uncomfortable on exactly that topic. I think the Commission very wisely has moved in a more deregulatory market approach.

But we get to some of these allocation decisions, it is sort of necessary to find out what actually exists out there, what is really being used.

I'm a little uncomfortable, I admit myself, that we may have gone a little bit too far and don't have as much information as we might be able to usefully use in considering reallocation proposals.

MR. FRANCA: I think just adding to what Dale said, when we looked at the emerging technologies band effort, and we did about a two-year spectrum study of spectrum below three gigahertz, most of our databases were fairly inadequate to do the kind of relocation work we needed to do.

And we really had spent a lot of that time building that from private coordinating databases and other places outside of the Commission.

There is a tension of collecting information from licensees and making sure it's valid, and the deregulatory approach where we basically ask for less information from the licensees right now.

DR. PEPPER: Commissioner, one of the things that's important in order for the market to work is that the participants need to know, have information about what in fact is in these bands, so you are absolutely correct.

In fact, there's an effort, a couple of efforts in different bureaus, trying to put on-line our spectrum databases.

And as part of the universal licensing efforts in the Wireless Bureau, people who want to apply for licenses now can actually see who else is there. And maybe one of the next steps is to integrate the databases across the bureaus, some of the work that's been done over the last couple of years, really good work on computerizing the OET databases so that these then become available not only to us but to potential licensees or people who want to work together and negotiate with one another to provide better services.

MR. HATFIELD: The problem is, in some bands we just don't collect the basic information.

MR. SUGRUE: If I could add, just follow up on what Bob said. In the Wireless Bureau, we do try to keep track of all our licensees.

One problem is though they're in, I believe, it's eleven different databases at the universal licensing system. We're sort of in midstream right now implementing that. It's supposed to help solve, because the information isn't always as retrievable as one would like.

I'm surprised to find sometimes that even though these are automated systems, the amount of manual work sometimes that has to be done to generate information along the lines you're suggesting right now.

If we have an en banc like this a year from now, I hope we'll be able to have a better story to tell.

MR. TYCZ: I would just like to add on the satellite side, because the population of satellite system is rather small in the U.S. We have a good sense on the commercial side of the satellite systems, themselves, but when you start going to the earth stations, and particularly for VSETs and mobile earth stations, we blanket license those at 100,000 at a whack, and we don't really know who all the subscribers are. We just have to go to a service provider and we're hoping that he has an idea associated with everyone of those.

But we don't have that database to give us some counts periodically.

With respect to the international systems, it gets even more complicated. Other countries coming into the U.S. market is going to make that issue even more problematic, I think, as we go forward.

CHAIRMAN KENNARD: Thank you.

Any further questions?

Commissioner Ness?

COMMISSIONER NESS: I think everyone can see from the quality of the presentations today that we have an extraordinary group of individuals who are helping us to discern how to best make a spectrum available for the public.

Each bureau, for different reasons, has different methodologies for licensing spectrum.

For example, in the satellite arena, we go about it quite differently from the methodologies that are used in the wireless. Usually we have an allocation, and then we go ahead and set up service rules, and then we go ahead and often times auction the spectrum. We even auction the spectrum that's shared.

In the satellite arena, we have applications for new technologies and new uses, and we go about it slightly backward from the methodology that was just described, typically not engaging in an auction process.

How best do we address the issue of shared spectrum? When you have the very long time horizons for getting the satellite systems up and operating, versus terrestrial systems that have a much shorter time horizon, and where we're talking about shared spectrum, particularly in an auction context.

Tom?

MR. TYCZ: I think you've hit on a good point, Commissioner Ness. The satellite systems have longer build out times. They usually have.

What we're finding is that many of the systems have to get a license first before they can get investors, and a lot of it is very futuristic, and there is a tension between trying to get allocations for satellite services and competing against terrestrial or wireless services, particularly when the immediate use of the satellite system, actually you have more immediate use of the threshold services than you do of the satellite services, which are a few years out.

So in the decisions between the bureaus, you have basically pleadings before us that we have to analyze to try to figure out whether or not they can share or not, and based upon technology, that they're saying they have now, and may not be what they actually implement several years from now.

So we are put in a position of trying to almost divine what some of the new technology is going to be to make this sharing possible in the future.

MR. SUGRUE: It is one area that I'd have to say I don't think we've been fully successful using economic concepts that we use when it's strictly a terrestrial service. Part of that is because there's a lot of legitimate concerns about using things like auctions in a satellite environment, although we have auctioned a couple slots off.

But given the international characteristic of many satellite systems, but one thing that does is it puts pressure then on the Commission to really start making decisions on how sharing will take place, as opposed to sort of letting the marketplace decide how much you're going to use the satellite and what the interference rules would be.

I'd still like to look at, as we go forward, trying to create something like more property rights in the use of that spectrum in both space and terrestrial uses which would get us a little bit out, at least on an experimental basis, would get us out of having to decide all those rules as a regulatory matter.

COMMISSIONER NESS: When we license through auctions, what are we licensing precisely, especially if it's shared spectrum?

MR. SUGRUE: You're licensing the right to use the spectrum according to the service rules we've adopted which may limit the right to use the spectrum in certain ways that inhibit the value of it.

That is, you do have to, in order to make a useful, meaningful judgment as to the value, to construct a bidding strategy to sort of focus it on auctions.

You have to know what the rules are, the same way if one bids on a piece of land, you need to know if someone has an easement across it, if it's zoned for particular uses that you don't want to use it for, or that someone else has a right to.

COMMISSIONER NESS: Does that mean that the Commission cannot change its rules at a later point in time?

MR. SUGRUE: I would never say that.

(Laughter.)

MR. SUGRUE: As a matter of law, I think you take them subject to the on-going regulatory oversight of the

Commission the same way most land use decisions you take subject to the on-going oversight of the Zoning Commission or whatever the regulatory authority is.

COMMISSIONER NESS: Thank you.

CHAIRMAN KENNARD: Any other questions from the bench?

(No response.)

CHAIRMAN KENNARD: We know where to find you all.

(Laughter.)

CHAIRMAN KENNARD: So if we have others, we'll find you.

Thank you all very much. That was very well done.

We'll ask our second panel to begin assembling up here, please.

(Pause.)

CHAIRMAN KENNARD: If I could ask everyone to come to order for the second panel, please, I'd appreciate it.

Thank you.

Our second panel will focus on spectrum management today. We want to hear a candid assessment from our panelists of what you think works and doesn't work.

I was talking to our staff as we were putting this together and I wanted to be sure that we had some panelists who would feel free to be completely candid with the Commission on this particular panel.

And seeing the group assembled and having worked with most of you, I don't think that's going to be a problem because I know that you have been candid with us in the past, and I appreciate that.

Dale Hatfield will also be a part of this panel, as sort of our panelist emeritus moderator, and will be jumping in with questions and comments as we go along.

We have one little housekeeping matter that I wanted to raise.

John Stanton has a conflicting engagement this morning and unfortunately will not be able to stay for the entire panel, so I'm going to ask him to begin with his presentation. And then, if the Commissioners have any questions for him, I will invite those questions after his presentation.

Then we'll go into the rest of the panelists.

With that, John, would you like to begin?

STATEMENT OF JOHN STANTON, CEO, WESTERN WIRELESS CORPORATION

MR. STANTON: Thank you, Mr. Chairman. Thank you for indulging my schedule.

I am the Chairman and Chief Executive Officer of Western Wireless Corporation.

I'm also privileged to currently be the Chairman of the CTIA.

Although I speak primarily for myself and my company today, I think my views also reflect those of many of the others within the wireless industry.

I thought it might be helpful to just begin by giving a very brief introduction to our company, although I have had the privilege of spending time with each of you.

Western Wireless was really founded as an organization during this Administration in 1992. Basically from scratch, we passed one million subscribers on December 31st of 1998.

And have, I think, managed to provide terrific service to our customers and opportunities to 4300 people who work for us in the seven years we've built our business.

We built that business initially by involving ourselves in the rural wireless business. We own 92 different licenses, almost entirely in rural areas, unless you think of Lubbock and Fargo as big cities.

We have participated in a total of 12 of the FCC's auctions, including all of the A, B, C, the D and the E, the F. The C and F, I should note, are through a partnership with Cook Inlet, and both of the C re-auctions, including a re-auction that's ongoing right now.

We've also participated in two ESMR auctions and have participated in the LMDS auction process as well.

We have purchased over $300 million worth of spectrum. Our company was the first to turn on an auction-awarded PCS license.

And we have also participated internationally. We've involved ourselves in a dozen different countries. We have licenses either issued or pending in seven countries, and have had the opportunity to participate in different auctions as well as other licensing awarding processes in other countries.

And so I've had an opportunity to get a broad perspective on the kinds of opportunities there are to issue spectrum.

I'd like to make a couple of comments this morning directly responsive to the questions that were asked of the panelists and really speak to what works.

I think in my perspective, having participated initially in my involvement at McCaw in the original license awarding process in cellular through the lottery process and now the auction, there has been frankly consistent progress made in the way auctions are awarded.

I would say that the mechanics for awarding licenses through the auction process have been very efficient.

The process of allocating spectrum and the greater freedom with which carriers have to utilize that spectrum are clear improvements in the process during the last 15 years in which I've been directly involved.

I think that the further allocation, based on market demand, anything that can advance the premise that the market will determine the best use of the spectrum, I think much of which is embodied in the current policies and the current thinking of the Commission is very positive.

I would tell you that some of the things that don't work, frankly, well spectrum caps may have been appropriate at the original outset of the PCS licensing process, we are now the seventh operator in the last two systems that we have turned on in the last four months in Phoenix and Seattle, and I would tell you that spectrum caps or limits on the amount of spectrum that carriers can own is not only not necessary in order to promote competition, it's actually damaging in terms of the ability of carriers to efficiently operate their systems.

We, for example, own 20 megahertz in Phoenix and would like to have the opportunity to buy 30 megahertz more because we think we can more effectively deliver the kinds of service opportunities that we would like.

That's the only spectrum that we see readily available to enhance our offering and be necessary to give back some spectrum under the current rules, unnecessary in our view.

I would like to speak, very briefly, to the notion of what I call forgotten spectrum.

We have participated and talked mostly about PCS, but there are a number of cases that are interesting in the cellular arena. We currently, as all the Commissioners and Chairman know, have been very active in promoting rural wireless with the wireless residential service offering that we've done in North Dakota.

We are trying to get ETC status in South Dakota as a part of our effort to continue to build our business. The irony is that the Staff is currently recommending against issuance of an ETC permit to our company, in part because we are not proposing to serve a certain part of South Dakota.

That certain area in northwest South Dakota was originally licensed to, issued via lottery. That lottery winner did not -- actually, it's part of the Rapid City MSA. Before we purchased the license, that lottery winner did not serve the entire territory.

The consequence was that they returned the spectrum. For five years now, we have been waiting for an opportunity to buy, or even to serve, based on interim operating authority, that area of South Dakota.

We're not allowed to under the Commission's current licensing process because there's been a five-year delay in that.

My time is up. There is another instance I could speak of where there's been an over ten-year delay in North Dakota in issuing licenses and five-year delays in paging.

All these are cases where they are a bit off the beaten track, they're not New York City PCS licenses but they are still very important to the people who live in those communities.

And anything that the Commission can do to expedite the licensing of those areas that are, as I call them, forgotten, I think would be a terrific help.

I'll end with that.

CHAIRMAN KENNARD: Thank you very much, Mr. Stanton.

I'll invite questions from the floor before Mr. Stanton has to leave.

Commissioner Ness?

COMMISSIONER NESS: Have you seen much use of disaggregation and partitioning in the opportunity to get additional spectrum?

We tried, to some extent, to privatize the availability of spectrum by creating secondary market.

Has that happened and is that a useful tool to avoid the issue of spectrum caps?

MR. STANTON: Commissioner, I think it is a very useful tool. Frankly, we have had an overlap issue that the Commission has been very patient with in the Wyoming area.

It came with the Denver MTA, but frankly our problem has been that we've had a very difficult time finding people who would even take disaggregated spectrum in rural areas.

Some of that has to do with the way the licensing process, meaning the very large geographic area, but I would say in general that disag, particularly if we could get down to the BTA or conceivably even the county level, in some cases would be very helpful.

The challenge for us is having bought seven MTAs, we really need all 30 megahertz in places like downtown Denver and downtown Portland.

We clearly can get by with substantially less spectrum in the rural areas.

COMMISSIONER NESS: What about partitioning to, for example, rural telephone companies or indigenous companies? Is that an opportunity waiting to be used?

MR. STANTON: We've had discussions, in the Wyoming case, with both an independent telephone company in western Wyoming, as well as a cable TV company that serves both South Dakota and Wyoming.

And I think it would be useful. We would like to try to do something. There are companies frankly who've had difficulties in resources, not in buying the spectrum, because, as I said, we basically give it to them, but in having the wherewithal to get the moneys to build out the system.

I think we've had an experience where it clearly is something that can be accomplished. We just haven't managed to get it done yet.

CHAIRMAN KENNARD: Any other questions from the bench?

Commissioner Furchtgott-Roth?

COMMISSIONER FURCHTGOTT-ROTH: Thank you, Mr. Chairman.

Mr. Stanton, you mentioned some questions with ETC designation, eligible telecommunications carriers, and you referred to problems with the Commission.

Is that the Commission the FCC or the South Dakota Public Utility Commission?

MR. STANTON: We've had challenges at the states, and that's primarily what I'm focused on.

This instance that I think is terribly ironic in South Dakota actually is a problem in this Commission or its Staff not having resolved the award of licensing or even interim operating authority to provide service in northwest South Dakota in this part of the Rapid City MSA that I referred to.

So in this case, it is the FCC.

But most of the challenges we have had, frankly, have been the states and the staffs, in my view, not being as pro-competition as this Commission.

COMMISSIONER FURCHTGOTT-ROTH: I'm still having a little trouble following this.

Is the concern because I thought it was the state commissions that designate eligible telecommunications carriers, and not the FCC.

Is the South Dakota Public Utility Commission saying they will not designate you as an ETC unless the FCC does something?

MR. STANTON: I'm sorry, let me be clear.

We are at the staff level in South Dakota. We have not gone to the full Commission level. The staff is currently recommending against granting of an ETC status for us.

The reason for their current view is that there is a part of South Dakota that they would like us to serve, as part of our universal service or wireless residential service program, that we would be delighted to serve, that we have had pending applications to serve with our 800 megahertz spectrum for over five years.

We can't get licensed here. If we can break the logjam on the unserved areas.

It's the same in the North Dakota Three RSA, for example, is a similar situation. It caused us problems where we wanted to provide relief services and subsequent essentially replacement services in North Dakota, after the Red River Valley flooding disasters.

But literally, the North Dakota Three RSA, I believe, was originally lotteried in 1989. The original lottery winner never was issued a license.

In 1996, I believe, there was an effort to issue a new license, either by lottery or auction, but literally no license has been issued on the non-wire line side, the B side.

There we've been able to get into an operating authority but that has a chilling effect on investment. It's hard for me to justify the millions of dollars to build out that territory when in fact the Commission could make a decision to issue a license to someone else. And I had to pull my investment out.

COMMISSIONER FURCHTGOTT-ROTH: Thank you.

CHAIRMAN KENNARD: Are you confident that if you were able to secure authority for that one part of the State, that you would be able to convince the North Dakota

Commission to grant you ETC authority?

In other words, is that the only issue that's being raised in North Dakota?

MR. STANTON: We have our norths and our souths confused in this case because I used an example from both, Mr. Chairman.

To be blunt, we have great reservations in a number of the states. We have had problems in Kansas with ETC status. I'm not sure that's the purpose of the hearing today, but I'd be delighted to use this as an opportunity to talk about it, if you'd like.

The specific instance in South Dakota, the only serious issue being raised is that we, unlike the independent telephone companies who do have universal service obligations, we are not going to be able, in their view, to serve the entire territory, the entire state, and therefore they are hesitant, they have told us, to issue ETC status to us.

I can't tell you that if we overcome that obstacle that we won't find another obstacle, because we perceive that there is a bit of protectionism going on for the independent telephone companies in South Dakota.

But we are fully prepared to fight that issue. We are fully prepared to make the investment.

The one thing I can't do is I can't invest in the territory where I'm not licensed to serve.

CHAIRMAN KENNARD: Thank you.

Any other questions for Mr. Stanton?

(No response.)

CHAIRMAN KENNARD: Thank you very much for appearing here today.

MR. STANTON: I apologize for the schedule conflict. I'll hopefully have an opportunity to see each of you later today or tomorrow.

CHAIRMAN KENNARD: Thank you.

Mr. Claudy?

STATEMENT OF LYNN CLAUDY, SENIOR VICE PRESIDENT
OF THE SCIENCE AND TECHNOLOGY DEPARTMENT, NAB

MR. CLAUDY: Thank you, Mr. Chairman, and Commissioners.

I'm pleased to offer broadcasters' views on the Commission's role in respect for management.

As a history reminder, the primary reason for the passage of the Radio Act, which was the predecessor to today's Communications Act, was managing the spectrum to ensure interference-free broadcast service.

By 1927, chaos reigned on the nation's airwaves, and one of the Commission's greatest successes in its 70 years has been keeping radio and TV service free of destructive interference.

One need only to travel to countries such as Italy, among others, to find conditions that are similar to the U.S. in the 1920s, where radio stations operate without regard to limits on power, frequency or location.

The result of course is not radio for everyone, it's radio for no one.

The principles that the Commission has followed have recently come under attack by hundreds of unlicensed operators who have wrongly claimed a constitutional right to broadcast in the radio band.

We'd like here to commend the Commission for its dedicated efforts in fighting broadcast piracy.

Broadcasters believe that the FCC should work to ensure that spectrum can be made more useful if new technologies appear.

In many cases, advances in technology will permit existing services to use less spectrum to provide the same or greater level of service.

A good example are the pending proposals for in-band on-channel digital radio service which will permit radio broadcasters to provide much higher quality audio and new forms of data services.

Nonetheless, as the Commission weighs requests for spectrum for new services, it needs to be careful that it does not do unintentional damage to existing services.

In recent years, we've seen repeated efforts to displace broadcasters from frequencies that they use to provide electronic news gathering or other operations essential to providing a modern broadcast service.

We believe the Commission should follow several principles in this area.

First, it should recognize that many systems proposed to it are different ways of providing the same or similar services and it's unlikely that all of them can be successful.

Thus, the Commission should weigh carefully whether it is appropriate to displace several existing services where the actual market need might only require movement of one.

Second, the Commission needs to be careful when it accepts assurances from new services that they can share spectrum with existing users.

In theory, sharing is an ideal solution. No one loses spectrum and spectrum is used more efficiently.

All too often, however, such assurances turn out to be wishful thinking and the new user may call for the incumbent service to be made secondary or otherwise responsible in itself for preventing interference.

If the FCC is going to rely on sharing, it should make clear that new entrants will bear the responsibility, if sharing proves to be unworkable.

Third, the Commission must ensure that adequate replacement spectrum is available for any displaced incumbents, and in that context, adequate means not only that there is spectrum, but that there is equipment available that will permit all existing uses to be replicated in the new band without a loss of service quality.

And finally, the Commission must continue to insist that new users compensate incumbents for the cost of buying and installing new equipment as your New Emerging Technology decision provides.

While the FCC has been following these principles, increasingly you are under pressure to cut short these protections for vital existing uses.

We note that a number of new satellite services have been proposed that would operate in bands where other necessary broadcast station support services now operate.

Finally, you've asked under what circumstances the FCC should adopt technical standards and when it should allow marketplace forces to determine technology.

Broadcasters, unlike many providers of wireless telephony and similar services, do not control the equipment consumers use to receive their service. Instead, consumers buy equipment in the open market, and they expect that it will work anywhere in the country.

In order to provide consumers with the assurance that the investment in new equipment will not be lost, the Commission needs to adopt rules to ensure compatibility between broadcast signals and receivers and because broadcast signals are distributed by cable systems and other multichannel video providers, in that area as well, it's essential that the FCC work to ensure that new technologies are not lost through technical disagreements between industries.

Congress' direction to the Commission, both in the 1992 Cable and the 1996 Telecommunications Acts to provide standards for cable set top boxes is a good example of that policy at work.

Thank you very much.

I'll be happy to answer any questions.

CHAIRMAN KENNARD: Thank you very much.

Next, we'll hear from Mark Crosby.

STATEMENT OF MARK CROSBY, PRESIDENT, INDUSTRIAL TELECOMMUNICATIONS ASSOCIATION

MR. CROSBY: Good morning, Mr. Chairman, Commissioners.

The third question that you submitted to this panel particularly piqued my interest because it was concerned with non-economic factors and a couple of services were mentioned, that being radio astronomy, public safety, and the amateur community.

Mr. Sugrue used a parable. I'd like to use a parable as well, because I'm somewhat sensitive when private wireless isn't mentioned.

If there were a meteor crashing to earth, the radio astronomers would of course find it, the amateurs would tell us where to go hide, public safety would keep order, and private wireless would keep things running before the meteor hit, and probably keep things running when it did hit, and put the pieces back together afterwards.

So I guess that leads into my answer to question three. All spectrum management regulatory and allocation decisions cannot be reduced simply to defining market areas, population coverage and per pop evaluations.

If it were that simple, we would just need computer programmers, and I guess we wouldn't be here this morning.

Non-economic factors, such as contributions to business productivity, the safety of the public, employee safety, and the competitiveness of America's economy, supported and enhanced through the use of the nation's spectrum resources, are also factors that must be integrated within spectrum management policy determinations.

If we support America's domestic corporate competitiveness and vitality through responsible spectrum management, where the Commission leads through decisiveness, international competitiveness will certainly follow.

It is obviously difficult to determine the needs of services that do not automatically provide economic counters that may be statistically quantified.

There are no easy solutions and no matter how the Commission may attempt to modify its spectrum management models based on competitive bidding to achieve anticipated results, that effort will leave valuable spectrum uses behind.

The Commission is the world's spectrum management leader. If there are certain classes of spectrum users whose contributions are difficult to comprehend, I suggest that through normal comment cycles and open sessions, such as this morning's, clarity may be achieved that will assist the Commission in its spectrum management decisionmaking process, particularly for those classes of spectrum users that are perhaps more difficult to understand.

The private wireless industry, for one, certainly would look forward to such communication opportunities. Such an approach worked well in the past, and I'm sure it'll work well in the future.

Question one had to do with advantages and disadvantages of providing spectrum for new services by several approaches.

As I discussed in my written statement, spectrum sharing is an appropriate management approach to foster efficient use of the spectrum, particularly for communication industries like private wireless, that employ engineering-based license assignment mechanisms that are specifically designed to maximize the efficient use of the radio spectrum.

In fact, I would encourage a closer look, closer examination of the potential for sharing among compatible users such as government and non-government systems where spectrum use is similar and where technology and spectrum engineering may serve to significantly reduce the potential for interference.

It is also my experience that users in shared spectrum environments eventually demand, and manufacturers will eventually introduce innovative products that adapt to the shared spectrum environment, thereby promoting more intensive use of the spectrum.

A perfect example is the proliferation of innovative trunking technologies in the private wireless bands below 800 megahertz that have adapted to these shared frequency bands that are the subject of the Commission's ongoing requirements proceedings.

When it comes to reducing channel bandwith, private wireless is the model student, having experienced such a requirement four times in its history.

At least for the foreseeable future, I believe we have pushed the technical envelope, however, with 6.25 kilohertz channel bandwidths by the year 2005 as our industry's new hurdle.

Date certain transitions however need to accommodate normal procurement cycles of the licensees and are probably best utilized in major metropolitan areas where prospective demand is of course greater.

It is critical to remember, however, that when you split channel bandwidths in half, it's not simple math. You do not receive a two-to-one improvement in spectrum availability, as incumbent systems and concurrent interference protection requirements limit the effect of the technology spectrum that has been created.

The targeted industry eventually achieves the two-to-one gain, but the transition take a while.

We also need to take into account the fact that spectrum narrowbanding creates technology opportunities, but it also simultaneously reduces the potential for the development of broadband technologies that can serve the same purpose of promoting spectrum efficiency.

My time is up. I will submit this for the record.

CHAIRMAN KENNARD: If you'd like to sum up, we'll give you a few minutes.

MR. CROSBY: The other one I want to do is band clearing. Band clearing at 2 gigahertz worked extremely well because there was a spectrum that the incumbents could go to.

You made a wise decision and put some financial ground rules in place.

And I think the other reason why it worked well is because the relocators for the obligation were not in the same business as the incumbents and things have worked out.

As a clearinghouse, we have had no financial disputes to resolve. We have one other one that's right before you, and that is the 800 megahertz. It's a little too early to tell, but I have a sneaking suspicion that that's going to be a little bit more difficult because I don't think there is really good alternative spectrum.

The financial ground rules are a little bit less clear, and the predominant relocator is in, often times, the same business as the incumbent, but it's still hard to tell, and we'll see.

But thanks very much for your time.

CHAIRMAN KENNARD: Thank you very much.

Mike Kennedy, welcome.

STATEMENT OF MIKE KENNEDY, CORPORATE VICE

PRESIDENT AND DIRECTOR, MOTOROLA INC.

MR. KENNEDY: Thank you, Mr. Chairman, and

Commissioners.

First, let me start by expressing my appreciation to all five of you for spending the morning here on a subject that certainly Motorola regards as fundamental to the FCC's purpose. That of course is spectrum management.

And secondly, let me also thank you personally for the opportunity to testify.

While I don't consider myself a national treasure, I certainly am the only person in the room that has spectrum in his title, I'll bet.

I've submitted a written statement for the record, and I am aware that you'd like us to address the three questions that you asked.

I went through the questions, and I found myself saying, the answer depends, the answer depends on what services, what bands, what technologies, et cetera.

So I thought what I would do is make some remarks this morning about the process of spectrum management and try to tie in the questions at some appropriate points.

I haven't spent enough time at the Commission over the last few years. Those that know me know that I spend most of my time dedicated to Motorola's satellite startup projects.

But I have spent a lot of time, I've spent a lot of time overseas, meeting with your counterparts in other countries, attending radio conferences, going to regional meetings.

The comments I'll make I think reflect heavily on my experiences there, and I think they are applicable to both terrestrial and also to the satellite businesses.

I'd like to make three main points this morning.

The first point I would make is that you, and indeed we must start globally.

The second point I would make is spectrum management is hard work.

And the third point I would make is that spectrum auctions aren't the answer.

And I'll conclude finally with a recommendation.

Let me elaborate.

We have to start globally. I remember the time at the Commission when international was border coordination with Mexico and Canada.

Then I remember in 1979, and I guess I'm giving away my age here, I remember in 1979 when the Commission made a landmark decision in 800 and 900 megahertz for new mobile allocations.

The Commission was very successful. The U.S. Government was very successful in taking that decision outside of the United States.

The industry supported that. We had a very good working relationship, and we ended up with a successful mobile radio service globally that I think was earmarked by the United States leadership very successful time.

Now we have the International Bureau in recognition of the importance of international to the Commission and of course, as already been mentioned this morning, we have WTO commitments that are equally important

We've had some great satellite decisions. I've been personally involved in some of those.

We've done very well, I think, in satellites in the international community, but what have we done with mobile.

You asked for controversy, Mr. Chairman, I'll put some controversy on the table.

We did PCS. I was personally involved. Motorola played a major role in that proceeding. We achieved lots of terrific outcomes. We got more competition in the United States, we got more spectrum from mobile. We have something like 70 million users at this point in combined and cellular and PCS bands.

We have a very successful auction, very successful for the United States for the Treasury and a very successful test of the process, I think.

Where did we not do so well?

We didn't do so well in looking globally. We ended up adopting a plan that really put us out of sync with the rest of the world, and now we are in the position where I believe we're trying to figure out how to redress that problem.

It has ramifications for manufacturers, I think for operators, and I think for importantly the public and the end users in the United States.

I'd better move on.

Secondly, spectrum management is hard work. The questions that you asked on sharing, reduced channel bandwidths, et cetera, will take a focus to really arrive at reasonable answers.

The answer I would give you today is that spectrum management is dynamic, allocations will change and users will have to move up in the spectrum, and they'll have to be treated fairly.

Emergency technology rules are a good process there.

Finally, spectrum auctions. Let me be clear. Allocate the spectrum, auction the licenses for competitive bidding. That's what I mean when I say spectrum auctions aren't the answer. Manufacturers need certainty, I think consumers need some certainty, and I think that the global marketplace demands some certainty that a true spectrum auction might really not allow us to achieve in the marketplace.

Finally, let me conclude with a recommendation on the process.

I think that we need to formalize the process within the Commission and I think we need to elevate the attention.

That why I started by congratulating you for dedicating what I know is a time from very busy schedules for all of you.

Let's create a spectrum management board within the Commission. We've done some of this within Motorola where we have different businesses.

In the Commission, you have different offices and bureaus.

Let's put together a team of senior leaders in the Commission who actually sit down and deal with the issue of spectrum management so we can get the kind of complex problems solved that I think we face.

I looked at your first panel, and I said that looks like a spectrum management board to me.

Thank you.

CHAIRMAN KENNARD: Thank you, very much.

Next, it's always nice to welcome back a former

Commissioner, Henry Rivera, now an attorney with the law firm of Shook, Hardy & Bacon.

Henry, welcome.

STATEMENT OF HENRY M. RIVERA, ESQUIRE, LAW FIRM OF SHOOK, HARDY & BACON

MR. RIVERA: Thank you, Mr. Chairman. It's nice to be here. Commissioners, it's nice to see you all again this morning. Let me compliment you on this beautiful facility, Mr. Chairman, Commissioners, it's certainly not like the old days.

CHAIRMAN KENNARD: The parking's great too.

(Laughter.)

MR. RIVERA: I'm here on behalf of my client, Metricom, Inc., which provides a wireless internet access using primarily the unlicensed band. Few realize the extent of unlicensed operations because obviously there is no license process. The industry is not cohesive and it's difficult to assemble meaningful statistics about this industry.

Furthermore, the industry typically has a very low profile here at the Commission.

Nevertheless, the Commission has recognized unlicensed operations and the significant public benefits that it can provide by offering competitive equipment and services, lower costs, and mass consumer-off-the-shelf use.

Recent examples of the Commission's recognition of the many benefits of unlicensed operations appear in the

UNII and above 40 gigahertz proceedings.

In order for unlicensed operations to be successful, the Commission must internalize the fact that creation of unlicensed operations was also the adoption of a significant spectrum allocation policy.

From this follows two principles, significant principles.

First, unlicensed operations cannot be merely an afterthought in the policymaking process.

Secondly, the regulatory environment must exist for unlicensed operations. That is conducive to the accomplishment of the business plan, and provides stable and adequate spectrum that has reasonable shares in the band.

These principles should be embraced by the Commission because unlicensed spectrum operations, one) promote efficient utilization through sharing, and two) encourage technological innovation.

I was asked to articulate the advantages and disadvantages of providing new services by tried and true methods that the FCC has always used; sharing technical improvements, band clearing and reallocation.

The problem with all but one of these approaches is the premise that providing spectrum for new services must take, as a starting point, that interference will occur among users of the same spectrum and that interference is a bad thing.

This is based on the immutable truth that the license spectrum is generally entitled to exclusive use.

Most sophisticated users of the unlicensed spectrum have no problem with reasonable anticipated interference. These users have engineered their systems with sharing and interference in mind.

Unlicensed systems that are not robust enough to withstand interference from other users, and at the same time not cause interference to others in the band, will not survive and will not be commercially viable.

By promoting simple, flexible, and fair rules for sharing, such as those very brief rules for spread spectrum operations, Section 15,247, the Commission can encourage technology and marketplace forces to replace existing regulation and allow the engineers to invent the best solutions for managing the spectrum.

Which leads me to the second question the panel is supposed to deal with, which is when should the FCC promote more flexible use of the spectrum, and when should it adopt more detailed technical operational regulations.

This question indicates a failure to fully appreciate the Part 15 paradigm. With Part 15 spectrum rules, the Commission created an entirely new industry that is robust and economically viable.

Systems and services have been created and products are in the hands of consumers. And some Part 15 works and it works well.

By any measure, the Part 15 rules are very brief. There are very few detailed, technical and operational specifications.

Furthermore, there are no complicated etiquettes at all. To get into the Part 15 business, one just needs to follow the simple, technical rules. The market will decide the winner and losers and the Commission is spared the needless expenditure of resources to license and manage this spectrum.

Two final thoughts before my time is up.

First, the Commission should recognize that the Part 15 industry is one of the few remaining places where someone with little capital can enter the telecommunications business and make a positive contribution in terms of new services and devices.

One does not need to participate in an auction and the Part 15 rules reward technical achievement.

Second, in my estimation, the largest single problem that the Part 15 has faced has been that when the Commission is making spectrum policy decisions, it tends to forget the Part 15 industry exists.

This failure on the part of the FCC makes it harder than it ought to be to convince potential investors to invest in the Part 15 industry and potential customers to do business with Part 15 suppliers.

The notion that Part 15 has to accept interference from all and may not cause interference to anyone has caused some to believe that this means the FCC can make spectrum policy, completely ignoring the existence of the Part 15 industry.

Nothing could be completely further from the truth.

The Commission has not conducted itself in this manner. Once reminded of Part 15 interests, the Commission needs to keep the Part 15 industry in mind when it launches a proceeding related to unlicensed band.

The Part 15 industry cannot be an afterthought in the spectrum policymaking process. The inclusion of a representative of that industry in today's proceedings is an indication that the Commission is taking the unlicensed industry seriously.

Thank you again for inviting me. I really appreciate your attention.

CHAIRMAN KENNARD: Thank you very much, Henry.

The next witness is Phil Salas from Alcatel.

STATEMENT OF PHIL SALAS, DIRECTOR OF RADIO TECHNOLOGY, ALCATEL, USA

MR. SALAS: Thank you very much, Mr. Chairman and Commissioners. I very much appreciate the opportunity to come and speak to you here today.

If I could have my first slide, please?

(Slide.)

As you can see from the above, I've had the opportunity and privilege of being involved with being involved with many industry organizations all dealing with spectrum issues.

It seems like just a few years ago, people were saying radio was dead. Today, you can hardly find an available hertz. We are seeing all these new technologies and services coming forth that are emerging, and one of the ways we are addressing these is through spectrum band sharing and band sharing.

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(Slide.)

Increased sharing obviously has the advantages that new services can be added to our existing limited spectrum, but we have to keep in mind the potential disadvantages, which include frequency coordination issues, especially with significantly differing services.

We have a concern for the ability of existing services to grow due to additional congestion.

Sharing can also be dangerous to both the new entrants and the incumbent unless advance technical studies are not done first.

Sharing generally is found not to be suitable for mass market or ubiquitous type service, and sharing can be inefficient leading to spectrum warehousing if the new services don't follow through with their promised capacity needs, as we saw in DBS originally.

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(Slide.)

Required technical improvements may not be necessary for some of the new bands. However, I believe we should push technology to make more spectrum available in shared bands.

However, I believe technical quality should be observed at the very least.

As an example, Part 101 fixed service users have high spectrum efficiency requirements both for radios and antennas. By antennas, I mean Category A Shrouded Antennas.

The fixed service also has minimal loading requirements, growth requirements and may only occupy the bandwith and azimuths actually needed.

New entrants for sharing the band have few if any of these requirements.

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(Slide.)

Band clearing causes the least problem for new services. It allows for very wide licenses and flexible deployment. However, where can the existing services go when they're cleared out of a band?

Most of the existing services today are growing. Currently over 6,000 frequencies per year are being coordinated for Part 101 users.

So when bands are cleared, the incumbents must move to frequencies that are being used for growth.

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(Slide.)

When band clearing is required, relocation costs must be borne by the new entrants. This is obviously costly to the entrants, but the existing users have considerable costs buried in their existing networks, and these are revenue-generating competitive public service or public safety networks.

And again, most of these networks are growing.

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(Slide.)

Sharing between dissimilar services has a very poor track record. The recent 28 gigahertz negotiated rulemaking determined that FS sharing with ubiquitous FSS is not feasible.

Thirty-eight gigahertz studies have shown the same.

The reason 18 gigahertz NPRM is due to the fact that some technology is not sharable technologies. After two years of effort to determine PCS and FS sharing criteria in the 1850 and 1990 megahertz band, over two-thirds of the FS incumbents were relocated by the PCS entrants.

The FSS has effectively lost the 3.7 to 4.2 gigahertz band, due to its inability to share with licensed GSO downlinks.

The FS currently has difficulty coordinating 5.9 to 6.4 gigahertz links in many parts of the U.S. due to the large number of satellite uplinks.

Just recently, Virginia Power had to get a waiver to go to upper 6 for their high capacity needs because they were blocked by earth stations here in the D.C. area.

The FS successfully been able to coordinate around 11 gigahertz satellite gateways through frequency segregation.

Next slide, please.

If sharing between dissimilar services was truly viable, would the FS have lost 1850 to 1990, 2100, 2200, and half of the 18 gigahertz band?

And of course, 4 gigahertz, as I mentioned before.

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(Slide.)

Sharing has the highest ability to succeed when similar services share the band. Dissimilar service sharing, however, is much, much more difficult because coordination requirements differ, allowable performance degradations differ, and technologies involved can differ significantly.

When sharing must occur between dissimilar services, I believe band segmentation to be the best opportunity for success.

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(Slide.)

In order for sharing to be successful, spectrum studies need to be done prior to filing the petition for rulemaking.

These studies need to include complete identification of the incumbent, a thorough sharing and relocation plan, identification of destination bands, and any rule changes necessary in those destination bands.

We've had problems in the past where the bands were available but the rules did not support them, and an economic impact study on the incumbents.

It's also very important for the Commission to ensure that existing users have time to study and comment on important sharing issues.

New allocations leading to sharing must be done by NPRM, not by waiver.

The highly contentious earth station on board vessel issue has never had the benefit of the administrative procedures and public comments associated with an NPRM.

Last slide.

(Slide.)

Finally, no new spectrum is being created. Therefore, we must make efficient use of the spectrum. A lot of volunteer organizations and industry organizations are out there which have accomplished extremely high utilization of our spectrum.

I believe the Commission should take advantage of these types of organizations prior to an NPRM in order to minimize the pain of the NPRM in subsequent rulemakings.

Thank you very much.

CHAIRMAN KENNARD: Thank you very much.

Leslie Taylor of Leslie Taylor Associates.

STATEMENT OF LESLIE TAYLOR, PRESIDENT, LESLIE TAYLOR ASSOCIATES

MS. TAYLOR: Thank you very much, Mr. Chairman, Commissioners. I'm very pleased and honored to be here today to speak on spectrum management.

It's a particular honor for me, as a former Commission employee for almost ten years. I also worked at

NTIA, so I had the opportunity to see spectrum management from a couple of different perspectives in the federal government.

Since leaving the government, I've primarily focused on international and satellite spectrum management.

(Slide.)

As many of the people who know me in this room, my favorite kind of case is the most difficult one, primarily those looking at new services that require new spectrum and innovative spectrum-sharing solutions.

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(Slide.)

First, I want to express appreciation to Commissioner Ness for her involvement in global spectrum management activities. This kind of participation really helps the United States express to other countries that it does have a commitment to the international process.

And I would encourage other Commissioners to participate as well. I think the more, the better. And this process should go forward.

The communications marketplace is a global one. Today, U.S. manufacturers and service providers serve a global marketplace. U.S. consumers use products and services made in the U.S. and outside the U.S.

U.S. consumers travel extensively and expect and need high quality communications wherever they go.

Now I like to do a little show and tell. I didn't leave my cell phone on but I wanted to ask the Commissioners how many people have a cell phone.

You don't have to take them out.

(Show of hands.)

MS. TAYLOR: How many of you can take your cell phone anywhere in the world that you want to go?

CHAIRMAN KENNARD: It's a painful subject to bring up right now.

(Laughter.)

MS. TAYLOR: Do any of you not use the Internet?

(No response.)

MS. TAYLOR: Okay, everyone uses the Internet. Everyone have connectivity at the bandwidth speeds that you want everywhere, even here, even at your own home.

I just tried to get the ADSL in my home in Bethesda, Maryland, which is about ten miles from the White House. I can't a cable modem, I can't get ADSL. I have a dial-up so I think the problem you've recognized is what I'm going to ask you to focus on as you go forward in the spectrum management area.

The two driving forces in communications today are mobility and broadband, and if you keep those objectives in mind, as you are involved in spectrum allocation proceedings, I think that will take you to the right solution.

Some lessons from the past.

Next slide.

(Slide.)

I can put up some of these lessons because I don't think any of you on the current Commission were involved in these decisions.

Some of the early cellular decisions, while I do commend the Commission of the early 1980s for getting cellular going in the United States, it essentially bulkanizes cellular business in the U.S. and we had a standard situation which I realize was not the Commission's responsibility.

We had a standard situation that set us apart from the rest of the world.

However, we have a situation where Europe took a different approach. They adopted a common standard called GSM. They can take this phone -- not this phone but a phone -- and they can roam through a hundred countries. There are 120 million GSM users in the world today. By 2003, there will be 700 million cellular users.

Now what else would we like to do with the cell phone? Wouldn't we like to combine this mobile phone with broadband? Yes. I think that's something that you are all thinking about, talking about, dreaming about.

That's something that we would all like to see happen, and make happen.

Third generation wireless will be a critical component for new technology and this has got to be facilitated. However, we've got a lot of hurdles to overcome before that.

We have different standards in the U.S. We have different frequency bands.

On to satellites, next slide.

(Slide.)

Okay. Similarly in the satellite field, the U.S. has had something of a go-it-alone approach at times and at some points has taken critical allocations that were different from global allocations.

Sometimes this has worked out all right in the case of DBS and DARS, but in the case of MSS, where we need critical spectrum to move forward so the MSS can be a part of third-generation wireless, some of the MSS allocation was taken and reallocated to PCS.

At WRC-95, the U.S. did a very wonderful thing, that is, they went to a conference and they said, we think global broadband systems are extremely important.

We got the support of the international community and they got allocations for those types of systems.

However, in 1997, when other countries came back and wanted to have more allocations for global broadband, the U.S. was a little more hesitant.

So to sum up, I think that if we look at global broadband, they provide the best opportunity for universal service, for getting that high bandwidth service to every point.

We can't expect buildout of cable, we can expect buildout of terrestrial systems, no matter how good, and we need to work with the international community to make sure we are in harmony.

Thank you.

CHAIRMAN KENNARD: Thank you very much.

Now we have a little bit of time left for questioning of this panel.

I'd like to start by going back to the issue that Michael Kennedy raised about a spectrum management board. I'm sort of intrigued by that idea.

But I think we need to know in a little greater detail, Mike, what, if we were to create this board tomorrow, what issues would you expect to be at the top of the agenda of that board, and if you could give us your candid assessment of why those issues aren't being handled adequately or can't be handled adequately given our current structure?

I think that would be helpful.

MR. KENNEDY: Certainly.

First of all, I understand that you do have a spectrum coordinating committee where representatives get together between bureaus and discuss issues.

My proposal would be, in a sense, to elevate the level of that to bureau and office chiefs. I think I see, and again I'm looking of course as a former Commission employee but an outsider really looking in, but I think I still see what we in Motorola call silos.

I see an international bureau here and I see a wireless bureau there. And I'm not sure that the connections are made between the international dimension of spectrum management and the domestic issues that the wireless bureau is facing.

So I see a management board being a mechanism where those connections can be made, where all the bureaus will be able to sort of understand the issues that each individual bureau faces as it goes about its work.

Secondly, I think Bill Hatch talked about the linkages with NTIA. I think they're good but I think they need to be strengthened.

Bill also mentioned that 90 percent of the spectrum, I'll say, quote, that people are interested in, is really shared-government/non-government at this point.

Somehow we have to do a better coordination between the government users and your constituents, the public.

So, again, my recommendation would be to elevate to a bureau and office chief issue, the level, and actually have some focus on the generic issue of spectrum management.

Finally, what would be the issue?

I think one of the biggest issues facing the U.S. right now, and I think the Commission has a major role in it, is I'll call the legacy issues from our PCS decision.

How do we view the world, given that we do have different allocations here and indeed in much of Region 2.

Secondly, how do we look at efforts for looking at expansion spectra. Should we make the assumption that there will be no more expansion spectrum, or should we be looking at expansion bands?

I would see this largely as preparatory to domestic actions and also radio conference preparations.

CHAIRMAN KENNARD: Thank you. That's very useful.

I wanted to echo the comments of Commissioner Tristani, which she made in her opening today, when she talked about how important it is to bring telephone service to under served areas, particularly Indian populations in the United States.

We have spent a fair amount of time focusing on that issue. We've had two field hearings now. We've heard a lot of testimony on the issue.

Since we have this group of very distinguished panelists from the wireless industry assembled, I'd like to pose the question to you.

How can we promote the use of wireless technology, not only to bring service to under served populations, but also as an even more effective competitor against the incumbent wireline network.

It seems to me that wireless offers tremendous advantages in both of those areas as a new competitor.

And Leslie Taylor, you mentioned the difficulty in getting ADSL and cable modems in your home in Bethesda.

We ought to have a wireless solution that provides broadband access to residences around the world.

How can we change our policies here at the FCC to make that a reality sooner rather than later?

Mike?

MR. KENNEDY: Let me offer a response.

I think -- I'm not expert enough to know -- there are probably many state and local regulatory issues that operators would face.

Looking at it from a manufacturer's perspective, we have spent a lot of time looking at what we call wireless local loop systems.

Commissioner Tristani just recently made a visit and we had some discussions with her over those.

There's an issue of how big is the market, and it turns out when you travel the world, you find out that many countries are interested in an analogous requirement that you're looking at for rural and Indian Reservation populations.

Each country, though, tends to have a different vision. It's a different spectrum band, it's a different technology, it's a different standard, and when you fragment the market that way from a manufacturer's perspective, it makes it very difficult to envision a product that is cost-effective.

So I think there are two choices. One is sort of look for a common solution with other countries. The other is to try to bridge off of the existing major services like cellular or PCS, where you have large economies of scale.

CHAIRMAN KENNARD: Thank you.

Leslie?

MS. TAYLOR: I'd just like to comment on it. I don't get involved really in the inner exchange issues and those kind of competition issues.

But I did have occasion yesterday to review order which the Commission recently released or Notice of Proposed

Rulemaking, where you propose certain rules to facilitate the introduction of competitive local exchange carriers.

And I really saw a lot of good things in that proposal. Because introducing competition will help to bring broadband into the local loop, I believe, because the competitors will want to use whatever kind of technology is most cost-effective and enables them to get into service most rapidly.

So I want to commend the Commission for moving that proceeding forward.

As Mike said, I think that we need to focus, and perhaps a focus could be a little smaller scale than a spectrum board, but something that really focuses on the immediate future of the next ten years.

How are we going to facilitate broadband, wirelessly and non-wirelessly. I think that's something that the Commission is uniquely positioned to address, both in its policies on competition as well as in its spectrum management role.

CHAIRMAN KENNARD: Thank you.

Mr. Salas?

MR. SALAS: Several years ago, specifically talking about the Indian problem, we became involved in the

BETRS program, Basic Exchange Telephone and Radio Service.

We determined there was enough market there to make it viable for the manufacturer to get into that business. However, it turns out that there were technology problems associated with it.

First of all, the bandwidth was shared with high powered paging and mobile services.

Secondly, the extremely high out-of-band emissions of radars would blow away these kinds of systems.

Again, here's another case where a technical study, ahead of time, could have helped determine some of the issues involved prior to setting up this band for that particular service.

CHAIRMAN KENNARD: That was helpful. Thank you.

Henry?

MR. RIVERA: I don't have an answer to this problem. I simply wanted to commend you and Commissioner Tristani and the other Commissioners for your interest in this problem.

Being from New Mexico, I certainly can appreciate the isolation of the Native American population and the poverty of the Native American population.

Something certainly needs to be done in this area, and I'm very grateful that you all are looking into this.

CHAIRMAN KENNARD: Thank you for saying that. I appreciate that.

Commissioner Ness, did you have questions?

COMMISSIONER NESS: The third panel is going to be looking at some new approaches to spectrum management, and I would assume that some of the panelists will be talking a little bit more about privatizing spectrum.

In other words, you would be able to get a trenche of spectrum. I'm not quite sure how it will be divided geographically, but assume that it would be parceled out in some fashion, and you could do anything you want with it.

Can the various panelists comment as to how, whether that would be efficient use of the spectrum and how you would go about using the spectrum under a privatized approach?

MR. CROSBY: If I may. I've heard the term lately regarding privatization, particularly as it affects private wireless band managers.

Perhaps that's a new term for certified frequency advisory committees in the next century.

I think band managers for private wireless would be extremely effective, given the responsibility to ensure that the spectrum is used efficiently and perhaps with some other tools, I think it would be a boon for private wireless, and existing bands or new allocations for private wireless.

I think it's a great idea.

COMMISSIONER NESS: Mr. Kennedy?

MR. KENNEDY: I would just comment that I said spectrum management was hard. It's all about balance.

I don't think, when Bob Pepper sort of summed up the first panel, I sort of liked his summary because he kind of struck a note of balance, I thought.

As much markets' techniques as you can get, and I think at the same time, the Commission's always going to have a role, certainly at the allocation level, so I think a process like that can be made to work.

Again, I would stress let's try to look globally, let's try to look beyond the issues in the United States and see what issues we might create when we move in that direction with other countries.

MR. SALAS: I certainly see advantages and disadvantages to privatization.

I know today in a lot of the frequency bands, we get tremendous frequency re-use between competitors by proper sector management.

However, the proper utilization of privatization in area-wide licenses and so forth can also be effective if the frequencies are properly used and the buildouts occur as everybody expects them to.

MS. TAYLOR: I'd just like to make a comment about having spectrum available on a undefined basis.

I think the Commission's experience thus far has not borne out the theory that that works very effectively, at least in the near term.

Maybe over a long term, it may work effectively. However, if you take the wireless communications service as an example, you had a very unfortunate situation where the Commission, under requirement of Congress, had to take certain spectrum and auction it in a very short time frame, which really did not have the leisure or the opportunity to get public comment on how to define that service.

As a result, a fairly nice piece of spectrum was auctioned for a very small amount of money, and I don't think that was something that the Commission wanted to happen anymore than anyone else.

Generally speaking, when things aren't defined, people can't assess their value or their utility or even their interference characteristics of sharing within that band or adjacent bands, so I guess maybe I'm a little bit of a regulator, left over from my days of being at the Commission.

And I think you have a very important role to play here.

COMMISSIONER NESS: Mr. Rivera?

MR. RIVERA: Well, Commissioner, I think if you allocated a block of spectrum exclusively for unlicensed use, and not allowed other licensed users in there, I think you would get a tremendous expansion of Part 15 operations, lots of new services and a lot of new investment in that spectrum.

I think it would work quite well.

COMMISSIONER NESS: Mr. Claudy, did you have any thoughts on that?

MR. CLAUDY: No, I don't.

COMMISSIONER NESS: The issue was raised by Mr. Kennedy about having a more centralized approach within the Commission to spectrum issues, in particular, setting spectrum policy.

Does anyone else have any thoughts on that?

And perhaps if Dale could respond to Mr. Kennedy's comment as to what we are doing to try to elevate spectrum within the Commission itself.

MR. HATFIELD: Yes. Mike did mention that we did have the Spectrum Coordinating Committee that meets on a regular basis where we try to do some of what you're talking about.

To raise it further I think is probably more of a decision of you all to make, but I would say that I think it has merit.

The only thing that worries me sitting here, sort of in the back of my mind, is that sort of reorganizing mustn't be a substitute to coming to grips with the very, very difficult problem, that is, that this increased sharing we're talking about here is extremely difficult.

A number of people have talked about it. The engineering resources that you have to put into it. It gets very, very difficult.

And unfortunately, when we're moving at this sort of Internet speed now, the time that it takes to work out these sharing arrangements and so forth, you may have passed a couple of generations of technology.

So I'm concerned. I have this ultimate concern that just the organization inside the Commission, as important as that is, may not solve this fundamental problem that this rapid growth is making it very difficult.

The satellites move, I thought the videos were very good showing the complexity of some of the sharing problems we've got. That does bother me. We just need to focus on doing that.

Perhaps in the third panel, we'll hear we even need to step back a little bit further. Maybe that road's going to run out at some point.

The inherent risk gets so high, the difficulties, the delay it takes you to reach the decision gets so long that maybe we have to begin to think of some fundamentally different ways of going about it.

CHAIRMAN KENNARD: Commissioner Furchtgott-Roth?

COMMISSIONER FURCHTGOTT-ROTH: Thank you, Mr. Chairman.

Mr. Claudy, we've heard a lot this morning about spectrum management.

We have before the Commission a very important spectrum management issue, microradio.

I'd be very interested in your thoughts on how this Commission should approach spectrum management in the context of microradio.

MR. CLAUDY: The low power FM proposal in microradio is troublesome to broadcasters for many aspects.

I think from the spectrum management point of view, there is a feeling that the spectrum management cart has gotten in front of the spectrum management horse, perhaps.

The proceeding makes an assumption that radios that are in the world today will not be bothered by the introduction of more energy in the FM Band, so there's an assumption that radios have gotten better and are more interference-immune.

The evidence that exists on that point is scant, but it doesn't really support that notion.

So moving forward into a rulemaking, where the burden has been placed on the broadcasters to prove that radios are in fact still susceptible to interference that might be introduced by LPFM seems at least a premature notion, perhaps an unfair burden on the radio industry.

Secondly, the enduring principle that the FCC has operated by with radio service certainly has been to protect its future. And in communications services, the future means moving to a digital technology platform and that's certainly where the in-band on-channel digital-audio broadcasting movement is headed.

It's certainly not too soon to do that. We have the satellite digital radio service launching perhaps as early as next year.

IBAC, as it's called, is needed as a competitive response, but that is another example of a service which adds more energy into the FM Band and essentially is competing for that space with the lower power FM proposal or the extent to which those two services can share is very speculative.

So from the broadcast point of view, it would have made much more sense and been more comfortable to have moved forward with the proceeding on digital-audio broadcasting, at least simultaneously, if not before the introduction of a new service of the lower power and microradio proposal.

So from the spectrum management side, those are the troublesome aspects that are in tension with our goals and what the Commission's goals are.

COMMISSIONER FURCHTGOTT-ROTH: Thank you.

CHAIRMAN KENNARD: Commissioner Powell?

COMMISSIONER POWELL: Thank you, Mr. Chairman.

I have three questions. Two of them are related, and I'll ask them at once, and they are open to anyone.

This industry seems to be one of the most competitive and fastest changing of all of those that we regulate, and we increasing discuss innovation policy.

The concept of trying to identify the incentives and disincentives for innovation in a technology-information driven market, I'd be interested folks succinctly trying to identify aspects or variables of spectrum management policy that they believe to have been either facilitators of innovation or significant inhibitors in innovation, and perhaps some opining about ways that that can be improved.

And related, and I'll throw it out at the same time, in the interests of time, Mr. Kennedy talked about the need to have some sort of coordination across some of our traditional operations that deal with the management of wireless spectrum.

But it occurs to me, and we are having a debate about this increasingly, that convergence, the ability of industries that have not historically been competitors and operate on very different assumptions, both technical and regulatory, et cetera, are increasingly exploring providing goods and services in areas that they might not have previously.

Using I think wireless technology will prove to be one of the most flexible uses of being able to invade new turf.

And I'm curious about the strains you see in our organization and our approaches that are starting to emerge, not just between the satellite terrestrial wireless and broadcasting, but perhaps the arrival of broadcasting to internet space or wireless technologies to traditional common carrier space, et cetera.

And then I'll ask my third question after that.

Anyone?

MS. TAYLOR: Well, if I can take a shot at it first? Despite my concerns about the U.S. sometimes being out of sync with the rest of the world on wireless allocations, I think the communication, the FCC traditionally has gone in the right direction of making a lot of wireless allocations, getting systems licensed, getting service to the public.

This was absolutely the right thing to do. Every aspect of it isn't right, but you can't guess every aspect.

You can't know in advance exactly how to do it.

A lot of things are going to change within the marketplace. This has spurred a lot of innovation. We've seen just a tremendous evolution in the technology and this has happened because the spectrum was there, because people were able to get licenses, because they were able to go out there, get money, and go into service.

So I really would commend the Commission for that.

In addition, in the satellite area, by and large, traditionally the Commission has been very supportive of new satellite technologies of mobile satellite service, big LEOs, little LEOs, DARS, DBS. They first allocated spectrum for DBS in the early eighties.

We finally saw DBS go into service in the nineties. It's now really taking off. Sometimes you have to be patient.

So a lot of it is doing your best to try to determine what the future communications environment is going to be in terms of needs, broadband, et cetera, mobility, which I've cited.

There are other needs. Public service. I think the Public Safety Advisory Committee was a very good action along that line.

And the Commission followed up on allocations for that.

So it's just making sure you keep doing what you're doing.

And I'm sorry I have to disagree with some of my fellow panelists who have doom and gloom about sharing. I've seen sharing work. I think if you create the incentives for the applicants and for the services to share, that many if not most of them can find a way.

Thank you.

MR. CROSBY: If I could just add to that, to Leslie.

Again, as I said, private wireless is the epitome of sharing, at least in our bands. When you try to introduce some new technologies that are heavily encumbered, I think interference, there needs to be some analysis on the potential interference of the incumbents.

For example, the little LEOs and perhaps have an interest in some of the private wireless bands and this is extremely difficult. I don't know if there's enough evidence there to say that that works, so I think there always needs to be a component of the analysis when there's still sharing on the table to ensure that the incumbents and interference doesn't become a worse problem than it may appear, at least initially.

MR. KENNEDY: If I might just comment also, Commissioner, I think I would again echo the comments on satellites.

I think the Commission's done a terrific job of sort of fostering the growth of that industry globally, and I think you deserve a lot of credit for that.

I think on the issue of convergence, that's a very interesting one. You know, applications are converging, and I think one of the great challenges were going to face is with the growth of the Internet, how do we take the Internet wireless?

Where and how are we going to do that?

Are we going to do it in the new spectrum or existing spectrum?

My answer is probably both, so I think you're going to face a major challenge in identifying that spectrum as we move forward.

I saw a statistic the other day that cellular and PCS services globally are adding 100 million new users a year. There's no way that's going to be able to be totally accommodated in the existing bands forever, if they continue to grow at that rate.

And many of those new users are really using applications that are starting to mirror Internet kind of applications in the wireless domain.

MR. RIVERA: Commissioner, I have to say that, in my opinion, one of the greatest innovators or facilitators of innovation has been the Part 15 rule.

Part 15.247 is simple. You have created an extraordinary industry with a variety of applications from garage door openers to cordless phones to Internet access, on and on and on.

And I think the Commission would do well to look at the Part 15 paradigm, again in terms of future spectrum management.

With regard to your second question on convergence, I think the Commission is going to have to rethink itself and its organization and pay attention more to what is being offered as opposed to who's offering it in terms of structuring a regulatory model.

It's a very difficult question on very difficult issues.

COMMISSIONER POWELL: I had another question, but in the interest of time, I'll yield. But at some point, I'd like to hear people talk about the quality of our enforcement.

Because whether you're in a property rights regime, or a licensing of use regime, it's only as good as your ability to enforce and protect those rights.

CHAIRMAN KENNARD: Good point.

Commissioner Tristani?

COMMISSIONER TRISTANI: Mr. Chairman, I'd like to ask this panel the question I asked our first panel.

Mr. Salas, I think you touched on it.

How important or useful would it be to have an adequate inventory of spectrum usage?

If you want to start?

MR. SALAS: Sure. Obviously that would be great. There is no -- is spectrum available? The Commission has been I think very helpful and cooperative in helping us maximize the spectrum we have available to us.

For example, as the fixed service areas became more and more congested, representatives of the service would approach the Commission for rechannelization in higher spectrum efficiencies. You all worked with us to actually accomplish that.

So we have the ability to use technology to make more spectrum available.

Right now, to my knowledge, the only spectrum that I think is unknown to us is a lot of spectrum that's owned by the government and I'm not sure how much of that is properly used compared to the way it's used in the private industries today.

COMMISSIONER POWELL: And you won't get to know.

(Laughter.)

MR. SALAS: I know, I've tried.

COMMISSIONER TRISTANI: Does anybody else care to comment on that?

MR. KENNEDY: Commissioner, I would comment also.

I think it would be very useful to have a better idea of how the bands are actually utilized. I think one issue we will have is the legacy of services that have been there for a long time and haven't necessary lived up to their promise.

And I think it's clear from the first two panels that there will no doubt be more sharing and there will also no doubt be more reallocation.

And to do that, you really have to have some data. I think additionally it fits with your question, Commissioner, and that is to enforce, you have to have data also, and I think we probably could use a little more enforcement outside the Commission.

MR. CROSBY: I think Commissioner Tristani's suggestion on having an inventory is an excellent idea. I too would be happy to contribute, and I think if you had not only the users but the types of users, the technology that's in place, the technology that's being deployed, and future requirements for the incumbents of certain spectrum. I think it helps the spectrum management process select the inventory.

Enforcement is -- I'd love to see the pendulum coming back. It wasn't there for a while. ITA is a big fan of enforcement.

In fact, we executed an MOU with the Compliance of Information Bureau to assist the FCC in its enforcement endeavors, and it takes a lot of assistance.

CHAIRMAN KENNARD: And we appreciate that. Thank you.

I think we'd better wrap up. We will be reconvening in about ten minutes, but before we adjourn, I did want to thank this excellent group of panelists. I really appreciate your taking the time out to do this and it helped us immensely.

Thank you very much.

(Recess.)

CHAIRMAN KENNARD: Our third and final panel will consider some innovative ways to think about spectrum management.

We like to this of this as the sort of panel of visionaries who will help us think outside the box, and give us a sense of what is next, what we should be thinking about as we anticipate the future.

I've been remiss in not reminding our panelists to please state their name and affiliation for the record, so I'll do that now.

We'll begin with Professor Hazlett.

STATEMENT OF THOMAS W. HAZLETT, RESIDENT SCHOLAR, AMERICAN ENTERPRISE INSTITUTE FOR PUBLIC POLICY RESEARCH; AND PROFESSOR, UNIVERSITY OF CALIFORNIA, DAVIS (INVITED)

MR. HAZLETT: Thank you, Mr. Chairman.

My name is Tom Hazlett, Professor at the University of California at Davis, and Resident Scholar at the American Enterprise Institute.

It's a pleasure to talk about spectrum allocation, and of course, there has to be some sort of regulation of spectrum access to avoid a tragedy of the commons.

This sort of regulation is fundamentally provided by an owner, a party who asserts control to maximize the value of the resource.

Since 1927 and the Radio Act, the U.S. Government declared that there could be no private owner of radio waves, and so a federal agency has stepped in to act as sort of a quasi-owner.

It's important to look at this problem as a two-sided problem. Regulating use of the spectrum can be too lax or too conservative.

If regulation is too lax, interference results and transmissions are wasted.

If it's too conservative, communications services are suppressed and bandwidth is wasted.

The goal of public policy should be to minimize the cost of both sources of social loss, thereby maximizing the value of the spectrum resource.

Looking back at decades of history, however, we can see that the government has continually erred on the side of conservatism.

Since the earliest days of Commission regulation, entry requirements for providing wireless services have been overly strict, and the administrative process unnecessarily cumbersome.

The result has been that upstart rivals attempting to challenge incumbents by providing services on under-utilized bands have had great difficulty obtaining permission to compete in the marketplace.

The system has effectively protected the status quo at the expense of dynamic change. This overly conservative regulation of spectrum-based services stifles competitive forces in several dimensions.

First it blocks new entrants, secondly it blocks incumbents from entering markets served by others, sort of a cross-media competition which would be served by greater flexibility.

Finally, it discourages innovation protecting old technologies at the expense of the new by making it more difficult for the new technologies to get spectrum allocated and to get licenses issued for use.

Now, I think the hopeful sign is that if we look back over the past many years, we can see that there is a gradual liberalization taking place.

It would be wrong to call this a revolution that has shaken the spectrum allocation system, but there is a gradual drift towards a more liberal system.

We can compare the cellular telephone allocation licensing process, beginning officially in 1968, with the personal communications services proceeding a generation later.

The former delineated exactly what bandwidth was to be used, what technical standards phones would have, and the size of territories served by licensees.

Licenses were issued by lottery of course, and the allocation and licensing process together took 21 years to complete using the most generous accounting.

PCS, by contrast, may be completed in less than a decade. Most importantly, it allows licensees to engage in voluntary reallocation of radio spectrum by bargaining with incumbent spectrum users to vacate wavelengths.

It also allows the licensees to set technical standards in the competitive marketplace and to aggregate service territories so as to create efficient national and regional networks.

The robust competition unleashed has driven down prices dramatically for customers which is the payoff from liberalization.

Other successes have flowed from the relaxation of old rules. The competitive entry of Nextel, formerly Fleetcall, into wireless telephony was a classic example of how market forces create efficient use of spectrum despite bureaucratic prohibitions.

Today companies like Windstar and Telegen are creating competitive opportunities by reinventing old administrative paradigms.

But other firms wait for progress and may perish in the queue. The recent near death experience of the wireless cable industry, waiting permission to deliver Internet access over its allocated airspace is one case in point.

Many new technologies are today lined up at the Commission awaiting the opportunity to compete. That the system is geared to delay such progressive social activity is testimony to the magnitude of the structural problem.

I would call the solution, the liberal solution, one that could be fairly characterized by defining licensed contours and overlay rights.

To get a hold of this liberal solution, probably the easiest entry is to start with the PCS success story. The approach has not been in PCS and the overlay right was potentially quite profound, allowing private licensees to become band managers in PCS meant that they were granted flexibility to develop wireless services, so long as they did not disturb existing incumbents.

Then the overlay rights, which were issued in PCS, could be issued in other bands already allocated by the Commission as we found.

Given the shift in incentives, new services and technologies will be propelled by new momentum. Such overlay rights could be issued at auction, wherever demand exists.

The issue of interference would remain the Commission's concern and better definition of the contours of licenses would focus attention on the necessary regulation, avoiding the tragedy of the commons.

Expedited methods can and should be developed for adjudicating border disputes including arbitration conducted privately or under the auspices of the FCC.

By allowing a number of competing information superhighways in the wireless world, band managers with incentives to maximize traffic will bring new sources of competition and innovation to the market.

Service prices for existing operators will fall, and the telecommunications infrastructure will increasingly bring efficiency to the business sector.

In addition, the freedom to use spectrum flexibly will allow manufacturers to contract with band managers for what is now called unlicensed spectrum use.

Indeed, given a more liberal system, incentives to invest in R&D so as to discover dynamic new technologies, will reliably increase.

That is perhaps the biggest payoff of liberalization, ending the attacks of delay and red tape which now discourages deployment and therefore development of new wireless services.

Thank you.

CHAIRMAN KENNARD: Thank you, Mr. Hazlett.

Mr. Hendricks?

STATEMENT OF DEWAYNE HENDRICKS, GENERAL MANAGER,
WIRELESS BUSINESS UNIT, COM 21, INC.

MR. HENDRICKS: Good morning Mr. Chairman, Commissioners. I'm Dewayne Hendricks with Com 21 in the San Francisco Bay Area.

I believe today's communications technology is moving towards a world of all-digital transmitters and receivers.

These advances in technology, combined with the swift evolution of cell-based transmission and switching protocols is opening up a set of possibilities for unique new services utilizing intelligent networks.

These will contain smart transmitters, receivers, and switches. Today's Internet is perhaps the best example of a self-regulating structure that embodies these new technological approaches through the communications and the networking domain.

However, many of these innovations have not moved into the wireless networking arena.

I feel that the radio networks of the future will involve a mixture of links and switches of different ownership which terminate at the end user by a relatively short distance link.

What will then be required is a built-in distributed self-governing set of protocols to cause the networks' behavior to make more efficient use of a limited common shared resource, the radio spectrum.

Creating such a self-regulating structure for the optimal sharing of spectrum will require much effort.

One of the major problems which stands in the way of these approaches today is the current FCC regulatory environment and the manner in which spectrum is managed and allocated under its rules.

One of the major hurdles the wireless entrepreneur encounters who wishes to develop new, innovative communications products which involve radio is access to the requisite amount of spectrum.

This process makes the involvement of the wireless entrepreneur with the government mandatory, which immediately puts the entrepreneur at a disadvantage, when compared to entrepreneurs in the computer sector where government involvement is minimal.

As a result, innovation has occurred at a much slower pace since the use of technologies such as spread spectrum require the use of more spectrum and not less in order for their advantages to become apparent when it is used for high speed data transmission.

Historically, the current regulatory approach to radio has been based upon the technology that was in use at the time the Communications Act of 1934 was framed, basically, what we would call today dumb transmitters speaking to dumb receivers.

The technology that, at the time, reserved bandwidths to be set aside for each licensed service so that spectrum would be available when needed.

Given this regulatory approach, many new applications cannot be accommodated since there's no available allocated spectrum to park new services.

However, given the new set of tools available to the entrepreneur with the advent of digital technology, what were once dumb transmitters and receivers can now be smart devices which are capable of exercising greater judgment in the effective use and sharing of spectrum.

The more flexible are the tools that we incorporate in these devices, the greater the number of uses that can be accommodated in a fixed amount of shared spectrum.

One of the most promising regulatory actions by Commission in recent times was the move in 1981 to permit the use of spread spectrum technology in unlicensed devices with release of the landmark Notice of Inquiry.

This NOI eventually resulted in a new type of device that operates under Part 15 regulations, and are deployed in what are now known as the ISM bands.

Moreover, these devices are forbidden to operate at transmissions greater than one watt, and they must be transmitted over a minimum amount of assigned spectrum.

These strains notwithstanding, the 1981 Part 15 ruling, and later additions and changes to those rules have already spawned the development, manufacture, and marketing of a wide range of no-license-required products.

Because mass manufacturing on the consumer market has yet to occur, spread spectrum products for data transmission from the 60 or so current vendors carrier premium price tags and have limited the technology mainly to large organizations such as businesses, schools, and libraries.

There is every reason to believe that these prices will drop as manufacturing volumes increase to meet the growing market demand for higher bandwidth and secure wireless connections from PCs to the Internet.

In the future, people may, for example, routinely rely on wireless transmission to reach a central system that would then connect to a traditional network of ground-based lines.

We predict that reliable, secure, unlicensed data radios operating at T1 or higher speeds to a range of more than 30 kilometers will soon cost less than $500 each.

The Internet today represents the best example of the self-regulating mechanism that will be necessary in the new radio environment that we envision.

The creation of a similar decentralized structure for the optimal sharing of the radio spectrum will require a substantial effort by a combination of telecommunications experts and entrepreneurs working with the various regulatory bodies around the world.

We believe the deployment and growth of such a system is achievable through increasingly smart electronics and we envision a self-governing set of protocols that are built into these intelligent devices.

Packet radio operations as currently deployed in the amateur radio service in this country is a good existence proof of what is possible today.

As advance radios are deployed, society must tackle the crucial issue of incorporating the most positive and negative incentives within the network infrastructure itself to make the best use of a shared common resource, the radio spectrum.

Thank you.

CHAIRMAN KENNARD: Thank you very much, Mr. Hendricks.

Dr. Chuck Jackson.

STATEMENT OF CHARLES L. JACKSON, JACKSON ASSOCIATES

MR. JACKSON: Thank you, Mr. Chairman, thank you, Commissioners, for permitting me to be here today and share my thoughts with you.

First, an introduction. By training I'm an engineer. I've worked as a programmer and digital designer communications system engineer, and I've also worked at the FCC and the House Commerce Committee.

I am currently a principal, for at least almost a month now, with the consulting firm of LECG, Law & Economics

Consulting Group, and I'm an adjunct professor at George Washington University where I've taught a graduate course in mobile communications.

One thing I'd like to emphasize at the beginning is that as electronics get cheaper, better, smaller, more powerful, they make more valuable the complementary spectrum resource.

If you couldn't build a radio for less than ten million dollars, there wouldn't be very many radios for you folks to be worrying about allocating the spectrum to.

But as radios get cheaper, there are more ways consumers can use them.

Secondly, the FCC has a unique role here. The Department of Justice, the state attorney general, the state regulatory commissions can't substitute in whole or in part for the fundamental decisions you make over regulating the spectrum, so it's one of your most important responsibilities. And it will become, I believe, more important to our society.

We participants in this panel have been asked to suggest approaches the Commission should take to manage the spectrum in the future.

I think the first place to look for rules to govern the future is what's worked in the past.

What have characterized the Commission's big successes?

What practices have been associated with, shall we say, less successful outcomes?

And I identified, just sort of as a thinking tool, three areas where I'd say the Commission had great success.

One would be cellular flexibility, another would be the competitive cellular industry, and a third would be something that I think we've heard in all the panels here this morning, the unlicensed Part 15 devices operating in the ISM bands.

In the case of cellular flexibility, my recollection is that this was primarily at the Commission's own motion that the staffers, I guess in what's now the wireless bureau, said, gee, we can control interference by relatively broad constraints on out-of-band energy and interference at the boundaries of these cellular license regions, and we should give the cellular operators some flexibility when they don't create interference.

And my recollection is there was industry opposition. The Chairman is nodding, and probably was involved in that back then.

Yet, today, we heard John Stanton's strong support for that flexibility and how important it had been to them.

We also, if you look at the ITU standardization for third generation cellular, we see that the key proposals are around the CDMA technology.

But if we had not had digital cellular flexibility in the cellular industry, I believe the industry would have coalesced around the first digital technology developed, the standard regulatory scheme would have coalesced around that, and the world would be denied the proven CDMA technology at this time, which seems to be carrying the day.

There are also examples where the policy adopted by the FCC was less successful. I list those in my prepared comments.

I think in each of those particular examples of less successful elements, it was a situation where the FCC substituted its judgment for judgments that could have been left to the marketplace.

Certainly in one case, in the SMR industry, the FCC was able to respond to the pressures from the industry to permit the transition to a more efficient industry structure and more efficient licensing regime, but it did delay service.

So I guess my first observation is that unleashing markets works.

The successful cases were examples where the

Commission put in place rules that let a market work. But markets need rules. They don't happen automatically.

In some cases, such as the auctions, he market's rules have to be carefully designed to make sure they'll work well.

In other cases, Part 15 is the one that comes to mind. The FCC set rules that permitted a market to work and then got out of the way.

I think we just heard from Mr. Hendricks here, if you didn't have rules on things like the maximum power in the ISM band, probably everybody would be saying, well, ours will work a little bit better. We'll just make it a little bit stronger and pretty soon you'd have a power war, and you'd be able not only to use your wireless phone for calling, but you could just put it in a box and heat your meatloaf with it.

(Laughter.)

MR. JACKSON: So I've been observing spectrum management now for the better part of the last three decades.

When I started, I didn't have much grey hair, and neither did Dale.

I think one of the biggest changes is that there's a greater recognition today than there was 30 years ago, that spectrum management is fundamentally an economic problem, but an economic problem with unique technical constraints.

I think Tom Sugrue's parable this morning is something you wouldn't have heard in the Commission meeting room 20 years ago, as an explanation of what we're doing today.

It might have been offered by some academic economist as a lesson to what the Commission should be doing.

And I think also it's not the case that the Commission or our society always had this understanding. I think part of it is, if you look at the history of how the Communications Act came into being, the first concerns about radio regulation regarded military use, safety of life at sea, broadcasting.

There were only a few megahertz of spectrum that could be used at the time of the '27 Act or the '34 Act, and the radio waves in that area had very long propagation, hundreds of miles, tens of thousands of miles in that situation, and again, as I said, dumb radios and dumb receivers.

The regulatory regime was quite different than it is today.

So considering that both the technology, the area of the spectrum that's being used have changed, let me just make some specific recommendations.

My first recommendation would be to continue on the path that the Commission has followed; combine the practical experience of your staff with theoretical insights from academics and others.

And if you find a proposed reform supported both by your academic theorists and you experienced spectrum managers, it's pretty likely to be a good bet.

If they disagree, you should step back and see if you can understand why there's a disagreement and maybe force them to sit in long meetings until they can resolve it.

(Laughter.)

MR. JACKSON: Second, consider using combinatorial auctions. Combinatorial auctions are auctions at which the bidder and bid for a package of units being auctioned rather than merely posting bids for each individual package.

Combinatorial auctions offer a good opportunity to create efficient initial markets, for example, for defining the geographic extent of licenses, so that a person who wants to, say, offer service in both North and South Dakota doesn't enter an auction where they might win one or the other, but not both, but they have to bid against people who may want one or the other.

And finally, I guess this recommendation is more likely to be controversial. I think the Commission should follow the process it has followed for decades, of making radio licenses more like property rights.

Section 301 of the Communication Act explicitly prohibits the ownership of radio frequencies or the creation of any right beyond those explicitly granted in the license.

That section also speaks of expectation of renewal, whatever that means.

Over decades of practice, the Commission, licensees and Congress have reinvented many of the efficiency-serving aspects of traditional real property law.

I think the clearest example of that is that people can buy and sell radio licenses. You don't envision somebody buying and selling their driver's license. That doesn't make sense.

But a radio license is more like real property and it makes sense to allow it to be exchanged.

Renewal expectancy or cellular flexibility, the process of microwave coordination, those are all other examples of where the Commission and its licensees and sometimes Congress will work together to put in place rules more like commonlaw property law, and I think the Commission should systematically consider how to extend this process, even to the extent of asking Congress to amend Section 301 to explicitly permit the creation of rights with an indefinite term.

Finally, we were also asked to address new technologies and I'd just like to echo what Mr. Hendricks said about smart radios, radios that have the ability to incorporate inside them some of the rules for frequency management, like automatically searching out vacant channels, retransmitting when a packet is received in error.

And I think that that's a fairly profound new technology which we're just beginning to exploit, and it will become more important in the future.

I'm also much less optimistic than some about the ability of new or improved modulation schemes, such as spread spectrum to reduce the need for traditional spectrum management or the appeal of such things as property rights and exclusive licenses for the efficient use of that service.

Again, thank you for the opportunity to appear here today.

CHAIRMAN KENNARD: Thank you, Chuck.

Mr. Kontson?

STATEMENT OF KALLE KONTSON, VICE PRESIDENT AND DIVISION MANAGER, IIT RESEARCH INSTITUTE

MR. KONTSON: Good afternoon. Thank you for the opportunity to address the Commission.

I'm Kalle Kontson with the IIT Research Institute.

I've had the privilege of working in spectrum management with both the Department of Defense and the commercial sectors, during some very recent, exciting and interesting times.

While I'm not here to represent the DoD, I would like to describe the DoD's pursuits to illustrate new approaches to spectrum management.

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To begin, I propose that a new approach to spectrum management is necessitated by three dominant trends. One is an explosive demand for spectrum in both the Department of Defense and the commercial sector.

Second, wireless technology advances that bring vast power and flexibility, as we've heard described here, but also stress the existing rules.

Third, a regulatory structure that can't change fast enough and thereby threatens to become an obstacle to new technologies.

A key thrust in the DoD vision of the future is leveraging information age technological advances, especially commercial off-the-shelf products and services to achieve what they call information dominance.

The goal is seamless interoperable and instantly responsive information grids for the war fighters.

To support this goal, access to the RF spectrum resource must become more agile and adaptive and efficient than it is today.

Unfortunately, current spectrum management regulations cannot support the adaptive, agile, emerging systems without constraining their time to market or their performance.

To bridge this gap, new approaches are needed to address the market forces, the technology and the regulation of the spectrum.

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To begin, we should seek opportunities to leverage the evolving worldwide information grid for the advantage of all users, including the DoD.

There is already a push towards commercial off-the-shelf systems and services in the DoD. But spectrum management policy should also approach the federal government as a valuable customer. As a key player in the high tech research and development arena, the DoD can play a significant role in expanding spectrum access technology.

The development of a universal spectrum access technology can help achieve interoperability, and that is a key goal for all of us.

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(Slide.)

I think it's the promise of new technology that's really driving this train, the new generation of advanced, smart radio technologies in both the DoD and wireless market will be software reprogrammable and frequency agile, demand adaptive to meet growing information transfer requirements.

The efficiency and spectrum access for these bandwidth intensive wireless systems can be optimized to adaptive shared access in all domains, the time domains, space domains, and frequency domains.

The multi-mode, multifunctional radio will contain the rule sets that will allow the radio to sufficiently manage access to broad ranges of spectrum.

I believe what we are facing here is the evolution of a new frequency management discipline. Simply put, it is the art of teaching smart radios how to be behave in their operating environments so that they can be demand adaptive and still coexist with their wireless brethren.

In this spectrum management world, the emphasis on licensing will and should diminish, but the role of type acceptance or certification in military parlance will expand to cover quality assurance of embedded algorithms, embedded software, and embedded databases.

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What I am suggesting here is to allow the technology to have sufficient free play to realize maximum efficiency in spectrum use. To do this, the current regulatory policy notions of exclusive spectrum ownership, I'm sorry to disagree, must be replaced by a view of open shared access managed by embedded technology accountability for spectrum use based on information capacity utilized, not fixed assignments, and an access protocol that we need to trust and develop to access by digitized access codes internal to the radio, rather than long-term licensing.

And I know this concept departs from the band-delineated allocations and licenses that are right now the cornerstone of our current regulatory framework, but we should step back and take a critical view of that framework.

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(Slide.)

So how do we get there from here?

The changes I've described are pretty radical. It is going to be hard to do. But I do have a suggestion.

To start, we should first adopt a guiding principle, the United States regulators should address RF spectrum access issues in the role of a leader and an innovator, not just a broker of RF spectrum property rights.

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(Slide.)

Once we've adopted that guiding principle, we should also work on developing a national spectrum strategy.

Within the DoD and industry, as well, changes have already begun to accommodate the advanced communications systems.

We've heard those described. The FCC has taken some significant steps to streamline regulations, to adapt new technologies in response to very sound opportunities.

But there's much more to do if the policy and regulatory decisionmakers do not want to become an impediment to the newest wireless technology.

I believe the FCC, the NTIA and the DoD should assume a leadership role by pressing for and supporting the development of a national spectrum strategy.

The national spectrum strategy must recognize a regulatory technological public interest and market forces driving changes in the use of the RF spectrum.

We should promote the development of win/win strategies and policies where shared access to the RF spectrum will benefit industry from a national and international interoperability and assure efficient economy in the wireless grid.

Thank you.

CHAIRMAN KENNARD: Thank you.
Mr. Mitola?

STATEMENT OF JOSEPH MITOLA III, CONSULTING SCIENTIST, THE MITRE CORPORATION

MR. MITOLA III: I'm Joe Mitola from the MITRE Corporation on loan to the Defense Department.

I guess Kalle and I have the same attorney because I'm not going to be speaking on behalf of the DoD either.

I do have a unique background in a rapidly emerging global wireless technology, though, called software radios.

In 1991, I coined this term to signal what I foresaw as a shift between digital radios, which have about 80 percent of the capability really embedded in the hardware, and 20 percent in the software, maybe in the audio voice channel vocoder or something like that, to what is becoming now an 80 percent software defined radio.

I don't have any final solutions or even many insightful ideas about how to use this new technology for innovative spectrum management, but I do think it's relevant.

And what I'll try to do is to spend my few minutes just giving you sort of highlights of capabilities and limitations of the technology.

Software radio technology makes it not only possible but also affordable for not just audio but also for really the radio function of the RF modulation band, is it TDMA or CDMA?

This can all be under software control.

In addition, the software radio is a multiband, multimode radio and one designed to operate at a gigahertz, and can also operate pretty well at 500 megahertz, and a 2 gigahertz, just under software control.

This is a significant new technology. The way that this happens is that wide band analog-to-digital and digital-to-analog converters are increasing in data rates so their function can move towards the antenna.

As a result, the functions can be embedded in digital signal processing. This includes application-specific integrated circuits, ESP chips, and even pentium computer chips used in your laptops also have a role to play in software radios.

This technology is applicable to most aspects of wireless but it's not a panacea. I teach a radio engineering course, and I'd like to say that I am not a software radio salesman.

If you were trying to build a pager, the analog-to-digital converter and the ESP chip will wipe your battery out in a few hours.

So software radio technology may not be appropriate there. But in handsets, and particularly in infrastructure, it's a technology that's moving out very rapidly on a global scale.

We're in the midst of this transition toward the software radio. Now during this transition, mobile radios are becoming more aware and have more data in them, in the radios about where they are. They're becoming what the Europeans call location aware.

So there are location aware services and location aware radios that are being developed in the U.S. and in Europe, and there is also research in Europe to extend the awareness of the radio to other things including radio etiquettes which are algorithms that raise the radio's competence to autonomously adapt to the local circumstances.

This is a lot like playing chess and in fact, software now is competent at playing chess. And so if you take that basic technology and put it into a radio, what you get is a radio that has an embedded model of its own user of the network of radio propagation and a little bit about the world around them.

And these radios are called cognitive radios. Cognitive radios would use these internal models to dynamically adapt their etiquettes to the local conditions.

So the use of the radio spectrum then could be gracefully adapted to the time, place, and context of use.

Let me give you an example. According to CNN, on

March of '98, at Baylor University Medical Center in Dallas, they lost their heart monitors because Channel 9 initiated its new, high-definition TV service and it jammed the heart monitor telemetry system.

This could have actually been pay-pause, I don't know, but CNN blamed it on the HDTV.

A cognitive heart monitor would have recognized the presence of this high powered jamming signal and probed the band within backup modes, many different layers of backup modes for clear channels in the local radio spectrum.

And after the few milliseconds needed to reestablish the communications to protect the patients, these future cognitive heart monitors could have also advised the medical establishment that there was a spectrum problem and also even sent an order wire on the order wire channel to the FCC telling you guys that there was this issue or updating your dynamic database if you should come to have a spectrum use database.

Other cognitive radios would recognize these temporarily usurped frequencies, again advising the spectrum managers of local conditions.

Now since these are medical priorities, there would be sort of a deference or priority relationship. This is new technology and there could be a domino effect which would have what mathematicians call a combinatoric explosion and it can create problems. It's a research area, but it's an emerging technology.

Software radios also have the problems, just to cover the downside, of viruses and of crashing, like any other software, which means that this Commission will get to engage more and more in that kind of thing in the future.

But the software radios would have the flexibility to adapt and the cognitive radios would have actually the data built into them to know how to adapt in a polite way.

Cognitive radio may not become practical.

In conclusion, let me just say that cognitive radio may not become practical for another few years, maybe even ten years, but that's the direction that I think we're headed.

And as software radios transition to cognitive radios, there's a lot of room and innovation in spectrum management, polite backoff, autonomous reporting to spectrum management authorities, data rate agility, secure downloads of radio personalities.

This is just the tip of the iceberg. I think there are a lot of risks involved, of course, but the possibilities are really exciting.

And I thank you again for the opportunity to speak to you.

CHAIRMAN KENNARD: Thank you for being here.

Professor Noam?

STATEMENT OF ELI NOAM, PROFESSOR OF FINANCE AND ECONOMICS, COLUMBIA UNIVERSITY

MR. NOAM: Thank you very much, Mr. Chairman. Thank you for the opportunity to be here. I'm a professor at the Columbia Business School. I'm also the Director of the Columbia Institute for Teleinformation and I do not represent the official views of Columbia University.

I'm very happy for the opportunity to talk to you about the future you said of the spectrum to the FCC.

The FCC is an important agency. It's even got a real grownup building now. Hundreds of lawyers and consultants owe their living to the FCC, billions of business dollars are invested in pieces of paper issued by the FCC, and therefore it's perhaps useful to understand the very shaky foundation on which this whole edifice rests and how fragile it is.

Simply put, the FCC exists largely only because of a relatively straightforward problem of physics and engineering.

The physics problem is that two electromagnetic waves of the same number of oscillations that are harmonic multiples of each other can cancel or magnify each other.

The engineering problem was that we could not do anything about it.

Therefore, we created, after some experimentation with self-regulation, a governmental frequency traffic cop, the FCC.

I'd like to venture and say that without the engineers failing to solve this problem, there would be no FCC in existence today.

Most people in this room might have a different job.

The telecoms issue -- no offense, I speak as a former public service commissioner for New York -- could have been just as well or more or less just as well dealt with by a combination of state commissions, federal courts, antitrust agencies, and federal legislation.

Nobody is indispensable.

It seems like MCI, Execunet, the ATT divestiture of local competition and the Internet were not exactly initiatives of the FCC.

I leave it to the White House Press Office to find those deserving credit.

(Laughter.)

MR. NOAM: Without the frequency issue, there would be no reason for licensing, policing, mandating, and defining anything.

Now at first the FCC proceeded in its frequency function by an administrative process of allocation, that is, through lawyers and lobbyists.

When this bogged down with the increasing value of the slices of the spectrum rainbow, the initiative shifted to economists and to simulations of market mechanisms.

They conceived the notion of spectrum allocation which was, at first, a heresy, then it was embraced as a revenue bonanza, and which has then advanced to the status of a religious belief with its own high priests like the Ayatollah, Tom Hazlett over there.

(Laughter.)

MR. NOAM: I'm very glad to hear over this proceeding here a real change in Tom with the passing of the self-congratulatory tome, there is now a willingness, and I hear this with the other witnesses and with you and the questions to go forward to the next step, which is very good.

Auctions are -- don't get me wrong -- a much better system than its wasteful predecessors, but they're not the end of history.

Suppose the engineers would solve their little problem of keeping frequencies from colliding by designing ways in which numerous users could coexist on a spectrum band without anyone needing exclusivity on a specific frequency.

What then would be the need for an FCC?

Or to take it still one important step further, what would then be the legal right for an FCC to regulate spectrum at all?

Ask the question, by what right does the FCC allocate frequencies if there's no interference?

The argument is simple; I've made it for years. Electronic speech is speech protected by the First Amendment. The state my abridge it only in pursuance of a compelling state interest and through the least restrictive means.

A license is a serious restriction on the speech of those who get the license. It is one thing to be a traffic cop, but it's quite another to assert ownership rights that can then be sold to private parties.

Could the government sell the rights to the color red? To the frequency high A flat?

The fact that allocating something is good public policy -- and in this case it is -- doesn't mean that you can do it.

Suppose the government auctioned off the right to print books in order to protect natural forests, trees?

Imagine that this would also partly be driven by the revenue needs of the state?

Now part of the problem that I see is that many people are prisoners of the analogy of spectrum for real estate. Once you accept that analogy, you inevitably are pushed to a form of exclusivity.

A much better analogy in my mind would be the high seas, ships navigate and avoid colliding into each other even if they're insured, they'll find various ways to their destinations, pay tolls at lochs and canals, all without a real need for exclusive shipping licenses for a route or a lane.

Suppose, as I said, we could design a technology to keep transmission from interfering with each other, spread spectrum technology.

We've heard this now several times. CDMAs, software-defined radio, electronic antennas provided early generation of tools that make it possible for many users to share bands.

In such a system, no licenses would be required.

Now I should mention that if everybody were to do that, there might emerge another problem, that of excess demand or congestion. That would be similar to the congestion problem on the Internet and could be solved in a similar way as recommended for the Internet, namely, by congestion prices on the users.

In the future, we can imagine many users sending out packets of information that get transmitted on an ultra-wide CD MA-type band, not an exclusive slice of the frequency.

Those packets would perhaps also carry their own tokens of electronic money with them, paying tolls with those E-money tokens in order to use the band or be carried on a network, and the prices for these tokens may depend on traffic congestion.

Now what are the policy implications? Experimentation of spectrum usage should be encouraged. The FCC's ISM, UPSC, and UNII bands are steps in the right directions, but these are fairly little slices with big restrictions on power and usage.

A more significant step would be in fact to encourage much more spectrum mining by users. The FCC should help establish technical standards directly or through industry groups to access the many other spectrum bands by users who do not interfere with each other and with preexisting primary and secondary users.

In other words, permit a third category of users who can skip around the bands, listen, find a frequency that isn't actively used at that moment, transmit briefly, listen again, transmit again, until another user shows up, including the license holder or the secondary licensee who have priority.

Now you can start with a few bands to see how it works, encourage the technology to experiment with methods of self-management by the band users themselves.

These bands need to be big enough and the transmission power strong enough to make them commercially viable.

To conclude, such a system would encourage innovation and technology and efficiency in usage. It would lower the entry barriers to new entrants and encourage competition.

It would benefit especially rural areas because there are likely to be large stretches of fallow spectrum in those regions.

It would end the absurd restrictions against foreign entry into spectrum usage.

And most importantly, it would constitutionally be more defensible for if you keep prohibiting people from using spectrum, even where they do not interfere with each other, sooner or later, one of them will make the constitutional free speech least-restrictive-means argument and may well win.

And when that happens, the entire foundation for an FCC will start to crumble.

Thank you.

CHAIRMAN KENNARD: Thank you, Eli. Appreciate that.

Mr. Petroff?

STATEMENT OF RALPH PETROFF, PRESIDENT & CHIEF EXECUTIVE OFFICER, TIME DOMAIN CORPORATION

MR. PETROFF: Thank you for inviting me, Mr. Chairman and Commissioners.

My name is Ralph Petroff, President and Chief Executive Officer of Time Domain.

I would like to take my five minutes to discuss how spectrum and its policy needs to be more responsive to important new technologies, especially new technologies that were never anticipated when the rules were written.

Our small business, like Dwayne's and many others, are companies that have invested tens of millions of dollars in developing all sorts of novel wireless technologies.

I'd like to describe one of these technologies that you've heard a little bit about today. It's called ultra wide band, or increasingly ultra broadband wireless.

This is a very, very different type of radio. This morning, Dale Hatfield showed us how radio has all these continuous waves. This is a technology without continuous waves. It sends out a little pop about the height of this pencil and then the signal evaporates, and right about where that Exit sign is, the next pop comes out.

Now if that next pop comes out a few trillionths of a second earlier, it's a one, a few trillionths of a second later, it's a zero.

Right now, we have got this technology popping along at 40 million of these little pops per second, so that's a lot of megabits to be sending a lot of zeros and ones.

We believe in the near future, we'll be able to push that past a hundred megabits and our engineers are even challenging themselves to try and reach that gigabit level.

You've heard a lot of talk today.

Let me give you, I think, the best news of the day. The best news of the day is that this can all be accomplished on an ultra low power basis. Instead of sending out all these pops and pulses at half a watt, instead we can do this at 50 millionths of a watt. And 50 millionths of a watt fits into well under Part 15.

As the name ultra broadband or ultra wide band connotes, you have a tiny bit of energy spread out over several gigahertz of spectrum so it's a little bit of power and at any particular point on the spectrum, you are looking at only a few quadrillionths of a watt of energy.

So it is like ultra spread spectrum and it can share spectrum with other users to an unprecedented degree.

It offers potentially several orders of magnitude improvement on things like not just wireless communication but also radar and positioning as well. And in volume, we believe it can be unusually inexpensive.

And rather than consuming spectrum, this is a device that can effectively create new spectrum in the sense of being able to use that Part 15 for high speed wireless connections.

Sort of like talking about the Portals this morning, this is like finding another five basement decks below the Portals so you have plenty more room to park cars.

These entire capabilities can greatly increase the quality of life for American consumers and especially in the area of public safety and for the disadvantaged.

Let me just give you a few examples.

See-through walls radar that police can use before they knock down a door so they can know who is on the other side.

Covert communicators that cannot be detected.

Devices that can be detected in rubble from earthquakes or bombings.

Smarter airbags that can have variable

deployment.

Seeing-eye wireless for the visually impaired.

And radar that can see underground to find cracks in bridges or buried conduits, or even plastic land mines.

And especially ultra high band width and ultra high capacity short-range wireless networks for schools, homes, and rural areas.

These are just a few of the many benefits that can potentially exist.

Let me give you sort of maybe the worst news of the day. That is that none of these applications can be brought to the public under the present regulatory framework.

Although this technology clearly meets the intent of the rules and the intent of Part 15, it doesn't meet the absolute letter.

Telecom product lifecycles are getting shorter and shorter. Everything is getting developed at Internet time.

If the regulatory process cannot move at Internet time, the new technology will wither and die, and a multi-year rulemaking process becomes a de facto kiss of death for innovation and for small companies.

There are two dozen small companies now trying to bring the products that I've described to market, and they increasingly face three choices.

First, to abandon their efforts and some have.

Second, to ignore the rules, and some have done that.

And third, they will go overseas.

I don't think any of these serve the public interest so what specific constructive steps can we take first to give two new technologies that were not anticipated a way to be test-driven in the real world?

Second, the great and appropriate vehicle for this is to use Part 15 where billions of device already cohabitate with each other.

And third, empower the technical experts at the FCC to be the final say on spectrum issues. They've got the expertise, instincts and market knowledge to make wise decisions as we go forward in these uncharted waters.

The genie is out of the bottle on this ultra wide band, and worldwide attention is now being paid to this technology.

EPSI has started the standards process already and soon somewhere, someone is going to be deploying this remarkable new technology.

Let that be here where it belongs, and by those who invented it.

Thank you.

CHAIRMAN KENNARD: Thank you very much.

In the interests of time, I'm going to limit my questioning to just really one question and a couple comments.

First of all, I really enjoyed Professor Noam's presentation today. I've been told by our enforcement people and our Compliance and Information Bureau that there is a pirate radio station operating somewhere in and around New York City, and after your presentation, Professor Noam, I was wondering if you know something about that?

(Laughter.)

CHAIRMAN KENNARD: Don't answer that question.

(Laughter.)

CHAIRMAN KENNARD: I'll ask my question, and then I have a comment for Mr. Hazlett.

This has been a great panel and I really think that we've achieved our goal of really doing some forward-looking thinking and trying to anticipate what is ahead.

I, for one, feel very confident that we are moving into a future where more intelligence is going to migrate into the receivers, into the transmitters, to the edge of the network, if you will, and that will solve some of our shared use problems.

The question that I have though is a very practical one. How do we make the transition.

I'm going to ask you, whoever would like to volunteer to answer this question, can you give us some very sort of practical steps in how we can migrate our processes and our rules to accommodate this technology?

Obviously we can't flash cut this overnight, we've got to do this over a period of time, hopefully a short period of time. But I'd like your thoughts on that.

And while you're thinking about that, I did want to quibble with one thing, not that Professor Hazlett but what he wrote.

Last week, there was a very interesting editorial that Professor Hazlett wrote in the Wall Street Journal. And it was about cable television regulations and it was really sort of an obituary to cable television regulation or at least a portion of it.

I read it and I actually found myself agreeing with some of what you said, until I got to the very end when you called for the end of the FCC's high definition television mandate to allow broadcasters to provide unlimited digital TV signals, thus permitting U.S. households to enjoy 50 or more over-the-air TV channels.

When I read that I thought about perhaps writing a little letter of correction to the Wall Street Journal, but since I knew you were going to be here this week, I just wanted to point out to you that the FCC does not have a mandate for HDTV and never has.

And so broadcasters today are free to do multicasting on their digital spectrum.

Would anybody like to address the question that I posed about the transition period?

Eli?

MR. NOAM: I think you should open up considerably more spectrum bands to unlicensed usage, and at the same time, convene or help the industry help some standards for the users of those unlicensed uses on conditions that they do not interfere with the primary and secondary users that are present.

MR. HENDRICKS: I think the approach should be that the new players in the technology should bear the burden of dealing with the incumbents.

What I would like to see you do is to take a wide swath of spectrum, say below 3 gigahertz, and sort of like reform it by letting the smart radios run around in there, sort of think about it like an open range, okay.

That means operating over existing services so essentially come up with a definition of what you're going to allow to go into the open range, and then let them go out and do it.

And if it works, then expand upon that.

MR. KONTSON: I actually have two suggestions.

One is building on what was suggested I think by Mr. Kennedy earlier, and that is this board, the spectrum management board idea.

But I would expand that idea to include all the user communities including the government and maybe international community and then telecommunications lawyers and regulators and engineers, I mean, the real hard core engineers.

Put them in a room, lock them up, and if they do come out, see what they come out with, with a charter of addressing the transition period.

The other thing I think we ought to seriously consider doing is viewing ourselves in that leadership and innovator role by leveraging some of the resources we have combined with the DoD and other parts of the federal government as well as industry and conduct what the DoD calls advanced technology demonstrations.

There's nothing better to make people comfortable with being able to tolerate levels of interference that must be tolerated with this sort of wide open, freewheeling environment, nothing better than showing it works.

And I think the U.S. ought to look at themselves, as perhaps taking some of the money we've earned off of auctions, and starting an IR&D program.

I think that's what industry does, and I don't think it's a bad idea for us to do that too.

CHAIRMAN KENNARD: Thank you.

Chuck?

MR. JACKSON: I'd just like to raise a caveat. You know, the kind of model posited by Professor Noam may not work all the time.

Certainly on the high seas, we have rules of the road. If two oil tankers ram into each other, they both sink, but obviously a wooden yacht doesn't hold up very well when one has to collide with a modern supercarrier.

There are applications, such as broadcasting, where the transmitter's on 24 hours a day on a single channel, and it doesn't make sense to say, well, we'll let channel 5, when it goes on, search around for a vacant channel. It's there all the time.

For things like local area data networks, Internet access, maybe some kind of voice communications, garage door openers, car door openers, that model does make sense. So I think we have to be careful before we get too carried away with any single approach.

I also observe that there is a moderate amount of spectrum available for unlicensed use, 902 to 928, 2400 to something like 2450, and the new NII band which I think, as I recall it's about 300 megahertz, which is a fair amount of spectrum.

And so until we start seeing crowding in those bands, maybe it's a little premature to start asking these questions of how do we make even more spectrum available. Three hundred megahertz is a lot.

I think there is a problem with the ultra wide band technologies, which don't even fit well into the 300 megahertz, and I think there's an area where one must think about transition policies in a different fashion than for some of the more traditional things.

I also observe that, you know, we have CDMA working today in wireless telephony, but it wasn't easy to get it working that way. It had all kinds of weird problems, some of which were not widely publicized by the participants in the industry.

And I think you will find those kinds of complicated problems with instability and system crashes will occur with a lot of these distributed control systems that Professor Noam is advocating.

So we might want to go slowly.

MR. MITOLA III: I'd like to add to that. I support Mr. Hendricks' idea of trying to find a band to open up in which to use innovative spectrum management.

I think if you had a public process that solicited inputs from developers and suppliers and people with novel radios like Time Domain, that you'd get some interesting inputs and also that would help the steps to be better advised.

But in addition, I'd say that you've got to have some scientific and technical underpinnings for such an enterprise because, you know, one chess game has 64 squares on the board and a couple of dozen pieces, and there are ten to the 120th moves in a chess game.

So if you started when time began, you still wouldn't have finished evaluating all the possible moves on a chessboard.

Well, the game that we're talking about here is much more complicated than a chessboard. So in order to avoid system crashes and instabilities, you're going to have to have, I think, a measurement and analysis campaign along the way so that your decisions are based on some good science.

That would be my input.

CHAIRMAN KENNARD: Thank you very much.

Commissioner Ness?

COMMISSIONER NESS: Mr. Hazlett, you talked about the tragedy of the commons. How many others on the panel believe that there is a tragedy of the commons present today?

Anybody want to comment on that?

Mr. Hendricks?

MR. HENDRICKS: What I find is that people throw that up, but there isn't the science necessarily around to back it up.

People haven't really gone out and made measurements to determine whether or not that's really true. I know I've made measurements in the San Francisco Bay Area on the unlicensed bands, and I found it to be quite reasonable to be able to go out and deploy new systems.

In fact, I've been able to deploy unlicensed systems in the 902-928 band where Metrocom is predominant and deployed them within a quarter of a mile grid, and still I'm able to deploy unlicensed systems that cover like 20-mile ranges in the Bay Area, which is a pretty dense environment there, in terms of having a lot of intentional radiators in those bands.

COMMISSIONER NESS: If we were to look at providing greater property rights for licensed spectrum, would that preclude the ability to later overlay sharing opportunities or overlay, for example, some of the new technologies that we're talking about here, the pops that are going across many gigahertz of spectrum?

Or would that cause problems for satellite delivery of telecommunications?

Mr. Hazlett, would you like to respond to that?

MR. HAZLETT: Sure, thank you.

I would say just the reverse. It would encourage sharing. That is, as soon as the flexibility is granted the licensee, that licensee is going to become a dedicated missionary with respect to seeing how to increase traffic over the allocated bandwidth, and so you're going to get a lot of innovations in terms of what kinds of services can be provided.

You know, thinking about this transition which obviously is where it comes down to, I mean, you can start with flexibility for current licensees but I think you want to move quickly, as quickly as possible towards opening up a process in which new overlay rights can in fact be created.

And so that would promote the sharing to allow that flexibility.

COMMISSIONER NESS: In other words, if you're using a spectrum for a particular purpose, would Mr. Petroff have to enter into an agreement with you in order to be able to have, I forget the pops going all over the place, in order to be able to use those types of services?

MR. HAZLETT: There would have to be coordination of some sort. The fact that we've avoided a tragedy of the commons is testimony to the fact that we have coordinated well, so that is not a huge problem, as long as there are clearly-delineated rules as to who should be primary and who subordinate.

COMMISSIONER NESS: But you would not be entitled
to receive compensation for those pops traversing your

spectrum?

MR. HAZLETT: It depends on what the rule is. Certainly if there's a broad right established for the first or primary user of the radio wave, then in fact there would be compensation. That's the way that contract would work.

If in fact, it's carved out differently, you know, and some low-powered use goes to some other licensee, then in fact the money would flow the other way.

COMMISSIONER NESS: Would anyone else like to comment on that?

MR. NOAM: I think you should let licensees resell quite flexibly their spectrum for lots of uses, but I would warn against kind of an absolute fee simple all the way up into the sky.

I mean, just imagine real estate rights, real property rights that would go out to 25 miles high up, and every airline would have to contract with a landowner about overflight rights.

I think this is the situation that some of these companies would face.

MR. PETROFF: And let's remember one other thing too. If you're talking about operating in the Part 15 range, there are right now billions of devices like this little timer I'm holding here that is a Part 15 device that gives off emissions.

These folks aren't being charged right now, and I think it would stifle innovation if they were.

To follow up on a point that you were asking about, Mr. Chairman, the most important thing I think we can do in Part 15 is to reevaluate the interference criteria.

Right now the interference criteria, part of it is a judgment of how much power you emit at what levels at what distance, which makes a lot of sense. But there's another component to it. That is the intent clause.

Right now, signals are governed by intent. You have intentional signals and unintentional signals, and I think the rule should be, if it interferes, it interferes, and if it doesn't, it doesn't.

Intent may be important in a murder trial but I think that the signal should be graded on interference, and that would do a whole lot to stimulate innovation in this area.

COMMISSIONER NESS: We also have heard from the previous panels about the importance of trying to achieve some global unanimity as far as spectrum use is concerned.

Would anyone like to comment on the advisability of doing that or the inadvisability of doing that?

MR. HATFIELD: Could I just add here, we've heard almost conflicting advise that we need to align with the rest of the world, and yet we're hearing from this panel, with these sort of software defined radios, it may in fact be possible for the radio to reconfigure itself, depending upon its location.

That seems a little bit in conflict and I would be curious to get a reaction to that.

MR. JACKSON: I'll expand a little on that if I can.

One, we have seen the development, at some additional cost, of radios that can operate on multiple bands. I believe today you can buy a GSM phone that will work here in Washington, D.C. on the Sprint Spectrum system, and then you take it to Europe, and it'll work on the GSM-900 over there.

If we'd had to wait in this country until Europe had standardized on a single cellular band, cellular would have been delayed another ten years.

They developed a standard, digital standard for their second generation cellular, which was different from our cellular and was in a different band and became commercially available just about a decade later than our cellular system.

And if we had waited for harmonization, it would have been terribly expensive for our society.

Conversely, if we know in advance that we can get harmonization, it's very, very beneficial.

I think that we will be able to have radios that operate over wider ranges and with more flexibility, whether quite as much as suggested earlier, I'm a little pessimistic.

But I think, as a general principle, that will be the case, so that the lack of international harmonization may be less damaging in the future than it is today.

MR. MITOLA III: Can I just add, it's not a question of doability as much as it is affordability. The military had a technology pathfinder program called Speak Easy, a multi-band, multi-mode software radio for the military, and we demonstrated coverage from 2 megahertz to 2 gigahertz in just three RF bands.

The middle band was something like 400 -- excuse me, 30 megahertz to 400 megahertz. So you can't operate over these bands. It's not as effective at the band edges and it's more expensive.

So these phones that do multiple bands, a dual band cellphone at the cost level, not what you pay for it, but it costs about 25 to 35 percent more for the additional RF chips and other changes than a single band phone.

Once you get to three or four, however, it becomes more cost-effective to have one wide band RF front end, and then do the rest in software than the other way around.

And in fact there are products by companies represented in this room that'll be announced over the next 18 months or so that will be showing this technology in an affordable commercial type form factor.

COMMISSIONER NESS: Have these technologies been vetted with our global partners such as in Europe? They're also looking at the spectrum management issues.

I'm just wondering if anyone has had an opportunity to chat with folks over there and what their reaction is.

MR. MITOLA III: I was the keynote speaker of the first European Workshop on Software Radios in Brussels in '97, and then also a panelist at the First International Conference on Software Radios which was held last year in conjunction with the European Mobile Summit.

And the Europeans, I think, have engaged with and are investing more heavily, just from my kind of informal straw vote, than we are in the U.S.

The big U.S. telcos are looking at the rollout of third generation wireless and saying, for example, Steven Blust of Bell South says maybe this will be around 2003. The Europeans are looking at that happening a couple of years sooner, and it won't be affordable without software radio and technology, so they're much more highly motivated than U.S. manufacturers right now.

But of course, most big U.S. manufacturers are global as well, so they have their global perspectives.

I wouldn't pretend to speak for them, but those are just my data points.

MR. KONTSON: I'd like to make a point about the regulatory aspects of these wide band multi-mode radios.

At first blush, introducing some of these concepts like Speak Easy, I guess you could call it Son of JTRS, which is the joint tactical radio system, from 2 megahertz to 2 gigahertz radio concept.

When you go to introduce it initially in foreign countries, you get this rather shocked reaction, but then, as he points out, you do recognize that it's software reprogrammable and it can be whatever you want it to be.

Therefore it promotes harmonization provided that you know the standards where you're going and you can quality assure that the software that you load into the radio will allow it to behave properly.

So the onus is going to be in the future not so much on frequency licensing and all that negotiating that goes before you're allowed to bring a radio into a country, for instance. The onus is going to be on quality assuring and assuring the host nations, if you will, and the host environments that how you have loaded that radio with its smarts is going to allow it to obey their rules and obey their standards.

That's the way it's going and I think that's where the regulatory emphasis needs to be.

COMMISSIONER NESS: Thank you, Mr. Chairman.

CHAIRMAN KENNARD: Thank you, Commissioner Ness.

Commissioner Furchtgott-Roth?

COMMISSIONER FURCHTGOTT-ROTH: Thank you, Mr. Chairman.

This has certainly been a very stimulating panel. I've learned a lot.

Professor Noam, it's so delightful to have people come here from outside of the beltway and inform us poor Washingtonians of things such as the only reason the FCC exists is because of physicists.

This is such a revolutionary idea in this town in which physicists and other academics are a very distinct minority.

But a lot of what we are talking about on this panel is considered to be futuristic, things that don't exist, but I'm struck and Professor Noam, I think I would have to take exception with the notion that the analogy is either kind of black and white, either land or the seaways.

I think if you look out at the history of mankind, certainly the history of law, and how different societies have developed laws, whether they are laws that apply to the use of land, to the use of the sea, to the use of rivers, to the use of intellectual property, to air rights, to mineral rights, to the intricate discussion of livestock rights in the Bible, these are all issues that have been heavily debated over time, and in which societies have often developed a set of codes, a set of rules that are not uniform.

A set of rules that allow for different types of rights to apply to different types of lands or different areas of the sea, or to different rivers within the same country.

The discussions that are going on here today are a repetition of discussions that have gone on for millennia about how different societies should treat different types of property.

And they have in the past and they will in the future lead to different types of rules that will change over time.

And we are here at this point in a sort of medias res. At this point in time, we have the benefit of knowing what has gone on in the past, and not quite knowing what is going to go on in the future.

We are here to think about what type of rules would be best on a going-forward basis.

I think Chairman Kennard, I think you have hit precisely on the right issue we should be asking these folks.

They have come to us, and we have I think on this panel, I could reduce it to two general types of ideas. One is a highly property-rights oriented that's advocated by Professor Hazlett and Dr. Jackson.

And others that are more of an economic common that's been advocated by some of the other presenters.

I have no doubt that this panel, as illustrious as it is, is not entirely designed to exhaust the many possible options that are out there.

The issue is what can we, as a Commission, do, based on the legal authority we have, to work in and consider other options.

And a lot of this will depend very critically on how we get to where people want to be, given the laws we have, given the rules that this agency has to operate under.

To go outside the laws, folks would have to go ultimately to Congress.

We are bound by the laws that we have under Title III of the Communications Act.

But all of this has been very stimulating and I would urge the panelists to give some very serious thought to the question that Chairman Kennard raised, to get back to us with ideas for transition policies or experiments, if you will, based on the policies that you're advocating, consistent with what we at this Commission can do.

Thank you, Mr. Chairman.

CHAIRMAN KENNARD: Thank you, Commissioner.

Commissioner Tristani?

COMMISSIONER TRISTANI: Mr. Chairman, in the interests of time, I just want to thank the panelists for their very insightful comments, but I will echo what Commissioner Furchtgott-Roth said, and the Chairman. We need help, and we need to create concrete ideas.

We can talk a lot about theory but that doesn't help us in our task.

Thank you.

CHAIRMAN KENNARD: Thank you very much, Commissioner Tristani.

In the interests of time, I also am going to defer my closing statement, but I did want to thank this panel of presenters and also thank Commissioner Ness once again for getting us collectively focused on this issue, and raising some really, really important issues that need more attention at the Agency.

So I commend you for your leadership and your hard work and the work of your Staff in pulling this together.

I also wanted to thank other members of the Staff who were instrumental in pulling this together, in particular, Dale Hatfield, and his fine Staff of folks over there including Julie Knap, Rebecca Doytsch, Bruce Franca, Fred Thomas and Jack Linthicum.

Also OPP was very much involved in this session today, Bob Pepper and of course Evan Corell, the father of option theory at the FCC, the Wireless Bureau, Tom Sugrue, Diane Cornell, the International Bureau, Tom Tycz, Carl Kensinger, and Joe Heaps, and of course, a special note to Dan Connors in Commissioner Ness' office for doing really a lot of the hard work of pulling this together.

Thank you all very much.

Commissioner Ness?

COMMISSIONER NESS: I can also add my thanks to all of the aforementioned players, and just to note that the representatives of OET, the International Bureau, the Wireless Bureau, the Mass Media Bureau and the Office of Plans and Policy have really pulled this together with unprecedented harmony.

And while this has been a delicious opportunity to talk through many of these issues, both past problems and future challenges, the nice thing about these panels is it's raised more questions than it's provided answers, which means that we've got to continually think about where we are going with spectrum policy as we work with our global partners to come up with the most vibrant services for consumers everywhere.

Thank you all very, very much for the participation.

CHAIRMAN KENNARD: Thank you again.

(Whereupon, at 1:25 p.m., Tuesday, April 6, 1999, the hearing was concluded.)

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