The National Academies

Computer Science and Telecommunications Board

Improving Spectrum Management Through Economic or Other Incentives: A Workshop

March 1, 2006

Lecture Room
National Academy of Sciences
2101 Constitution Avenue, N.W.
Washington, D.C.

Proceedings by:

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P R O C E E D I N G S [8:40 a.m.]

Agenda Item: Welcome - Mr. Hatfield

MR. HATFIELD: Welcome back to the second day of the conference, I believe we don't have any logistic announcements, I think thins will run pretty much as we did yesterday. This morning of course we're turning to international perspectives and we're very fortunate to have with us and it's my honor to introduce Hugh Railton. In keeping with practice we introduced yesterday of keeping the introductions rather short, I'm going to follow that again this morning, but I would like to hit a few high points of his career.

He's currently a consultant specializing in telecommunications policy and spectrum management. Most recently until early 2005 he served as deputy executive director of the Asia Pacific Telecommunity where among other things he represented that organization in many international conferences in meetings. Prior to that he served in many important capacities in the government in New Zealand dealing with spectrum management and in the groundbreaking activities that have occurred there including the introduction of auctions and so forth. His last position at the Ministry was as manager of spectrum planning with the responsibility of developing spectrum strategies including the auctions.

So please join with me if you will in welcoming Mr. Hugh Railton.

[Applause.]

Agenda Item: Keynote - Hugh Railton

MR. RAILTON: Chairman Dale Hatfield, thank you very much, adjunct professor University of Colorado. Distinguished guests and experts, ladies and gentlemen, it is indeed an honor today to address you about this very important meeting on a subject which has been a major part of my life work.

A glance at the history books ladies and gentlemen will show that 277 years before Christopher Columbus set sail that the Magna Carta brought down by the Chancellery of King John of England identified the rights and obligations of property holders. Indeed your very own father of modern economics, Smith and his wealth of nations, over 200 years ago amply treated this matter. So why I ask you when property right concept for land and other commodities have been well understood and applied for over 800 years has there been difficulties and issues with theories and their applications for spectrum?

Well, ladies and gentlemen, a barrel of oil is a barrel of oil. You know the size of it, you know the weight of it, you know its wealth making properties. Property owners understand boundary peaks and fences but

the spectrum, well, you can't see it, it doesn't behave itself with respect to manmade laws, it's governing laws are the laws of physics rather then economics or political lines in the sand, so it's difficult, difficult to describe in a legal sense of what is your right. I have a title for my property, making a title for spectrum is difficult.

So is the application of property rights appropriate for the radio frequency spectrum? Fundamental question. I believe it is, that in some segments of the radio frequency spectrum the management is better off being the responsibility of the party to which excess of the spectrum gives the greatest value.

Take the similar radio bands for example, management of interference with these bands by the service provider allows for a dynamic approach to engineering. There are -- [inaudible] -- to my own country where the antennae patent has changed between morning and night to make up for the capacity, drive time, extra capacity needed. Can't apply for a license like that, that people are doing it need to be master of their own destiny, management rights allows people to be masters of their own destiny, property rights.

One of the roads to excellence in spectrum management, like virtually any other activity of mankind, is through competition. Imagine that you want to put a

fixed link between point A and point B. You need a license, you go along to one spectrum manager and he gives you a proposal, but then if you can get another proposal the quality of engineering is driven up and the costs down, fundamental part of competition. And you all know it, have it seen applied to every other field.

So what is needed to bring this about? How do we get there? Let me use the example of my own country, New Zealand. In the early 1980s the New Zealand economy was racing to the back door. In just 30 years we'd managed to move from one of the wealthiest nations per head per population to about 20th on the OECD list. There were many reasons for this, New Zealand is a small country, it did not have the ability to determine its own future economy, we were a pointer(?) in the falling of the European Community and many other things that caused it. But nevertheless our economy was racing to third world status.

The country was amassing huge debt and as I said the economy was sliding backwards. In 1984 the new labor government at the time under the Prime Minister of David Longey(?), upon being reelected to power opened the books and finding the cupboard rather bare decided change was needed. At that stage ladies and gentlemen about 48 percent of the workforce were either directly employed by the government or in government agencies. At that stage

the government owned the New Zealand Post Office, the railways, the airline, the tourist bureau and so on and so on and so on. The government of the day looked at what it owned and decided to undertake a zealous program of government asset sales. The theory was that the revenue from the sale of assets would help alleviate the national debt. It would also bring market forces to the provision of services and the excellence that such forces would bring.

As a first step the government formed state owned enterprise with the government as owner. Each state owned enterprise had a commercial mandate and the body of business law applied to it, they were no longer under the umbrella of protection of government. The SOE was required to provide a dividend to its owner and the government, which was the government which also helped to round the budget.

When the opportunity is right the state sold some of the SOEs and used the money mainly for the national debt. Not all SOEs or state owned enterprises end up being sold, some were too difficult. And in a couple cases, notably in the airline industry and in the railway industry, the whole theory fell flat in the face and the government had to come involved again. It wasn’t a completely wonderful story all the way through but

generally it was. The sale of Telecom New Zealand was quite a success story for example.

But it was in this environment of the need to privatize, to look at the business efficiencies in every sector, that the government officials of the 1980s looked at the opportunities to enhance the value of the radio frequency spectrum to the nation by overcoming the problem of a monopoly supplier, the then New Zealand Post Office. In 1988 the government contracted the NERA, N E R A, Organization of the United Kingdom, to report on what the possibilities were. This was a major turning point and even though history has shown that the issues were rather oversimplified and there's a tendency always for people to oversimplify spectrum management issues that the basic concepts were of great merit even today.

NERA recognized that in order to get a scenario where there was competition in the provision of spectrum there would need to be competing band managers. A property right was needed that described the rights and obligations of an individual associated with managing a frequency band. The spectrum products sold within that band are the licenses, but also required to be in the form of a property right where the owner could make changes and even subdivide or join together with another license to meet their needs. These two forms of property rights, what I call management

rights for the management or frequency band, and license rights for an individual license like a broadcast station or whatever, were the fundamental cornerstone of the New Zealand spectrum sales program.

Just to be really clear here what I call a license, or an administrative license, is a grant of renewal access to spectrum controlled by the government that enables a party, an individual to carry out specific radio communication activities. We've had that, all countries have had that for a long, long time. A spectrum property right is a registered instrument that confers a measure of ownership onto the holder. A property right is a commercial document, it's an asset, it can be bought, it can be sold, it can be mortgaged, it is subject to the whole body of commercial law, it's just like a title for a piece of land.

The NDLA(?) was really a waiver of enthusiasm in a brave new world, in reality it was a lot harder then first thought as I mentioned before, it is a lot harder. Unfortunately the laws of physics did not yield or bend to economics or politics. The NDLA allowed three years for the process of devolving control of the spectrum to private ownership to be completed, history has shown this was well short of the mark. New Zealand did not end up with competing purveyors of spectrum products as was envisaged,

it ended up with a robust sale of bands and of licenses to meet specific corporate needs. Almost universally the purchasers of spectrum were to enable the holder itself to provide a commercial service or to meet the present and future needs. The purchase of spectrum to enable trading as a commodity just did not happen.

Let me bore you with some more history. New Zealand held first the spectrum sale in 1989 for individual licenses within the UHF television bands. The government itself was becoming a private band manager. I remember it well as I hand carried the tender schedule to Auckland from Wellington on Christmas Eve for sky television. Preceding that sale though, ladies and gentlemen, was nearly a year of difficult engineering work with a team creating the license rights of a tender. This was followed by a number of tenders for other broadcasting licenses, the 8900(?) cellular bands and in July 1990 with a wave of enthusiasm a suite of licenses for MDS were sold.

Now in that case ladies and gentlemen we had a group of fledging MDS operators came through the door and said we'd like spectrum to do this service, the government said auction is the story, fair enough, the MDS licenses were sold, they were bought by the broadcasters and by the telecommunications organizations. The MDS operators didn't get enough spectrum to operate a service. After 16 years

the spectrum remained unused and it has now reverted back to administrative licensing. I say that because it's necessary to think about what you're selling and I believe some auctions or sales need to be preconditioned to get the outcome you want, it's pretty important I think.

In a similar matter with a lack of preconditioning and a wave of enthusiasm in 1990 the cellular telephone bands were sold at 8900 migs. But it took some three years of litigation before the bands could be used. Now that could have been easily fixed by saying the object of the government is there shall be two operators, or at least two operators, in the cellular radio bands. One has to really I believe think about the outcome you want out of this, it's no good just leaving it to the market, it doesn't always work.

The government tried very hard, and Bruce will disagree with me here, not to turn the tender process into a money raising venture. The aim was to place spectrum products in the hands of those who most valued them. Initially the tenders were second price sealed tender, that's where the winner paid the amount quoted by the second highest bidder. This caused huge distortions in the market and eventually was replaced by the normal tender procedure where the highest bidder is the winner at the bid price. But it took a few years.

In 1996 auctions were introduced using the format that I believe was developed by the FCC and indeed it has proved to be an extremely robust method of moving spectrum into the private sector. This process removed a lot of distortions to typify the tender approach.

So ladies and gentlemen after 16 years of work of creating and selling property rights the spectrum that has been defined as property rights and devolved to the market is mainly cellular telephone, including the INT 2000 bands, broadcasting, AM, FM, old television, and associated services like two gigs that were caught up in the INT 2000 sales. To clear the spectrum for INT 2000 we had to move something like 2,000 fixed services that involved incumbency rights and the like, it was a big exercise. The majority of the spectrum though today still remains under an administrative regime by government.

The evolution of spectrum management in New Zealand reinforces my view that the creation and sale of spectrum products, even though the process is difficult, is a vital part of stimulating usage and commitment to the provision of services to a nation. The certainty of access brought about by ownership underpins large expenditure and is often needed to develop the necessary infrastructure. That is not easy and it requires lawyers, marketing experts, policy advisors, engineers, working closely

together to create spectrum products that are attractive and of high market value.

But not all of the spectrum can be handled this way, the huge diversity of applications that use radio frequency spectrum, from garage door openers to HF(?) forecasting, means that there's no universal or optimum solution for every band and service. Just like real estate many forms of rights are needed. There are many applications of radio frequency spectrum that required shared access and a dominant party would be inappropriate. The rights of access vary from exclusive to unlimited access in like the public pack, from the private property to walking in the pack.

What I believe is needed is an overall spectrum strategy where the various levels of access are managed in the best way for the users of any particular band and in this context a definition of spectrum products in the form of property rights is one of the most powerful tools in the arsenal. Even though the requirement for exclusive access would suggest spectrum sale, this is not always the case. Take air traffic control for example, or the military, shared bands would suggest management by administrative processes and also public packs. Bands with large international obligations, for example the unplanned FSS(?) bands, are possibly best still treated under administrative

regime where the state has some flexibility to move and to reach accord under its international obligations to other states.

We should not lose sight of the need to provide bands that the many non-commercial or low revenue applications need like radio communications for utilities and for scientific and other experimentation like the amateur service or aspiring engineers, things like the earth's exploration satellite service and deep space, etc., they all need spectrum. And it's necessary that management rights or property rights are appropriate in this case, the appropriate form of management is required.

Though in New Zealand, ladies and gentlemen, we have a special license called a license to receive no interference. Now that could well be an applicable form for some services, for example deep space where you put an exclusion zone around a particular area and give them the legal clout to be able to do something about it. What you're doing there, ladies and gentlemen, is you're externalizing the control from the central government regulatory body to the people that really have to do something about it, the people that are using it.

If one looks closely at the record gross of wireless land technology I believe that this was the payment on the being available public pack spectrum

process. The need to provide workable systems in this unfettered environment has led to innovative technologies that allow many users to share the resource. In the ITU conference at the CICG in Geneva you look down and see a sea of laptops, none of them with documents on of course, they're all looking at everything else but they're operating. So the flow into the economy though is huge and it more then justifies the creation of the spectrum pack.

As you can see, ladies and gentlemen, there is no silver bullet, there is no one unique solution application that applies to all things. It indicates to me that a whole range of types of spectrum access rights are needed to serve the community and of course to underpin the creation of wealth. We must recognize that what suits one country may be unacceptable to others. I have had a number of interesting discussions and reactions, for example, in discussing the sale of broadcasting frequencies. In the Asia Pacific region Australia has a vigorous program of spectrum auctions but they have avoided the challenges associated with the sale of broadcasting bands, I think the broadcasters may have too much political clout to allow that to happen.

Many other countries decided the fate of the INT 2000 bands using spectrum sales and very interestingly they have sold the BSS allocations and the plan band, 11.2 to

12.2 gigahertz for BSS allocations. The rest of Asia has used different approaches that best suit their national policies and culture. To our way of thinking market determination has huge merits, however not all countries and people think the same. Most of the major allocations in Asia have been determined by other factors rather then the ability of the people to pay the highest price. That proposal which brought more wealth to the country, employed more of its local people, etc., etc., etc., some of the criteria are quite different to what we would expect to see in a normal dispersal of rights.

This of course is not restricted to Asia, many European countries have granted exclusive spectrum access without resorting to auctions, quite a few have. This clearly demonstrates the two parts of the process, the first part is the generation of the spectrum products to serve the needs of industry, and the second is the allocation process. These are two completely separate matters. Definitional or property right, the spectrum product on one hand and how you allocate it or distribute is the second part.

One of the more interesting public policy initiatives was taken by one country in providing access for cellular radio spectrum. I think this is a good example of what I’m trying to say here. The criteria on

deciding who got what was the guarantee for the fixed level of charges to the end user. The organization that guaranteed it would hold the lowest rate, for if I remember five years, was the winner. What was important to that country was the need for rapidly expanding low cost communication services to support growth. It didn't have too much of a telephone infrastructure, bringing the cellular telephone infrastructure at the lowest cost to its people was what was important.

In a number of countries in Asia the provision of telecommunication services is still carried out by government agencies and it is difficult to see how they would actually sell spectrum to their own agencies.

So far I've addressed the big services that naturally fit the spectrum ownership but what sort of regime do the rest require? A spectrum management regime that is open is in my experience the best arrangement. You've had it for years here in the United States. In the past the trend was for spectrum managers to be surrounded by a vial of secrecy and associated wizardry, this has not served countries well. My own country was like that for many years. Unused or hoarded spectrum is a waste of national resources. The spectrum is there to be used, after all the radio frequency spectrum is the original renewal resource, it can't be destroyed. I turn off my

transmitter, you turn on yours, there's no other resource quite like it for supporting a nation, it just does not deteriorate with use, it needs to be used to create wealth for countries.

In New Zealand now the databases are a matter of public record and a suitable qualified and approved individual can carry out spectrum engineering, like carry the New Zealand band plans and assignments on a laptop for example. The internet of course has made all this possible and is being harnessed in New Zealand and in many countries as a powerful tool.

Just as land right records have been open to public scrutiny for many years now the opening of spectrum management licensing files is a healthy trend to encourage innovation and new forms of service. Most countries in Asia though have a long way to go before they reach the point where independent engineers have available to them all the data so they can carry out spectrum engineering in the quest for new and innovative services. Australia and New Zealand, and I believe the U.S., are well down the track of opening the books.

I can envisage a regime in the future where if a license where a fixed link is required the spectrum engineering is done on a competitive basis. And as the records are public any interference issues is resolved

between the interested parties, they don't need to go to the FCC or whatever, it's solved between the parties that are trying to achieve the particular objective. There's still some form of license needed for public record keeping and this would probably need to be fundable license fees. There needs to be a central repository of data, no matter what you do, if you create management rights, license rights, whatever, you need a central repository of data open to the public. But this is very, very important, New Zealand has its Registry of Radio Frequencies which is a register of license rights and bands and I can scrutinize that, I can see exactly what people have got where and when and can engineer around it or with it or whatever I have to do.

I'm also attracted to the public pack concept. When I see the expansion of our lands it would suggest to me that larger amounts of spectrum would be required in the future for unlicensed applications. Ladies and gentlemen we're seeing radio being used for everything, blue(?) tooth(?) and it's latest derivatives to soon you won't have any cables between your keyboard and your mouse and your PC, in fact you can do that now and it will get more and more. Now these are valid applications and I think they'll require wider and wider public facts as time goes on.

Now ladies and gentlemen I've given you enough

history and background, let me go over some of the problems of creating property rights. One of the pitfalls is the tendency to strive for technical neutrality, to give the owner the greatest flexibility of application. Technical neutrality is an absolute myth, in my view the most successful sales and best implemented regimes are where the product that will use the spectrum is already known. This allows the technical characteristics associated with the use to be accurately described as part of the property right.

It must be noted that even though the rate of change of technology is absolutely incredible the rate of change of spectrum uses is small. The broadcasting allocations and the International Radio Regulations I believe were Atlantic City 1948, they weren't in 1935 but certainly Atlantic City 1948. Many of the allocations which we have today have been around for yonks(?), so if all the allocations have been pretty stable what's going on in those allocations is changing rapidly and the technologies and the allocations are changing.

As I say most frequency allocations in the International Radio Regulations have been there for decades. I would suggest very strongly that the needs of today should be addressed and leave the crystal ball somewhere else. Every time we've tried to protect things

we've fallen over. And the bands where usage is not well established high transaction costs can often occur as the owner of the spectrum attempts to change the characteristics to meet the particular need. This was a feature of the original Australian auctions, the regime where the intention was the frequencies would be sold in designated geographical areas, and these could then be merged to meet the needs of the owner. I understand the transaction costs made this approach somewhat unattractive and later auctions dropped the idea. In fact one commentator indicated at the time that spectrum sales in Australia were like buying real estate by the square meter.

One of the big difficulties I experienced was the sale of licenses rather then bands. The economists who I worked with indicated that all existing and future licenses in a particular band should be on offer so if I was offering UHF television it wasn't good enough to just offer all the licenses were there, but all the licenses that could be created in that band and so that all be put on the block at the same time. Now the economists told me this was a very useful thing to do, as an engineer it was very difficult but there we are. To create such a schedule of license rights the existing and future needed to be modeled, you need to say, you need to model what's going on. And then each element legally described to wrap up a

sale.

No matter how hard I tried I always got the new FM broadcasting licenses located on the wrong hill or building for the new owner of the spectrum. And thus after sale, after the auction, there'd be a flurry of activity where the parties who were having won the license right would want to move it to another site or if it was a broadcasting service would want to increase power. New Zealand developed a whole policy framework for allowing for post sale changes, this was brought about by the need to model what the future may hold rather then just selling the band with incumbency rights and letting new entrants come in and buy licenses in the existing way.

The broadcasting industry of course had agreed to the competitive purchase but there was no way in the world though it would agreed to a private organization holding the management right for the bands, they wanted that to be still held by government, that's the sale of broadcasting, all broadcasting spectrum and licenses. Other services like the cellular radio the sale of bands still require some assumptions, for example the original 900 mg bands were models as analog services. The unwanted emission rights at the end of the band gave considerable difficulty because what was being put in the bands were digital services. Thus there was great difficulty between the

modeling of what you're trying to sell and then the legal description of the model, and then finally what's sold and finally what the person wants usable.

I believe all the above are challenges, they are there for us to overcome and we must overcome them in the way of doing things. They are there to be faced but the end product is worth it, ladies and gentlemen, after all that angst and problem I believe our property right regime has made some things work in New Zealand that wouldn't have worked so well under the normal government services.

Let me finish with one extra thought, the deviation of the spectrum as I said before is in two parts, the creation of the spectrum rights or product or whatever you want to call it, and the allocation of it. There is some merit in creating the spectrum product or right, not necessarily selling it. For example you could have a service that has an exclusive user, aviation for example, that could hold that right, which would give them the power to do things and protect their own patch, but would take the responsibility of that away from the administrating body.

There are some advantages I believe, for example when we heard Mr. Taylor talking, Dr. Taylor talking before about radio astronomy, say hey, here's your spectrum product, it surrounds what you want to do, if you want to

fight tooth and nail to protect it so be it, that's your business, you can do it far more efficiently then what we can because it means more to you. And so I leave that thought with you, you don't need to, just because you create a spectrum right you don't need to sell it.

Once again, ladies and gentlemen, thank you for inviting me, I hope my comments will assist you in finding the best way forward for this mighty nation. Thank you very much.

-- [Applause.] --

MR. HATFIELD: Are you free to take some questions?

MR. RAILTON: Yes.

MR. HATFIELD: Can I assert my prerogative as chair and ask maybe the first one, actually the concept of license to receive no interference and as an engineer we know that as a practical matter that's not completely possible, and again somebody, tell me what the enforcement mechanism is, what it appears that we have here is where you get an injunction too easy, or maybe not easy enough, but could you go through the process of what would happen if I have spectrum rights and what would be the procedure if I perceived that I was receiving interference.

MR. RAILTON: Gladly, I'll let you go do something slightly broader then that, let me go into some

of the terms which are used in spectrum products in New Zealand --

PARTICIPANT: Could the question be repeated into the microphone?

MR. HATFIELD: I'm sorry, I didn't use the microphone --

MR. RAILTON: The question is about the licenses to receive no interference and what the enforcement mechanisms would be associated with that. Well, I said I'd go back into what some of the terms that we have in licenses. First of all it was realized that there was a noise floor in a New Zealand license and a spectrum right does not go below -143 DBW per meter screen(?), not DBW, it's a noise floor. Now you're going to have a low level under which you can't go on further down, otherwise you'd need to have a regime that protected electric drill, so there's a minimum level.

In licenses they have an area which was called a receive coverage location, it's a geographically described area, and within that area there is a thing called a maximum permitted interfering signal level, and so that's the maximum interfering signals that can come in from outside which you as an owner have to put up with. And if you take for example the AM broadcasting band obviously needs such a provision, the international signal coming out

at night, so you need to be able to specify what's the level of interference that can come into that area before you have a right to yelp.

Now in the interference situation you've got actually two cases, you've got illegal interference, where somebody transmitting outside the law, an unlicensed operation, and the same applies whether it be an administrative license or a management right. The full force of the law is administered by the ministry as radio inspectors come down on them. So the legal action, and you can be dragged through the court, your equipment seized, and who knows what else and that's an illegal interference situation.

The other more interesting case is where you have legal interference where you have two organizations operating legally within the terms of their license but there's interference. Now how do you resolve that? Now we have a first in time light that said if you're causing interference to me and I was registered first you move, or you fix it. There were lots of distortions in this, you would get people came in and would register their licenses and then not implement them for ten years. Meanwhile a whole lot of licenses have been implemented and they come in ten years later and then put in their license, but I was here first, I was registered first. So in the review of

the Act we put a whole pile of procedures in for arbitration, compulsory arbitration, within the spectrum management regime, to fix these problems. The whole purpose of these things was to have legal clout at the end of it, the owner has got of course has legal redress but there is a framework where they can mitigate the problems without going through the courts of law.

Now I think this is pretty important otherwise the whole process gets very litigious and very expensive and it's not in anybody's interest but there is a process for arbitration that is encapsulated within our Act. As far as the final bit, the final case, for example if you have an interference situation, they don't agree to talk to you and you got a real problem, if you've got the right, you were there first, your right was registered first, you're being grieved by this, you do have the full recourse of law to take legal action to get the courts to order accordingly. But it's recognized in New Zealand and I think in many other countries that you try and get regimes to sort out the problems without that but you would need a big hammer at the end to do something about it.

Does that answer your question?

MR. MCCONAHEY(?): Jim McConahey, NTIA. Hugh, I want to thank you for a very illuminating recount of what's happened, you clearly were there with the pioneers. In

your experience could you give us advice for those of us who follow you in terms of performance measures, metrics, for example you implement a given policy in a country how do you know you've done well, for example spectrum efficiency, do you recommend say audits, periodic audits to see if in fact you're on target? Cost/benefit analysis, perhaps something like that? Any guidance you could give us would be very helpful.

MR. RAILTON: Well this is a very interesting point. Yesterday we heard a lot about efficiency, there's a problem in here, when you define a private property right you lose the ability to tell the owner how to operate that property right, and so therefore efficiency and everything else, well it's nice but that actually is the business of the owner. So what you have to do is organize it so the economic environment, the prerogatives are that they're not going to sit on their band. There's many ways of doing that, one of the best is an annual charge a bit like land rating. Now Oliver Crommel(?) found that out soon after he beheaded Charles the First, that there's nothing like land tax for getting movement in the land. The same thing applies in your property rights, you can actually put in charges, annual charge, that says hey we've got to use this or we're just bleeding money. But there are many other ways, another way is the use or lose.

We never put it in place but we should have in my view, in the MDS auction we should have said to the people who are purchasing the spectrum you have an MDS service going within 18 months or your property right reverts back to the state. That makes it happen. There are many of the economists who will say hey, this is interfering in the market, you shouldn't do this, but if you want an outcome you're going to have to do that, you're going to have to do something like that, otherwise you just won't get the outcome.

As far as auditing of the spectrum on the measures(?) side, it's done by our end users. In New Zealand we set up several organizations, one I set up which Bruce is the chairman of, is the major spectrum users advisory group to government. And the big users come together, or they used to come together, I don't know how long since you ran a meeting, Bruce. But the principle is that they slated a ministry, hey, you're not doing a very good job here, we need more concentration on this. So you actually need this feedback from the users, you need the people, the people that's using the spectrum are the people who best know the problems and so you need that feedback and so that's what a user group does, like an audit in the system to do it. But you do have this problem that when you create a private management right just like your

property nobody can tell you what to do in it, so it's something which you have to work through.

MS. MORRIS: Thank you, Adele Morris from the Treasury. You mentioned that in your view technological neutrality was a mess, I think was your quote, but we also heard though that instances when you were very specific about the license characteristics at times there's difficulties because people had to readjust those parameters. So I'd like you to elaborate if you could on more specifically why you found technological neutrality to be a mess and how you went about striking the right tradeoff between that difficulty and then the difficulty with being too specific about the business model that was being established.

MR. RAILTON: Now let me give you an example. In the INT 2000 auction we had a number of bands which associated with fixed links, the old ITUR 1096(?) plan, and we didn't know how to handle it, we didn't know what was going to go in that plan so what we did is we put straight sides on the bands, in other words it went from the end frequency straight down to the noise floor, we didn't put any allowance for unwanted emissions at the side. The effect of this was two organizations bought these frequencies and they spent the next two years with their lawyers trying to sort it out. Now this was not good for

them and not good for the system, if we'd understood better what the bands were for we could have made allowances which would have meant they wouldn't have had to do that. Generally though if you take a band, the original concept of NERA, going back, was that spectrum was spectrum was spectrum, and you buy a band and you could put a broadcast station if you want to, or you could put a land mobile, or you can put whatever.

Well what I'm saying is this just doesn't work that way, the world is not like that. First of all you're going to comply by the ITU overall allocations, and secondly, describing such a thing is extremely difficult, a product that would allow that flexibility. I think the only way to overcome technical neutrality is to do better information gathering about what you're trying to generate and then to try and give as much flexibility when you generate that product, when you actually make the title, to enable it to work, but just as I say straight sided systems as a means to get it on the market and all sorted out just didn't work, or it worked but it was very difficult.

MS. TAYLOR: Hi, Hugh, thanks very much for your very useful remarks and suggestions and I think the experience of New Zealand and many other countries is going to provide a lot of guidance to those of us in the U.S. as we move forward with our own work in this area.

This is a little bit of a follow-up, by the way I'm Leslie Taylor from NTIA, is a little bit of a follow-up to Adele's question but also relating it to, relating it to the concept of the flexibility within, the tension between defining a service and a use for band and allowing the flexibility, which Adele referred to. As those of us who have labored in the vineyards in Geneva and the ITU we're very familiar with the very specific service definition concepts in the radio regulations most of which have been largely adopted in national tables of allocations. Do you think there's any potential for readdressing the definitions or allowing for alternative approaches such as apply the definition or apply an interference regime concept? So for example you could evolve from a fixed or provide a fixed and a point to point service in the same band so long as you were compliant with interference measures. Thanks.

MR. RAILTON: Well I certainly agree with you, in fact if one looks where the world is going I'd be very surprised if in the next few years VF(?) surgery(?) is not needed on Article I of the radio regulations to bring it under reality. As the digital emissions come into the band the digital pipe that you're carrying television in or other digital traffic is exactly the same so you're getting the situation between broadcasting and fixed and the like,

it’s getting very blurred, there’s a need to look at that or maybe there’s a need to not look at that to say look we just don’t have these specific services per se. You can’t do this universally, for example you do need to actually identify where in the regulations you’ve got to put the Navy’s high powered radar. It can’t be right in the middle of the cellular telephone bands, but you do need to make these definitions.

As far as the given flexibility, this is going to change rapidly because the unwanted emission format for digital emissions is very broad, they tail off fairly slowly and it really doesn’t matter whether you’re talking broadcasting or you’re dealing with wide band CDMA, the format, if you have a look at the envelope, is not much different. So while years ago it was, under the analog it was much more defined by each one it’s coming better and I think in the years to come you put out unwanted emission limits which will be wider.

I have to say that New Zealand has a whole machinery for modifying your management right, modifying your unwanted emissions, it’s got a whole process set in law where you get the agreement of the next owner, etc., etc., and you get a right attached to your title so to speak that says you can now slop a bit more out the side. But you need that machinery, the additional machinery. I

think there's something like 21 different forms in the forms regulations associated with the management right regimes of different things that you need to correct occasionally on that, quite a big process.

MR. HATFIELD: It seems one of the themes I've heard during this meeting and I think was picked up on your comments, that there seems to be a disappointment that there's not been more of a secondary market created. I was an advocate when I was at the FCC of secondary markets and I even sort of had this notion maybe that it would almost be a spot market in spectrum, and while I think secondary markets have already been useful in facilitating certain types of transactions we've not seen really the development of a true secondary market and I wonder if you might comment on what your experience has been and see if there's any ideas as to how we might encourage something that looks more like a real market on sort of a day to day basis.

MR. RAILTON: Thank you very much for that question, that's something which is rather dear to my heart. To understand the lack of secondary markets, New Zealand is a country about the size of California, 270,000 square kilometers, it's got four million people in it. I can go for a walk from my cabin in Lake Tarapin(?) and walk for an hour and not see another human being. We haven't got the large numbers of humans that you have and other

activities to drive these things with only four million people.

But let me give you a suggestion, say for example you wish to refarm 60 megahertz of spectrum, say that was about to come about and you wanted to have competitive providers or a market of spectrum products, or a secondary market or a primary market, I prefer to see a primary market to be quite honest. One way to do that is to condition the sale of those, that 60 megahertz into either three 20 meg blocks or two 30 meg blocks, and to not allow one owner to own the lot. And then you get the situation where you've got competition in providing services within that particular 60 megahertz. If you just put the 60 megahertz on the block and expect to get a market out of it it's not going to happen. But I think there's a lot of sense about, if you're devolving or refarming a big chunk of spectrum precondition it so you force there to be a market of spectrum products.

I think we've seen the same in land and other commodities throughout the history of mankind where you had to ensure there were multiple traders in order to get competition. Without competition it really doesn't matter how good the company is, you get the same problems as you get and the same monopoly provider, whether it be the government or a private provider. I'm a great fan of

competition even as a way for management. I hope that answered your question, we didn't get secondary markets because we're so small, people wanted to buy the frequency for their own use.

MR. HATFIELD: If I could have a follow-up question, picking up on your notion of well we'll create three bundles of rights totally 60 megahertz to assure competition, there wouldn't be anything though keeping the owner of that license from entering into long term leases, each of them from entering into long term leases which would again sort of preclude a shorter term market. Am I clear, I mean that spectrum could still be tied up even if you gave it to three different band managers, each of those could in turn enter into long term agreements. Is that not the case?

MR. RAILTON: Well I think the world looks a the U.S. for its competition policy and you have a very robust form of competition policy within your statutes. In New Zealand competition policy applies to spectrum the same as applies to any other market, so it comes under the commerce commission, even though we have a communications commissioner within the commerce commission he's a bit of a toothless tiger. But you've got a body of competition law out there that says if you're going to go off and say sell out to the next door neighbor you've got a few hoops to go

through and the competition law will adjudge whether in fact you can make that sale or not in terms of the interest of the state. It's not perfect, ideally you'd say look, three owners and no sale of these rights within five years, that's another way to do it. But you people have to answer those difficult yourselves but I still believe preconditioning of an auction like that is absolutely essential to get the outcome you want.

-- [Applause.] --

MR. HATFIELD: We're right on time, we'll take a 20 minute break and come back at 10:00. Thank you.

[Brief break.]

MR. HATFIELD: Okay, we are going to get started. We're going to continue with our theme that we started with our keynote speaker of talking about international experience in marketplace approaches to spectrum management and our moderator for this session again really needs no introduction to this group. It's Janice Obuchowski who's president of Freedom Technologies, Inc., she was of course former assistant secretary of commerce for communications and information and as we all know U.S. Ambassador to the World Radio Conference in 2003. So Janice?

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Janice Obuchowski, Moderator

MS. OBUCHOWSKI: Thank you. Thank you, Dale, I

always am very proud of my association with NTIA and obviously very happy that you are working closely with CSTB in this conference which is absolutely cutting edge, very timely in the United States, as you know we're about ready to embark on the two very, very large spectrum auctions, largest in almost a generation, we have the Presidential Initiative which is sort of reaching I'd like to say sort of a close although this is an ongoing process and clearly as we look to the next generation of decisions here with spectrum we very much need the insights that are being developed around the world, we need to know what works, what doesn't work, we need to share experiences. One of my great pleasures as WRC Ambassador was to work with many of the experts here at the table because what you know about spectrum policy is that this is a great field for cross pollenization, you have very bright people the world over thinking hard about this critical resource that underlies so much of our knowledge economy.

So I am very privileged to be chairing this panel and I think this is a joke that some of you have heard before but I feel that when I chair these international panels what comes to mind is moderating another session of international spectrum idol and if you are putting together a show of international spectrum idol you would definitely have these five gentlemen as your top contestants. I am

not going to go through the bios of each of them but what is absolutely fascinating and wonderful is that we have the top, some of the top experts in the field represented, so please do consult the bios.

I think I'd like to begin by asking Martin Cave who spoke a bit yesterday about the UK experience to share for the audience his perspectives on that experience as well as any general observations. Thank you.

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Martin Cave

MR. CAVE: Well thank you. I thought for one nightmarish moment there that we were going to be compared to ITU negotiators which would have been deeply scary.

When I used to watch children's TV with my own children about 30 or so years ago there was one very robust program that we had, it was like sort of an adventure program, in which people would come on and one week they would abseil down from a 12 story apartment, then in the next week they would show you how you could generate a controlled nuclear explosion using ingredients found in your kitchen and so on. And then there was a moment when they turned, the presenter would turn to the camera and say very seriously children, don't try this at home. I'm never really quite sure when I'm talking about UK spectrum reforms whether I should add that important clarification.

On the other hand I don't think I need because what we're really doing, what I'm going to describe, is really sort of piecing together and taking a bit further the ingredients which come from other parts of the world, auctions from the U.S. and the general philosophy of secondary trading from New Zealand and Australia, and not typically at Guatemala, the famous Guatemala which I hope we'll be hearing about in more detail later on this morning.

So what is the UK strategy, which I'm just going to run through, introduce secondary trading as widely as possible, including spectrum currently in use by public sector organizations. Auction substantial holdings from stock, sort of getting on out there, the UK has a program of awards, I can see Peter licking his lips already at the prospect of taking part in these auctions, has a program of awards over the next two or three years which represent I suppose something like seven or eight times the spectrum that was released at the time of the 3G auctions, which generated about $40 billion dollars although I guess the expectations for what's going to come out now are obviously much less. And just parenthetically in the light of what he was saying, I thought a very interesting talk, greatly enjoyed it, the question is how you actually sort of configure the spectrum, the spectrum auctions, how much you

try and second guess the market and say well we think basically it's going to look like this so this is how we'll package it as opposed to the initial Australian approach you described of having sort of standard spectrum units which were sort of utility units that were applied in every auction.

The off color approach to this which I think is quite sensible is to try and form conjectures about what is most likely to win the auction and then to configure the spectrum in a way which suits those bidders. Now there's a horrible risk here of a self fulfilling prophesy and I think the risk has become particularly acute, for example, when we anticipated sale of the spectrum which would be freed from -- [inaudible] -- switch off in 2012 because it's very high value spectrum it's very adaptable spectrum, it can be used for most anything. And actually trying in those circumstances to introduce the principle to which I still adhere despite Hugh's doubts of technological neutrality was to at the same time trying to get out of the problem of post auction negotiations and so forth, I mean I think that's a very difficult problem to solve and in any particular case it's going to lead you into quite serious troubles.

Then the third plank which I described yesterday is to liberate public spectrum environment is the pricing,

as we put it rather purposely, try to get it back from the generals. And then extend the commons a little, now this is quite tricky because in the United States people tend to be either 100 percent commoner I suppose going back to the 1870s in France, or they tend to be very strong opponents of it and reluctant to admit it has any role, which I must say strikes me as being an unnecessarily polarized position. Because if you look at the plans in the UK for changing the allocation method over the years between 2000 and 2010 you'll see the sort of the headline change of course is that market allocation with secondary trading is projected to go up to 71 percent. Command and control obviously falls commensurately but there is a small increase in the commons which the arguments finally paused over whether it should be eight percent or six percent I think but I would be pretty unhappy if the plans included taking down to zero.

So obviously this projected state in four years time does reflect what we heard from Hugh, the coexistence of different modes, horses for courses, I'm sure that's absolutely right, but of course it's really the proportions that matter and I think the key thing is actually driving up the market allocated spectrum just something like three fourths of what's available, that's really important, if had only gone up to ten percent then that would have

represented a very, very modest change.

So I guess what I am supporting in this talk although I'm basically maybe to describe what's happened in the UK is that kind of very substantial expansion because I think that's the, expansion which as I suggested yesterday should include public sector spectrum uses because I think that's the only way we're going to get the flexibility that we need to meet the new technology developments which Hugh described in his talk.

Now defining rights, I mean this is a horrendously complicated topic, we had a sort of defining rights 101 from yesterday but this is like the pre- pre-defining rights 101 slide I'm afraid. But it does indicate how you do actually have to change your perspective completely upon defining rights when you move to flexibility and use and in particular the old regime in which you were basically licensing operators and you apply well established tools to model interference on that footing followed by local adjustments by barter, you switch yours down a bit and I'll switch mine down a bit and then we'll both be happy, that does have to change. And I think it is important to emphasize the importance of trading at the boundary because post flexibility none of this is going to be perfect, there are going to be all sorts of tweaks that will have to be made, trading at the boundary if it's

bilateral it runs into problems, both sides trying to steal the gains, if it's multilateral there are hundreds of parties involved, you may run into problems.

So this is anything but a trivial problem and the question of enforcement becomes of huge consequence. We heard a bit about that yesterday over the question of administrative law judges, the FCC or alternative methods of dispute resolution. In the UK it's very clear that OFFCOM(?) will stand ready if the parties fail to agree on a solution and to arbitrate, and it will be able to do so using its administrative powers which have been granted it under the Communications Act 2002, so it does in a sense have a really big head start, our administrative tradition rather then alternative legal conditions enable us as we constantly experience but perhaps beneficially in this connection to trample over people's rights fairly effectively, and in this case we hope we'll be able to ensure effective spectrum use.

Now competition issues, if you're having this trading regime what kind of competition regulation is required, and in particular a big debate, should spectrum trades be subject to exanti(?) regulation? Now this obviously depends upon how you define spectrum markets because that determines the probability that there will be dominance in those markets with the potential for abuse.

And the key point to follow in this is if we really do liberalize, if we allow flexibility, then the definition market is going to widen. Of course the demand for spectrum is a derived demand which is based fundamentally upon the demand for the services which the spectrum actually generates.

Now if there are all sorts of different ways to market in those downstream activities, both wire based and in spectrum terms using a whole bunch of different frequencies which potential operators are now entitled to use subject to liberalization, then you should see these spectrum markets widening and the opportunity for anybody actually to hoard spectrum, to corner markets, to exclude competitors by denying them access to this essential in put, that should be with the passage of time sort of go out the window. So this depends to some extent upon international action as well as action taken by any country, but the view that OFFCOM has taken at the moment is that our competition, which is basically European competition worries, is quite adequate to deal with it ex post. And our competition there is in fact quite rigorous, we have the rather dubious distinction of having thrown out under our competition a whole bunch of mergers which the Department of Justice is quite content with, G.E. Honeywell is the major case in point, whether this is a good

illustration of competition or a bad one is open to question.

But there is also another problem which may be peculiar to the UK which is that in acquisition, we have two political regimes, one relating to mergers and one relating to established positions of dominance. The acquisition of spectrum does not qualify as a merger, a merger has to be between enterprises under UK law and actually buying an input such as some land or some spectrum does not amount to a merger and therefore we're unable in that context to subject spectrum acquisitions to the same kind of review that would be possible if there were a merger between two entities which were producing services downstream using spectrum. So it was a bit of a punt on this, in a sense it's almost a race between the speed of enhanced flexibility which reduces market power and the speed with which operators are able to seek to exercise market power by for example acquiring spectrum in auctions and things of that kind. But I think the UK authorities have in fact chosen to back the right horse which is a non-interventionist horse in this particular case.

Now I already spoke about transition issues, pointing out that at a very early stage of spectrum reform the UK government said that it would in no circumstances in the course of the reforms withdraw rights which were

already held by existing licensees, so the idea which has happened in Australia for example and which we heard about in relation to Canada, a slightly different context yesterday, was of hauling the spectrum back in and then relicensing it as opposed to maintaining the current occupants in situ has not really gained any currency. But the problem is that our existing licenses are annually renewable and an annually renewable license would of course be useless and a body of expectations, inducing the expectations has been built up by licensees that they have N years of tenure that they require and use, nobody knows what N is because it's never been dealt with but people think it's probably somewhere between four and six, God knows how they think that but that's the sort of the view of the lawyers. And that legal uncertainty obviously makes it very difficult to do anything other sort of grandfather the rights because you aren't really sure what kind of legal challenge you're going to be subject to if you try and get out of it, hence my observations yesterday about the importance of trying to defuse the windfall gains issues in the United Kingdom by various methods which I won't bother to repeat.

I also discussed yesterday at some length the role of the public sector as players but I'd just like to draw your attention for purposes of today to a point which

I omitted from yesterday which is that public sector organizations, crime organizations, government organizations in the UK, do not have licenses, it'd be demeaning for a crime organization to be given a license, so they have, they exercise a kind of duadasinore(?) severance privilege, but you have to remember in the UK we only abolished the duadasinore about 50 years ago, I'm just kidding, that's not really true. But crime privilege does still exist and so nobody knows first of all how they can be made to pay the consented prices if they don't want to, you have a small problem. Secondly, nobody knows precisely what spectrum rights they have because they aren't codified and the absence of that codification means that it's very difficult for them to do any leasing and equally it's very difficult for anybody to contemplate using spectrum adjacent to a public sector user because you don't know what you're up against. And so one of the key things that has to be done to get this show on the road which is a sort of collorary(?) of the data available in the register about spectrum rights is to establish what I call quasi licenses but what legally are called in the UK is recognized spectrum access which actually indicate precisely what it is that the public sector can do.

Now what's happened so far, well we haven't many trades, we've had 14 months, it's like throwing a party and

nobody comes, but last week to everybody's great relief some authentic trades took place, which have been written about with great excitement. They're trades which don't involve change of use, they're for fixed wireless broadband and it looks as if the original purchaser at auction lost something like 90 percent of the value on the spectrum as it lay unused, nobody's quite sure about that. So everybody is sort of keeping a stiff upper lip and say well we didn't expect anything to happen really, spectrum is a long gain but just you way, over the course of the next two centuries something is going to happen which is going to transform things.

Now I just want to finish with just two very quick slides about whether one country can go it alone, I mean we have in the UK approximately 15 times as many people as the New Zealanders so we aren't quite in the same situation as New Zealand. But obviously from the standpoint of equipment manufacturers contemplating producing equipment for use in for example a public sector spectrum which has been leased for commercial uses, it just isn't on. And so there are various points of view about this, there are the people who say well we shouldn't make any changes until everybody else has changed, that's an argument with which you're no doubt familiar in other contexts and of course if everybody makes it what happens

there, principally enough, nothing.

The more optimistic view is that a country which liberalizes, is able to benefit its consumers by offering a range of imitative services, it's also able to generate a kind of technological ability which can then be exported to other countries when the time comes, and that the short term gains may be small but they'll grow as other countries join in. And in particular the most obviously candidate countries to join in for the UK are fellow members of the European Union of which of course we're one of 25. And in September of last year the commission issued its own political proposals for the reformance(?) spectrum, recall that the commission only has any kind of lackas(?) in relation to spectrum which is used for communications purposes, spectrum which is used for defense and emergency services, and so is entirely the prerogative of the member state.

But in relation to spectrum which is used particularly for communications in terrestrial broadcasting the commission's proposal is that by the year 2010 that spectrum should be tradable within the 25 member states and that all member states should adopt the same kind of provisions that I've been describing in relation to the UK and this would then open the door for a new kind of harmonization, the kind of harmonizations that we've had of

spectrum within the European Union through the GSM Directive and the ERME's(?) Directive which set up spectrum for paging system which was never built, have been based upon and saying okay guys, this is it, this is the spectrum go and do it, which in the case of GSM they did but in the case of the paging mechanism unfortunately didn't so the spectrum has lain unutilized. But the new approach is in essence not to harmonize spectrum assignments, spectrum allocations, but to harmonize spectrum management methods and this therefore creates the opportunity for equipment manufacturers and operators to achieve their own defacto harmonization by the decisions which they make about where to locate particular services which seems to me in the forthcoming decades to be a better way of doing things.

So I'll stop there. Thank you.

-- [Applause.] --

MS. OBUCHOWSKI: Thank you, Martin, thank you also for being so very forthright, Martin left me musing yesterday when he was talking about administrative pricing, I think that's such a very tough nut to crack and you know, Martin, you started talking about radar, that the next frontier was going to be military radar, and I watch too much history channel, I started fixating on the battle of Britain and I thought how are they going to price that military radar, I mean if you priced it in that context

you'd probably put a value on it that would be radically different from the value you might put on it in 99.9 percent of your subsequent history and yet somehow that mix of where does one price spectrum, particularly if you don't have a truly free market to do the pricing for you, becomes a real conundrum. I was thinking a little bit about the 700 megahertz spectrum about which I know quite a bit, there was an auction of that in 2002 and Aloha picked up some eight megahertz of it for $2 million dollars because of the regulatory risk. We now anticipate, I think CBO anticipates that's going to go for over a billion commensurate spectrum in the next auction. So I find administrative pricing to be a really, really tough issue, I don't know if you want to respond to that or not but perhaps you could in the Q&A.

The next speaker we have is Bruce Emirali who represents the New Zealand Defense Forces, is their great spokesperson at WRC. I'm left musing about what it is in the gene pool there in New Zealand that you produce such great spectrum experts, four million people and two fabulous speakers.

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Bruce Emirali

MR. EMIRALI: Thanks very much and good morning, certainly it's my pleasure to come here and I'd like to

thank NTIA and the organizers for giving me the opportunity.

I didn't know that Hugh was coming here, unlike me to frequent bars I found him in a bar two nights ago, and he said I'm the keynote speaker, I'm going to talk all about the administration regime in New Zealand. And I said well, you just destroyed my presentation, Hugh, so we can keep this reasonably short.

I've got a slide up here, it's not 101 on geography, it's really to highlight how New Zealand sits in the world geographically and how isolated we are so we can play around with things without too much worry about upsetting the neighbors, not that New Zealand upsetting Australia really worries me. I was hoping when I came here that I would learn about spectrum efficiency because we throw it out all the time, just about every time I talk to people they say military, spectrum hogs, you should be more efficient. And I say well let's go into this and discover what is actually spectrum efficiency, and that goes round and round in circles and I go away none the wiser. So I put a little dotted line in here to give you an idea of how far New Zealand is away from Washington and I've got 28.5 hours to get here. This was produced before I left New Zealand and I got in time involved what I would call the airline efficiencies, unfortunately the efficiency crashed

at LA and I was allowed to have another 12 hours, so for that I'll try and blunder my way through this remembering what Hugh said and figuring what I got to do next.

What I was going to do originally and will still stick to it because the presentation is here, the odd method we went through and that I think leads up to the new regime that we've been forced upon me and you've got appreciate that an I'm not an economist, I'm not a lawyer, I do radio engineering, I mess with the military spectrum a bit, which is quite extensive, and this regime has effectively been forced upon me, so with that in mind that's where I'm coming from.

Yesterday I listened to all sorts of things and the two main things I got out of yesterday which I found very interesting was concern over public, how do we deal with the public sector spectrum in any regime, and the thrust of this has been based on property regime or management rights as we call them, there may be other solutions out there and perhaps we can find them one day.

The other thing I picked up was people were worried about fees and I thought this must be a common thing because I actually produced this before I left New Zealand and I've got a thing on fees which I'll just touch on. And then I think what the last slide that I'll get into is probably of more interest is the observations from

my perspective. I will put a disclaimer in here, I'm not speaking on behalf of the New Zealand government, they'd probably shoot me if they knew what I was going to say, and now that Hugh is out of the government I don't mind speaking in front of him.

The old way, goes back a long, long time in New Zealand and staggered me when I researched this, there was a one page document that was the Wireless Telegraphy Act of 1903, it was a one page thing and it effectively said how you can do communications, it said that if you've got to do any radio communications you must get a license or some degree of authorization and by the way the government owns the whole spectrum at the moment so you must get it from the government. Then our government sat down and they said we'll have to figure out a way of doing this and they come up with administrative licensing which everybody is very familiar with, and it was really a first come first serve, there was no scientific calculation to determine what the license would do, you turned up, you said I've got a radio, it does this, I want to do this, and they said pay me some money and you can have it. And that was fine until people started to get cheaper radio equipment, wanted to do various other things, so then the government over a period of years developed the regulations and came up with the apparatus licensing regime which I believe is in vogue in

most places these days.

We move into the new regime, and this was very interesting, Hugh has covered it in reasonable depth but there was a couple of things though that I think needs to be highlighted a little bit. Prior to 1989 as I say we had these regulations, they weren't applicable to government departments, the government departments like the UK could virtually do what they liked within the spectrum. Unlike the UK we still had to get licenses, we didn't pay, it was great, the records were very vague, that was also great. I'd hate to say that defense or admitted defense as a spectrum hog, we're not really, we're busy doing our work, we think we're doing it well, and we don't like to tell too many people. As Hugh alluded to secrecy was a great thing that made it very difficult for other people to engineer into the frequency band because they didn't really know where we were until they bumped into us, so that was a fun thing.

Coming into the Radio Coms Act, and I blame our legal people with interference, they slipped in cunningly, they slipped in a little clause that said this act is binding on the crown, very small sentence, hidden away in the find print, but that effectively said all your crown departments will now have to honor all these rules and regulations and especially the bit at the back that says

you'll pay fees, and that became very concerning especially to my chief of defense, he thought his whole budget was going to go out the window paying for spectrum.

They then created the Radio Regulations to assist in some of the Act, the Act has actually has Hugh alluded to established the means with which to move into a market based approach and later on the amendment to the Act gave the provision for the government to sell the spectrum. The Radio Regulations really are maintained to keep some control over administrative licensing that doesn't, is in vogue until the spectrum has passed into the new management regime.

What Hugh didn't say was when we sell off these spectrum license or the management rights they're open, they're up for 20 years, and I always found it rather amusing that 20 years, okay, that's a commercial decision, I guess you buy it on the basis that in 20 years I've recovered all the outcome and made a handsome profit if I'm doing trading, and that's fine. I note in Australia it's ten years and when we spoke to the people in Australia I said how did you come up with ten years, and you know, this is not attractive in terms of moving and the people that were advocating it then said ten years is good, once you realize ten years it doesn't matter whether it's ten, 15 or 20 years, you'll make a business decision based on that and

how fast you can recover and that will give you some idea of how much you're prepared to pay because you know what your revenue streams will be, or required to be. So they came up in New Zealand with management rights and spectrum licenses as Hugh has alluded to, the management right is for a band so you buy the band, that doesn't actually authorize you to make radio transmissions, it just allows you to buy the property and then you create spectrum licenses which are the actual authority to do transmission. If you're not in the management right you stay in the administrative right regime.

And then he's gone to great lengths to explain our tender, tender system to start with and our auction system. It always amused me and as I say not being an economist I couldn't understand the second price tender mechanism we had, you put in a sealed bid tender, if you won you paid the price of the guy you didn't know how much he'd bid for and so you could expect to pay less then what you actually tended for. And I tell you, I had a bit of a problem with it, but I recall one particular tender in the deep south of New Zealand for television, I think it was television or radio license, and a university student went into this in depth and he said well there's about half a dozen licenses up for sale here, I'll bid for one, so he put in a bid of one dollar. And nobody else bid for it, so

the second highest price was zero, so he was now the proud owner of a license for a TV station that cost him absolutely nothing. And of course when people woke up they said well, gee, they ran along and tapped him on the shoulder and said we'll give you ten bucks for that license, he was a very cunning student, he had fees to pay, he said $13,000 is a good number and he actually sold it, so there was a bit of secondary trading in that instance.

We saw the errors of the way and they went to a sealed bid highest price tender and then more recently into auctions and I think one of the innovations in New Zealand is they're now conducting these auctions over the internet and it makes interesting watching when you see, you can log in and watch the auction taking place even though you're not a participant.

But as I say there's two regimes running, there's the market based price regime and we've maintained a radio apparatus license regime, which I think, listening to the argument or the discussions should I say yesterday and certainly Carl said to me Bruce we're waiting for you to tell us how to do this in the U.S.. Listening to the debate yesterday, you've figured it out and Hugh alluded to it today, there's no one solution, you can't find the perfect solution. Certainly in New Zealand the initial market trading was, we were going to or the intent was to

put all the spectrum in New Zealand into the market based environment within three years and they had a very rigid program. The first series went around and then the government sat back and said oops, and as you Hugh said took a long time to engineer these things to get them right, it became very difficult, we're not 16 years down the track and we haven't sold much of it at all, so a lot of it has maintained or retained in the administrative licensing and that's where the public crown identities reside and hopefully will stay for some time.

I've just chucked a slide up there just to give you an eye, there's the arrow of spectrum and there's the blocks that have been sold off in New Zealand, I apologize if it's hard to read and the numbers haven't come out, I was trying to correct this out on the airplane on the way over. But you can see, we've focused on what we would say reasonably high volume areas, the TV, the cellular, NDS, fixed wireless access, so you can look at that in your leisure later on.

Moving onto fees, fees are always near and dear to us because they're going to cost me something and it's like being at home and somebody comes along and gives me a bill I get a big worried. So the main thing here is it has been applied to the government agencies, as I said the legislation said we have to pay, we have to abide by the

regulation in New Zealand. That's rather a novel approach for military people, I have a lot of trouble telling senior commanders you can't do that because of regulations so you can't. And they say go away you horrible little man, we're the military, we can do what we like. And I say there's a big chapter in our regulations that give these people the right to sue us for loss of service and all these other things and do you want to incur extra fees because you're breaking the law, and that sort of gets their attention. But we do pay fees on the administrative licensing system.

During the negotiations when we were coming into the market based approaches I said well why are we doing this, what's the overriding reason for going into a market based approach. I think Hugh clarified that today by saying the country was in deep debt(?) and they said we've got to get some money from somewhere and although they won't turn around to me and say we're doing it to make money, they were saying we're doing it to make spectrum efficiency, and once again we go what's spectrum efficiency, we go round in circles. And they said well what we can do is we will only try and recover, through the administrative licensing we will only try and recover what it costs us to manage the spectrum in New Zealand. And we said good, write that down on a piece of paper so that really opens up the books and we can see what you people

are spending our license fees on and see where the excess if there is any and demand that you reduce your operating costs and what have you. So that's where we came up with a mixture of apparatus fees and band fees, although you actually own the spectrum you still pay the government a small sum for your spectrum license and the manage there is for them to ensure that that's protected.

I've got in here GURLs and you'll way what the heck is GURLs, that's the public parks things, General User Radio Licenses, and that's your areas for your Part 15 devices, we also have moved more and more into this regime where we've put the aeronautical bands, some of the international obligations, they have created this GURL which spells out some of the parameters of it and they of course do not attract fees. This has encouraged a lot of people to get out of spectrum and go into these GURLs because they don't have to pay for things. Defense would like to do that but I think the interference potential for all these devices gets a bit too high.

I'd like to point out at this stage too that when we run auctions the proceeds of the auctions actually go back to the government, they don't go back into the spectrum regime or whatever, it goes into the general government coffers and that's where I say hey you're trying to balance the overseas deficit here, and they say no, no,

we’re trying to get spectrum efficiency. What they really mean is we’re trying to get economic efficiency and hopefully spectrum efficiency will be a byproduct and I’ll tell you a little bit later about how successful that’s been. For those that are interested, to this day I’m not quite sure how the government determines the actual cost of an apparatus license other then the fact that they have declare how much each year costs to administer the spectrum and therefore the license fees are jiggered around so that they only recover that amount of money. And people can approach me later but because of the surpluses they gathered over a few years they’re now returning the surpluses back into the licensing regime so we’re not at the full potential of paying for the overall cost of the department just yet.

I chucked this in because my teachers used to tell me no presentation is good unless it’s got a pie chart, an org chart, or a formula. New Zealand did look at formulas for determining the cost of spectrum and we discussed this a little yesterday and people will look at that and I can see all the mathematicians trying to figure this one out. This was the very first attempt at it, I chaired a panel in New Zealand of industry people that said you’ve got to be joking, the whole idea was to try and get transparency and quality across the charge in regime which

was very slanted against broadcasting at the time because the broadcasters said we can see us saving a lot of money using this. The funny thing I found about the whole equation is you got all these nice things there and right at the very end is what we call the K factor, and having run this formula through and come up with a number they said oh dear, we're now going by applying we're now going to recover millions and millions of dollars but we don't, we've made the statement we're only recovering enough to make our department work. So they apply this K factor and drag the numbers down and they're in play and I thought well what's the use of a formula if you get an adjustment factor at the end but that's enough about formulas.

Moving on very quickly to the observations and as I said we've had it for 16 years, I was very resistant to change, I had an attitude if it ain't broke don't fix it, I couldn't see any problem with the regime we had in New Zealand and then as I say my attitude was they're just trying to make some money.

One of the things that has come out and you need to really think about when you're going into any property type regime, our management right regime does not promote sharing. The owner can buy the spectrum and he can keep people out of it. I find this extremely difficult when we're trying to coordinate wide band systems in areas that

the management right is held and it's held by various owners, so instead of where I used to go and negotiate with the government and say we promised to be good citizens and our high powered radar in the cellular band won't cause interference, we're nice people, we now have to go to all the cellular operators, all the management right holders, pitch the same thing, and if one of them says no the system doesn't work. Now for any emergency service or security service that can have severe consequences, so when you're starting to create some of these management rights or property regime things give some thought to that and how can you resolve this.

Hugh mentioned the noise floor, the level of property right boundaries, this is one of the things, we're usually operating above that noise floor a little.

One of the other things we found or I observed, and this relates to probably international activities, is the management right holders as was mentioned and other people have said, they've bought it for their own use, they didn't have secondary trading in mind at the time. Because of that they seem to forget or in some instances they've overlooked the fact that they are the owner and I don't care what they do with it. They still think the government should look after them at various international forums and they don't send people along to look after their own patch

and I think that's something that when you're going into this regime you've got to make sure that the new incumbent is very well aware of his obligations.

As I say here the New Zealand expectation of spectrum efficiency has not been realized. We thought it would happen as I say a byproduct of the whole regime. I think the reason part of it has not been realized is because the market was too small. When you look at the figures in comparison the dollar value didn't really meet the expectations that we thought would happen and people could buy spectrum and sit on it, and that has happened in some instances.

The other thing there I think which is really touching to me is once you've sold these spectrum the people have their rights, they have their boundaries, and then the national delegation goes off to a World Radio Conference and is really bound to argue to protect these guys, so if there's any small shift in the boundaries up or down or you're looking for global harmonization while the government of the day might be quite willing to make concessions they're bound by some of the limits that have been posed by selling these blocks of spectrum off to other people and it can hinder some of the national discussions at World Radio Conferences. They're the negative things, you'll now think I'm a negative person, perhaps I am.

But really, I firmly believe as Hugh does that there is a place for market based mechanisms and there is still a place for the old administrative mechanisms and I think that's where the public sector stuff should sit. How you determine, I was listening to Martin yesterday and said gee, I'm glad he didn't come down to New Zealand when we were going through this, 55 million pound for a license fee for the defense force, that would be about a third of my budget, no thank you. But really I regard charging the crown identities as really an academic exercise at the end of the day, the government owns the spectrum until it's gone into the new regime, the government is charging the government for something that it already owns, it's an academic exercise. The first year would be a shock because I wouldn't have budgeted for it, the second year I would have budgeted and I would have gone to our government and said be prepared, you've made this rule, you're going to charge me X amount of dollars, you've got to pump up my budget by X amount of dollars, so we get into a little money go round and I think in my instance it hasn't promoted defense getting to be more spectrally efficient, that comes with the long lead times for equipment, when we change the equipment, the other thing is we change equipment, what we don't do is change the spectrum allocations and that could be a way forward is as you

change equipment you then revisit the allocations and say do you need all the spectrum given that the equipment is now, technology is making it more efficient, not the administrative licensing.

And with that I thank you very much and have a nice day and don't hit me too hard with questions.

-- [Applause.] --

MS. OBUCHOWSKI: Thank you. Our next two speakers represent the United States but interestingly Wayne Leighton, who comes from the FCC where he is one of the most senior economists with a great track record, will be speaking about his experience in Guatemala where he saw firsthand as a visiting professor their institution of spectrum reform. And then Peter Pitsch, who represents the U.S. private sector from Intel will probably very happily carry the portfolio of the FCC, at least he'll tell you about it. So first, Wayne.

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Wayne Leighton

DR. LEIGHTON: Thank you. The title of my presentation is Telecom Reform in Guatemala, you could also make it Pablo Spiller's presentation part two. What I'm going to do is put some meat on and more detail into the framework he sketched out for you yesterday. Having said that I'm going to give you a first class Guinness Book of

World Records long disclaimer which is that the opinions expressed here are those of the author, yours truly, and reflect the results of research that I did while I was on a leave of absence from the FCC, this was July 2004 to July 2005, and I was teaching at and conducting research from Francisco Mardocane(?) University in Guatemala City, Guatemala. So the results here and the ideas here do not represent any opinion of the FCC, any commissioners or staff, Francisco Mardocane University in and of itself, trustees, any of my coauthors, any of my friends, neighbors, research assistants, I speak for myself.

Ronald Cose(?) wrote a very famous article in 1959 and turned around in 1960 and did a little looking at creating property rights to spectrum and was pretty seriously criticized, and this was a criticism of his paper he jointly coauthored, this is a remarkable document, time somehow has left the authors behind, they ignore the social, cultural, and political values which have come to inhere in mass communications, in particular broadcasting, as well as 50 years of administrative law developments. I know of no country on the face of the globe, except for a few corrupt Latin American dictatorships, where the sale of spectrum could even be seriously proposed.

Well, Guatemala and El Salvador which followed suit a year later in its reforms, both Guatemala and El

Salvador have had some problems with corruptions, they're not dictatorships but they've had some pretty serious problems with corruptions, legal systems, etc., but they've done a pretty nice job, especially Guatemala, in creating a strong property rights approach, the properitization as Larry White would call it. And suddenly why it's important, this offers a real world test of Cose's 1959 paper, it's reform by legislation and not by regulation, which is rather interesting, and it gives us a model or at least something we can study for how property rights regimes may work.

The short version in summary which is similar to what Pablo said so I'll just whip through it, private property rights were defined very simply, something of a minimalist approach to defining rights. The dispute resolution in Guatemala has been mostly a minor factor because there are incentives to overcoming interference when you create this strong bundle of rights. And the mobile telephony market shows that Guatemala has been very successful.

Okay, putting a little bit more meat on the bones from the presentation yesterday, in 1996 the -- [Spanish] -- Telecomunicaciados(?) allocated spectrum into three categories. First one is reserved for government use, the second one is reserved for amateurs, and the third is

called a regulated band, this is a little bit ironic because what they call regulated are some of the most liberalized bands in the world but they use the term strictly translated from Spanish regulated bands.

Okay, reserve bands for government and amateur use, government use has 1,335 megahertz of which 1,000 megahertz are 3,000 megahertz or three gigahertz and below. If you refer to this, some people refer to this as the beachfront property spectrum, government has a third of that. The amateurs have 4,761 megahertz, again from the 1996 Act, but only 12 megahertz of that are in the beachfront property. Both government and amateurs receive -- [Spanish] -- this cannot be sold or transferred and this is separate from what Pablo was talking about yesterday which are the -- [Spanish] -- or TUFs, TUFs can be traded, they have flexibility under tentacle constraints, they are for all these other people in the regulated bands, broadcasters, CMRs, providers, fixed point to point operators and the like.

And this part Pablo describes for you yesterday, TUFs entail the schedule of operation, the area of operation, geographic area, the maximum transmission power and the maximum interference at the border of your coverage area. Evan described the importance of some of these issues yesterday.

A quick summary, TUFs are not licenses, a spectrum license is a right to a very well defied or specific purpose, sometime to a couple of different purposes. A TUF is much closer to a property right, it's a strong use offrectory(?) right, freedom to use the spectrum as one sees fit subject to some very specific technical limits including the specifications that I just laid out.

Okay, the results in the mobile telephony market, which is what I focused most on while in Guatemala, lower prices and increased subscribership, I will show you a picture on subscribership that Pablo showed you so the only thing I want to add to this is the reform happened in 1996, again this was Pablo's slide from yesterday, the reform happened in 1996, at that time there were 40,000 mobile telephone subscribers in a country of about 12.5 million people in the mid '90s. Today, well, this is middle of last year, 3.5 million out of a country of about 13, 13.5 million people. Wire line went from 400,000 to 1.2 million, tripled in response to this competition.

Guatemala's prices, there's a couple of different measures out there, I chose this slide that shows them as the lowest in Latin America, and this is prepaid mobile telephony prices, four cents a minute, other estimates are 6.5, so I'm not saying this is absolutely the number to take home with you but depending on the studies you're

looking at, depending on your source for the research groups that you consult with, the prices are either the lowest in Latin America or among the two or three lowest countries in Latin America. Regional average in this study 12 cents a minute and this is for prepaid mobile telephony which is the dominant way people receive their mobile telephony in Latin America.

Something that needs to be laid out a little bit in studying liberalization, how does this tie to lower prices? The chain of reasoning is that if you do the econometrics liberalization will beget lower prices, it's really as follows. Liberalization means it's easier for parties to acquire spectrum for highly valued uses. When there's more spectrum for these highly valued uses you have more competitors, with more competition lower prices. Let me show you what I mean.

This is mobile, this is spectrum that can be used for mobile telephony, the slide should say 2003, this sample was done in 2003. Today both El Salvador, well, today Guatemala has a little bit more spectrum then this. The chart shows Guatemala at 140 megahertz available for mobile telephony, I think it's probably 30 or 40 megahertz higher as of today. El Salvador just under that at 137.5 with similar but not quite as significant a reform.

The other countries that are also high would be

Chile and Argentina, they are much richer countries, their per capita GDP is about three times that of Guatemala. Paraguay is the outlier here, a little bit hard to explain, they've been very generous with spectrum, if you look at the far right here you see the liberal mean and then the mean for all countries, so the farthest to the right is the average amount of spectrum across Latin America, a low level 100 megahertz as of 2003 when this sample was done, spectrum for mobile telephony. Compare that low level 100 megahertz to Guatemala and El Salvador at 140 megahertz, also take into consideration the relative poverty of these countries and it's a significant amount of spectrum available for mobile telephony.

What does that translate into? It translates into more competitors and when you have more competitors you have a lower HHI. Again, look at El Salvador and Guatemala, HHI a little over 3,000, as we know if you have a monopoly your HHI score is 10,000, as you have more competition your HHI score comes down, it's the measure of industry concentration. Honduras is very high, this is a little unfair to Honduras so let me point out this is 2000 and 2004, the average, Honduras was a monopoly for 2000, 2001, 2002, and we're now in 2003 I believe they reformed so Honduras is coming down. Other poor countries are coming down like Nicaragua, they're getting some

competition but El Salvador and Guatemala have had competition since the late 1990s, significant competition, really lowers their HHIs, and that explains your lower prices.

But since I spent a year there I decided I'd do a little field research, economists like to do this thing, so traveling up into the highlands, this is the area where they were devastated by mudslides in the fall of last year. But I'm traveling, I'm trying to buy some of these textiles that are really, really nicely made and being an economists I realize that I want to find a low price vendor who's going to give me good quality. Well these ladies, and there were about five or six of them, are poorly capitalized, they don't even own stalls, the women behind them own stalls, these ladies were just walking through the market with as many textiles as they could throw over their shoulders, so maybe a dozen.

I'm surrounded by them, I announce I'm ready to buy, I'm ready to bargain, and I said by the way, does anybody happen to have a cell phone, I'd like to make a call. And the lady on the left here, she was pretty good sized, and she reaches into her, right here, and out comes her cell phone, a rather interesting place to store it but she immediately had a cell phone available. And people on the street, people shining shoes, people driving cabs, my

maid, everyone has a cell phone, not everyone obviously but the number of people who are working, not making a lot of money but have access to mobile telephony is very significant.

And to put a public safety spin on this, because I know it's very important, in the same market a few blocks away I see four police officers, they travel in group because, well, because there's a lot of crime in this country including your drug runners. The gentlemen with his eyes closed but his right hand on what looks to be his handgun, it's not his handgun it's a cell phone, and it caught my attention so I went up and started talking to him and I said do you use your cell phone, why yes I do, well what do you use it for, well, I use it to communicate, don't you have a walkie talkie, there's no police car, these four officers are on foot, do you have a walkie talkie, no, well how do you communicate with your station, well they call me, what if you need them, well I call them on my cell phone, which he paid for himself. So we have a lot of issues to work on in public safety here in the United States, they have more. Fortunately he didn't have to pay a high price to get this so there is some benefit there.

Very quickly, interference disputes, Article 53 in the 1996 law allows a TUF holder with a complaint of

interference to file a complaint, the regulator must notify the accused who must respond within ten days. After that response the regulator must issue a decision, a formal decision, that basically says based on the terms of the TUF what your rights are as a TUF holder, what this party's rights are as a violation, there's been a violation or not of the terms of the TUF and then the decision of the regulatory must be followed.

So a quick summary of interference issues and then I'll wrap right up, is that there is no chaos in the market, especially mobile telephony, the issues or the problems are resolved very easily, but there is a problem with irregular enforcement in broadcasts, particularly in FM radio, there's this little problem of pirate radio, particularly community broadcasters and religious broadcasters who don't feel the need to pay for their TUFs and they just broadcast away and that has not been enforced, the violations have not been enforced against so the regulator has not stepped in in these particular issues of pirate radio.

Last issue, 2.4 gigahertz, that's not a problem of interference, I have heard it discussed in other telecom events, how Guatemala got 2.4 gigahertz, I find that interesting. Guatemala issued TUFs in 2.4 gigahertz, in this band, to a number of different parties, the

predominant user is a band, they use this for fixed point to point in Guatemala City, the metro area, about four million people or so. This bank connects 200 locations and ATMs and the like fixed point to point. Well, guess what's happening? People are using it for unlicensed as well, in their homes, the little restaurant right down the street from here, the McDonald's had free wireless internet for 30 minutes if you bought a Big Mac. I asked the manager what band are you using, 2.4, good, you don't have any right to be there but he did, people used it all over the place in the country, they are doing this and what's happened is the bank would simply raise their power lever a little bit when they had a problem to overcome the interference.

Now as there's becoming more of a concern among the regulators that well maybe we want to see 2.4 used more and more in Guatemala, the Guatemalan government is negotiating with these TUF holders to buy them out, pay them, compensate them, and allow them to locate somewhere else in the spectrum. So we've had two uses going on with this spectrum, a private use and licensed use, a licensed use and unlicensed use, and now we're moving to government buying back the property holders in that band.

Last slide, my summary, increasing the rights to spectrum increases the use of that spectrum and efficiency in economic terms, this is economically efficient, creates

consumer benefits which I hope I demonstrated, but some rights are imperfectly protected, they need to be protected better and they haven't been, it's the one weakness that I see in the Guatemala experience.

Thank you very much.

[Applause.]

MS. OBUCHOWSKI: Our next speaker is going to be Peter Pitsch who is speaking for Intel but I think all of you know Peter worked at the FCC as the head of the Policy Office and is one of the great fathers of a more economic approach to spectrum allocation. Peter?

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Peter Pitsch

MR. PITSCH: Thank you, Janice, it's a pleasure to be here. I want to give you a front line approach to market based spectrum management techniques in the world and this is going to be Intel's view. I'm going to talk very briefly about technology abundance and the artificial spectrum scarcity that we see and then tell you how we try, are trying to solve this problem. We're not trying to solve or cure world hunger here, we're out trying to get spectrum freed up in a way that new technologies can get in the marketplace quickly and usefully, and our emphasis will be on increment reforms. I am glad to talk about lots of things that are going on in the U.S. but frankly most, if

most of the world were following what we were doing in the U.S., or for that matter the UK and some other places, I wouldn't have to spend 80 percent of my time on this issue.

Just to set the stage for you there are lots of services and technologies in the wireless mobile space alone. The point of this slide is to show you that there are many different standards out there for differing reach, some of them will overlap with others and others will have particular value or comparative advantage or absolute advantage in narrow uses. But the point is there are lots of things coming down the road and in particular something called OFDM which I think for, and many people at Intel and elsewhere think is going to supercede the other technologies, it's the way wi-max(?) and UWB and wi-fi and even 3GPP are going. So we've got this tremendous problem of how is this new technology going to get in the marketplace.

I want to give you one concrete example of something that Intel is very interested in, that's wi-max, we this is going to be a great wireless broadband technology, it's going to have lower intellectual property costs, it's going to use OFDM, it's going to be a data centric from the get go technology which we think will work better and it will have applications for backhaul and for fixed uses. But eventually in that upper right corner it's

going to go into laptops, Intel's vision is to put this just like today 90 percent of laptops ship with wi-fi in it, that's where we want to get with wi-max. That means the incremental cost to customers is going to be very low, the average cost to customers is going to be very low, Intel is in the business of making ten to the 7^{th} or ten to the 8^{th}, that's what we do, we're a manufacturing company. And Moore's Law is a huge black hole and we're going to suck all those costs of making radios into that microprocessor and that's going to be very good for consumers but we are not going to be able to do that if we can't get our technologies into the marketplace because of a block on spectrum.

I'm not going to tell you much about wi-max, it's very, there are a lot of companies behind it, it isn't just Intel, okay. This is the fundamental problem, spectrum scares the, as I travel now and I do quite a bit and I go to each country, I frequently meet with people from their spectrum regulator and they all have a chart that looks just like this, it looks like a madras shirt, it's all spoken for. But as many people in this audience I think realize this scarcity is artificial and I would suggest just look at auction prices for different spectrum, some spectrum is much more highly valued, in a more market oriented approach it would attract additional spectrum and

drive down that price, that is the very point that Wayne was just making in Guatemala. Mobile broadband spectrum is way too scarce and relatively speaking in the U.S. we don't have that much available, most of the most valuable spectrum, I use 300 to 3,000 as the beachfront, is in command and control. It doesn't mean that we don't need command and control, command and control is better for certain uses. But like Martin, I avoid getting sucked into the religious wars over license propertized approach versus commons, I think we need to move more from command and control into both of those uses, and if we do that, if we make things more flexible, we're going to get better uses but most importantly we're going to free up technology.

Now how does Intel come to this view, how do we try to work with countries around the world? As I indicated we're not going in and saying you ought to adopt the new Zealand approach or the UK approach. What we do is say on the margin you need to make your spectrum management more flexible, more technology neutral, and if you do that you're going to improve use, you're not going to get locked into obsolete technologies, you're going to give your consumers the benefit of technologies as these various things merge and by the way, Intel is going to give your consumers the benefit of really cheap radios down the road.

Why does Intel take this approach? One, we think

it makes sense and it's compelling and it has a lot of moment behind it. But it makes a lot of sense from our standpoint, we're trying to for example promote the use of wi-max, we're not going to go into every country and give them a cost/benefit study on why they ought to take some spectrum away from somebody else and give it to some narrow allocation of wi-max, that would be foolhardy, it would be extremely expensive and difficult. We have a global story, make your allocations more flexible, let us sit down with the carriers and we'll make business deals with them, and if we're right that all FDM based wi-max makes more success we'll succeed, if we can't make that deal we'll fail. We're not asking you to make an allocation to wi-max, we want broad based wireless broadband allocations and that has been very successful for us. And in the long term Intel doesn't care about wi-max per se, what we want is that spectrum to be as plentiful and useful for technology because in the end we're going to be putting multiple radios in our chip sets.

This is the problem we have in wi-max, we're not going to get one global allocation for wi-max, we're focusing at two gigahertz band and three gigahertz band, a couple of different slots in two gigahertz, a 58 gigahertz band, and then I should have added, or could add, below one gigahertz.

This is the slide I want to take a moment to talk about, this is where the rubber meets the road and I'll give you some specific examples of what we're trying to do. There's a 3.5 gigahertz allocation to fixed wireless or broadband wireless, over 100 countries have this allocation. We're not trying again to solve everything here, we're going in and saying don't limit this to fixed, allow nomadic use as well, allow this laptop use as well. And we have been largely successful.

Similarly when we go to these countries we'll say make broad license, because it turns out that OFDM based technologies are much more efficient, you can't exploit their true technical efficiencies if you have wider licenses, so make it possible when you structure your auction or when you actually allot channels for someone to have a big license, preferably 30 megahertz or more.

I was just in Mexico City talking with their regulators saying you should structure your auction at 3.5 to allow someone to gain access to 50 megahertz of spectrum, in that case there's not a competition question at all, allow that kind of increment improvement. At 2.3 this is interesting, in Korea, a first is a measure of my bonafides here, Korea when we were dealing with them wanted to mandate wi-bro(?), their version of wi-max, and we actually sent a letter to them saying we do not want you to

allocate 2.3 to wi-max. We want you to allocate it to wireless broadband and in the end they did what they wanted to do. But we did that not because we're altruistic or more principled then anyone else, although I like to think we are, but we did it because guess what, the regulatory market is a global marketplace and we're out working in the ITU as Francois can tell you saying you know what, tech neutrality makes sense, service flexibility makes sense, and we can't be bobbing and weaving when we're breaking our pick in the ITU trying to open up that 2.5 gigahertz spectrum for more technical neutral approach.

And that's where I want to go next, 2.5 gigahertz, this is absolutely crucial to new wireless broadband technologies. The ITU created a global allocation at 2.5 gigahertz for the IMT extension band, IMT 2000 extension band 3G, five air interface standards are permitted on that band. This was done a long time ago and Intel's position in the ITUR as well as some other countries now including the UK, Australia, Canada and others, is you should make, the ITU should change its recommendations and make it possible for carriers to choose from among other wireless broadband technologies. This is highly controversial but I think this is something that the people in this audience, people need to focus on, not only my friends in government but my friends in academia and

others. An incredibly important decision is going to be made on this 2.5 gigahertz and if the 3G licensees succeed in locking up this spectrum for only 3G, only consumers are going to suffer.

And I want to talk a little bit about this and then relinquish the floor, one of the arguments that people say well, we've got limit it to these 3G interface standards. That battle was lost a long time ago, there are five standards there right now, the market is going to choose among them, they're not all compatible. And guess what? Markets do a great job of solving interoperability and reducing cost questions, just look at the U.S. cellular market, when I was at the FCC we totally bollixed things up on cellular, we fragmented the market, at great cost the market created national carriers, we solved interoperability problems, reduced roaming costs, reduced merchandising and marketing costs, they did all these things because it made business sense. Intel fully subscribes to open global standards, we'd love nothing better then for carriers to congregate around one of these.

What's the other argument? Guess what, it's protectionism and one of the perverse things here is that the 3G auctions are oftentimes argued as one of the reasons why we can't open up the IMT extension band to other wireless broadband technologies, these companies pay too

much. Let me just toggle between this slide and that one, this is the per capita in euros, per capita price that was earned in some leading 3G auctions, this is from Paul Klemper's(?) book which I highly recommend. And you can see that the two big outliers here are Germany and the United Kingdom. You know who strongly supports us on opening up this spectrum is the UK and I really think that at the end of the day if auctions become an excuse in a very mercantilist fashion to protect the vested interest rather then benefit consumers that will be a major disadvantage from having had auctions. Now I happen to believe in most cases they lead to more flexibility, more technical flexibility, fewer channelization and other things, and actually lead to more spectrum getting in the market but that's not been the case.

And just one last thought, in the ITUR process one of the groups who mostly benefit from this approach because wi-max is particularly attractive for rural applications is developing countries, and frankly at this stage in the process they haven't been all that involved.

So summary, wireless broadband is the battleground for spectrum reform, the government needs to focus on it and as I'll refer to something I use with my kids as well, Martin, and that is frequently I have to remind them that yard by yard life is hard, inch by inch

life's a cinch, and that's what we really need to do, we need to win these battles on tech flex and tech neutrality in a few key places in the wireless broadband area today.

Thanks.

-- [Applause.] --

MS. OBUCHOWSKI: Our last speaker of the morning is Francois Rancy, he is the head of the Agence Nationale des Frequences, it's the French FCC equivalent I guess you'd say, the allocator of spectrum, we're very fortunate that he came here. I always said when I was at WRC to our U.S. delegation that if Francois didn't exist I'd need to invent him, because he held his delegation to such a high standard that it was very easy for us to mobilize by saying France is going to be prepared, we need to be equally prepared. So thank you very much.

Agenda Item: Topic 3: International Experiences in Market-based Approaches - Francois Rancy

MR. RANCY: Thank you, Janice, thank you for all the kind words, I think you did quite well as well.

Well ladies and gentlemen it's a pleasure to be with you today. As the previous speakers I will only speak in my personal name and of course as you have understood in Europe we are not quite as advanced as UK in putting together the secondary markets but since two years ago the European Commission has basically told the path to us and

all countries now are introducing or have already introduced that but it’s obviously too soon to get any return on experience on that.

Another aspect that we are developing in Europe currently is flexibility and technology neutrality through a concept which was adopted at U(?) level a few months ago which is the WAPECS concept, you might hear that concept in the coming months, it standards for wireless access policies for electronic communications systems and the idea behind that is to set a few principle among which flexibility and technology neutrality for future allocations. Of course this is only a concept and no frequency band has been designated yet to use this concept and of course as soon as we will get to a particular frequency band you will start running into deficiencies, and I can follow what Peter just said is that the first candidate for that is 2.5 gigahertz band, and so we’ll get very soon in this debate, we are actually quite within it already.

So since we have not much experience and I’ve not much to tell you I first would like to go through our understanding of the secondary markets and see what lessons or what avenues we could do to make it work, I think everybody is keen on making that work but we have to recognize that there are some deficiencies. So what is

spectrum trading, secondary markets, it's basically allows to distribute rights along space, along time, and along bandwidth, so basically you have portions of spectrum which can be used when you need them, where you need them, and in the quantities you need.

Now are there any problem in implementing that? And I think you and Bruce went a long way to explaining the type of problems. Well, first, what I designated like pieces of sugar, spectrum is not sugar, it looks much more like mozzarella after half an hour in an oven over a pizza, if you try to take a piece of it very quickly everything goes with it, I'm sure you have all experienced that. And also the rights are very elusive and the reason for that of course is interference, interference links spectrum to adjacent spectrum and distant areas and of course you can say it's an externality, we know how to handle it from an economy point of view, I think it's so complex that it's not as easy. In particular most spectrum is shared, the discussion I have heard yesterday where implicitly predicated on having exclusive allocation or exclusive rights over a portion of the bandwidth, most spectrum is not going to look like that, most spectrum is shared with space services between commercial application and government applications and therefore I certainly am very much in line with what Hugh said and Bruce said, physically

only a part of the spectrum is likely to be suitable for spectrum trading.

Also one important aspect is that if you are in spectrum which is shared with others the rights you have are not going to be exclusive rights, they are going to be rights which are negotiated with time and basically on the per station basis against the other users of the same spectrum. And so what you are doing there for secondary trading is essentially permitting somebody for these rights to make assignments and therefore what you are doing is only delegating to the private sector the management of the spectrum because making assignments is basically managing spectrum.

One avenue which has been taken in the particular case of exclusive spectrum where secondary trading might be most efficient is to resolve interference through fixing limits at the borders and if you do that you have to realize that this will result in efficiency depending on the frequency band you are using and on the size of the area where you have the license, there could be a very large inefficiency, you just have to recall that in the broadcasting for example the service area is a few tens of kilometer but the area in which you can produce interference may be a few hundred kilometers. So you can see how much the service area is going to shrink if you

impose to meet a certain limit at the order of the service area, basically it could be one tenth or one fourth of what it could be without fixing limits. So please bear in mind that fixing limits seems nice because it makes property rights very simple but in fact it will result in efficiencies.

Also I would like to emphasize the power limit, like having a mask(?) as was very eloquently described by our friend from the FCC yesterday, it's very difficult to establish in a technologically neutral way or in service or application neutral way which is what we would like to do in the WAPECS concept.

Why? Because this mask can be designed in a million different ways and when you design them you always have some assumptions in your mind and these assumptions are based on what the technology is at the time you do that. It's like science fiction, after a few years it's outdated so after a few years you are likely to see a technology which is going not to fit in the mask but could be very interesting, I think wi-max is a very good example of that. So don't expect that technology neutrality is going to resolve things because in practice there is no way of ensuring technology neutrality over the time, it's something which is acquired at the given point but two years later it may not be applicable.

Another point which I would like to draw your attention upon is that time sharing, which has been suggested, is something which will work in some cases but not for large networks, you can't have a cellular mobile network developed using various frequency bands and you would basically go from one frequency band to another depending on the level of traffic, it's not going to work.

Now markets require stability, predictability and transparency, all that may not be so easy to achieve through secondary markets, I will go quickly for that.

Now I would like to focus the rest of my presentation on one aspect which has not been mentioned until now I think is that when we discuss secondary market the idea is the secondary market between operators essentially, like cellular operators or broadcasting operators, it's what I would call a retail market. But this market is actually fed through an upstream market which is something I could call wholesale market, which reflects the transactions being done between governments and regulators.

And if I can take the example of the French approach to how these transactions can take place we have two regulators for commercial communication, one is asset for telecommunication and CSF for broadcasting, and the situation is the same in most countries, FCC has the two

together, OFFCOM has the two together, but in general they're separated, as you said because of the political cloud of broadcasters. We have tried to merge that in France a few years ago and we couldn't do it. So these people are regulating the commercial radios but there are other wholesale users which are the government agencies. In France we have eight, I think in the U.S. under the NTIA you like 20 or 30, quite a lot in number.

The French to having these people discuss and establish transaction of spectrum to basically adjust to the market requirements of the downstream market is basically why we created the Agence Nationale des Frequences, be cause the agency I am director general of is actually putting all these people together, it's not above them, it's in between them, it's taking all of them together and so that we can function all together and unite our forces and find solutions. So this is what ANFR is and as a result of our activities, and activities which started even before the agency was created because we had similar model before, I take the example of what spectrum transfer occurred in France in a period of ten years between '92 and 2002 from the defense department to commercial communications. 50 gigahertz for GSM 900s in the '92 area, GSM 1800 150 megahertz, two gigahertz 3G, 140 megahertz and 2.4 gigahertz, the wi-fi band, another 83.5 megahertz. The

total of bandwidth which was transferred from the defense department is most of this band which is 350 megahertz. I think I will have to check with Thomas, his chart, because the chart we had yesterday was indicating a total in France of about 300 gigahertz and in just these example go to a total of more then 400. So it's just to explain to you that the main trend in the retail market or what we discuss in having secondary market for, the main trend is that this market is fed by the upstream market with new spectrum which is essentially given by the defense departments.

Now how did we do that? One very important instrument to enable this to happen in France in a very smooth way, an organized way, was the idea of having a spectrum refarming fund and over the last ten years these refarming fund has essentially put about $100 million into this process out of which you can see that only about two thirds have been spent for getting new bands for mobile, the rest of it is currently being spent for digital television, or television digitalization. I think this model has been also recently chosen in the U.S. to achieve the same purpose.

Now as a conclusion something which has struck me in the last two days is that one perception of spectrum management, in particular by many people in this room, is that we have the ITU, 189 member states, we have in Europe

CPT, 46 member states and 25 European Union member states, all these people actually are giving orders to the broadcasting regulators and the telecom regulators which in turn are giving orders to the stakeholders, namely the mobile and broadcasting operators, and all that is done through the ideas words of command and control.

So that's how the spectrum management is perceived by many people and my 15 years of experience in going through all these stages in various countries in the ITU, CPT, and European Union is absolutely not that. Mine is you take of course the same fora and the same actors but my view is that all that is done through negotiations and consensus, and that the people who are running your show are not the member states or the regulators, they are the stakeholders. And I think if we want new spectrum approaches to get to a better and more efficient world I think we have to take that into account, it's how things actually get done in the ITU, it's not by command and control in the ITU or in any country. And certainly I think the key to the success for introducing new approaches is that people discuss and so that ends my presentation.

Thank you very much.

-- [Applause.] --

Agenda Item: Q&A

MS. OBUCHOWSKI: Well that is a very fresh point

of view and I think a very good point of view upon which to conclude our formal presentations here. We're already out of time but I don't want to leave you without the opportunity to at least pose about three questions to our panelists, so if I might begin with you, Peter. And if you could introduce yourself, I know many of you know each other but introduce yourselves and them pose the question.

MR. CRAMTON: I'm Peter Cramton, the University of Maryland. I want to take us back to the very thing that Martin opened up with some time ago which was OFFCOM's approach to managing the spectrum, in particular when they were preparing for an auction, and the notion that they would try to speculate how they thought the auction, what the auction outcome would be and then use that information in designing the band plan. And I'd like to suggest that while that is a very useful step to take that in fact if you do exactly that, and I think there is a tendency to do that, that what you end up with is, and then you run a simultaneous sending auction, determine who the winners are, what you've done is effectively minimized competition to the extent that the, for example say you had 90 megahertz of spectrum to allocate and you felt after doing your analysis that Votaphone(?) should win 40 megahertz, British Telecom should win 30, and the remaining 20 megahertz should be split ten/ten between Orange and

whatever One to One is called now. Then they would step into the auction and they'd effectively know how the spectrum is to be divided among them and there would be no competition on the margin for the spectrum and there'd actually be no reason for price to play a role in that allocation. And I think that is the danger with auction methods such as the simultaneous ascending auction that the FCC and others use, that you sort of can fall into that trap and not have the competition at the margin, whereas if you structure the auction in a way that allows the competition at the margin so that Votaphone and British Telecom can fight over who's going to get ten megahertz more or less then you come up with market prices.

MS. OBUCHOWSKI: Was that a question or --

MR. CRAMTON: That was a question.

MR. CAVE: Well as I suggested I was uneasy about it because I remember I used the phrase a self fulfilling prophesy, that you run the risk of creating the market structure that you think is most likely to merge. And the problem doesn't only relate to what I guess your example would be sort of intra-modal competition because there are obviously with a lot of frequencies very considerable inter-modal or inter-standards competition. And I think there the risk of actually prejudging the outcome is probably even greater because the very parameters you'd use

to configure the offering would lead you towards one particular technology rather then towards another which is I guess probably likely to be even more harmful then what you're described. So it's a very different balance to be struck and I'm not certainly qualified to do it but I think anybody who can devise auction methods which introduce the maximum flexibilities is obviously doing a considerable service.

MS. OBUCHOWSKI: Next question.

MR. JOINED(?): I'm Bernie Joined of NTIA, I've got a quick question, everybody has been talking today like secondary markets is a great thing and that proves privitization is working and it's the marketplace and that's where we should be going. Maybe so, I'm not an economist, I'm an engineer, but it reminds me back to the days of the IPA stock market five years or so ago when companies were going on the market left and right with shares of $15 dollars a share typically and by the end of the day they was up to $100. Hey, that was a great thing, people made money, but the company didn't make any money, maybe they should have priced it more at $60 or $70 or $80 dollars a share in the first place. If the company is doing that there's their business. Is that what's happening in the spectrum? Have any studies been made to see if the prices on the secondary market are considerably

higher then the original price and if so has the public been gypped out of some money that maybe takes away the debt in New Zealand but the very small secondary market might be the way to go. Just asking a question, has any studies been made or does anybody have anything on that?

MR. PITSCH: Well Paul Klemper's book gets into the auction design and how it played out in Europe in great detail and how you structure, how many licenses you have and how many likely competitors there are and whether or not the other spectrum is flexible has a big impact on that. But just one factoid, when we were arguing for a date certain for the DTV spectrum in the U.S. we hired an economist, Colin Baslon(?), many of you know him, and so did others, to look at what that spectrum would be worth. And the prices that we came up were a function of not only the FCC and auctions of the next wave spectrum but also private transactions and those prices were roughly comparable.

MS. OBUCHOWSKI: Last question.

MR. BALT(?): I'm Gustav Balt, independent researcher affiliated to a small institute at Howard University, I'm based in France. My question is to Mr. Pitsch, if I listened correctly you did not seem to insist very much on the harmonization which you possibly require, harmonization of bands. When I started to get interested

in spectrum, that was already a few years ago I must say, very wise people told me that really now with the new technologies, cognitive radio, software radio, frequency agility, there is really a lot of possibility now for a system for new technologies to get agile enough to handle various frequencies in various countries, so my question was to Intel who is obviously quite advanced on all these questions whether you had a reaction to this. Thank you very much.

MR. PITSCH: I'll try to be brief. I three see ways to get to harmonization, one, through a command and control process, it can be negotiated but at the end all the countries agree you go to do X. I think that takes too long and you're taking spectrum back from people, Intel has got to get something done in two years, that's our product cycle.

The other way is the way I suggested, make more and more bands flexibility and then let the marketplace sort it out and those deals can get driven very quickly if there's money to be made.

And the third way is through technology, SDR, and I think in the future that holds great promise but I think that's more then a few years out yet.

MS. OBUCHOWSKI: I have the privilege of the chair to ask one last question, I've wanted to get back to

I think part of the guiding direction for this conference. You are truly some of the best gurus in the world, can you share, if you're looking to net out consumer benefit what would be the single reform you personally would seek to implement based on your experience? I'll begin with you, Martin, and we need to be very brief.

MR. CAVE: I'm assuming you've already done a fair degree of marketization of commercial spectrum and in terms of government spectrum the key to increase efficiency in my view is to find some mechanism of, and this is an interim solution because as I've indicated I prefer application of markets public sector spectrum, find some interaction between a charging regime and an incentive regime through budget making and investment appraisal and so forth that actually puts pressure upon public sector spectrum users to justify the use of the spectrum that they have. I think that's where you can get very big gains, I think it's a practical process, doesn't require overthrowing the constitution, and that would be my suggestion as to where to go.

MR. EMIRALI: I don't believe I'm going to say this but I tend to agree with what Martin was saying, I guess because in New Zealand we are taking a cost approach to the crown spectrum to try and get some efficiency. My own personal experience is the cost way that's being done

is not the main driver for efficiencies but I think there is some middle ground there. Certainly as I said before the technologies at the military are developing are forced, mainly because the long cycle of getting equipment means that we look inwardly and we take more efficient technologies but we don't actually look at the spectrum that's being used to see what the flow on effect is, we tend to use the spectrum, if I can say it, spectrum efficient technologies and apply them across the same spectrum assignments or allocations, so I do believe there is some room in there.

I might just point out though that a lot of the crown agencies or government agencies carrying out government policy and they don't have all that much flexibility so that has a bearing on the overall thing as well. Thank you.

DR. LEIGHTON: I promised to limit my comments to Guatemala and I'm going to continue to do that here, but what they did right as I stressed was they created a very strong bundle of rights, I think that is an important lesson, a highly flexible, not anarchy within technical constraints but limiting themselves to restraints that are associated with technology, with not interfering with your neighbors. And then for lessons learned, things they could have done better, essentially not to drop the ball when it

comes to enforcing those rights, which in general have not dropped the ball but in one case, in the case of FM radio and pirates operating in those bands they have dropped the ball there and they could do that better, in other words create a strong bundle of rights and enforce those rights.

MR. PITSCH: The government should focus on the 300 to 3,000 megahertz where the value is the greatest and the interference problems are manageable, they should use auction vouchers and two sided auctions targeting existing bands of spectrum to open up wide band licenses for flexible use. I would incorporate by reference the public sector stuff.

MR. RANCY: At the risk of surprising you and in the interest of time I think I will agree with Martin Cave as well.

MS. OBUCHOWSKI: So thank you very much.

[Applause.]

[Whereupon at 11:49 p.m. the meeting was recessed, to reconvene at 1:05 p.m., the same afternoon, March 1, 2006.]

A F T E R N O O N S E S S I O N [1:05 p.m.]

Agenda Item: Topic 4: User Perspectives

MR. HATFIELD: Our fourth topic and that is user perspectives and that will include this afternoon two panels; one, government users and then commercial users and then I want to remind you, too, at the end, we are going to have a wrap up session. I will urge you to stay around so that we can have some further discussion, more open-ended discussion about the things that -- issues that have been raised.

Our next panel then, government users, will be moderated by Peter Tenhula, somebody else that is known, I am sure to most of you. Peter just recently changed jobs. He joined Shared Spectrum Company as their vice president of regulatory affairs and business development. Of course, prior to that, he spent some 15 years at the FCC, where he had a number of important posts, including a very influential role, of course, in the release of the Spectrum Policy Task Force Report.

So, Peter.

Agenda Item: Topic 4¨ User Perspectives – 4.1 Government Users and Critical Infrastructure – Peter Tenhula, Moderator

MR. TENHULA: Thank you, Dale. Dale mentioned we are going to be changing gears a little bit, moving from

the high level academic and broad perspective to -- into the weeds with the real users of the spectrum and hear from their point of view about -- from the government users and then the next panel, commercial users.

What I have come to appreciate -- I will come at this from my perspective from my years at the FCC, where I come to appreciate that this is -- these applications of spectrum are probably the closest you will come to a public good in the economic sense. I have come to appreciate the value that these kinds of services offer to society. There are unique spectrum needs that these users have, but I think they will come and tell you that they are often on the defensive and they are fighting, you know, to protect the spectrums and the systems that they have in which they have devoted significant resources and for which the benefits are largely unknown. I hope we will hear about those benefits.

These are benefits that are unknown to most people or just taken for granted, like keeping your plane in the air. Like, for example, radio astronomy has contributed to significant scientific discoveries in space. The monitors natural phenomena on the earth from up in space and from my perspective, I was appreciative to this radio astronomy community for really giving us the concept

of interference temperature, which we stole and used in the Spectrum Policy Task Force Report.

Another thing that we take for granted is GPS. Pretty soon, it will be in all our cell phones and it will help 911 find us as one thing. There are broad benefits both to the public and the private sector, you know, from systems like GPS and aeronautical radar that keeps the planes, you know, as close on time as possible. The radars and the radio that make up these very complex systems -- I went out to the ATC center out near Warrenton, Virginia and I just was amazed at the complex and what kind of important job that these guys have and the communications backbone that is necessary to keep that system running.

Last but not least from a military perspective, where, you know, they have unique domestic training in homeland security needs and then the need to use spectrum on a global basis to do rapid and sometimes extensive deployment. So, we will hear of that.

The first speaker, which will present the radio astronomy or the astronomical point of view, is Tom Gergely. For about 20 years, Tom has been at the Division of Astronomical Sciences at the National Science Foundation. He is an electromagnetic spectrum manager and he is responsible for ensuring continued access of the U.S. scientific community to the radio spectrum, in particular,

protection of radio observatories from interference, as well as for coordinating their activities with communications services that make active use of the spectrum.

Tom.

Agenda Item: Topic 4¨ User Perspectives – 4.1 Government Users and Critical Infrastructure – Tomas Gergely

MR. GERGELY: Thank you, Peter. It is a pleasure to be here this afternoon. As Peter said, I have spent quite some time at the National Science Foundation. I am going to talk about radio astronomy, which is probably less well-known to most of you than the other services that have been talked about this afternoon at this meeting. So, I would like to talk about why we do radio astronomy in the first place. Well, in the first place, of course, we do radio astronomy because of the science. Radio observations provide unique information on the cosmos that cannot be obtained by any other means, not at optical wave lengths or sometimes any other wave length of the electromagnetic spectrum that at this point we aren't exploiting quite fully either.

There are a number of physical processes that can only be detected that occur in the universe naturally that can only be detected through radio waves and I have given a

few examples here. Antigetic(?) electrons in magnetic fields -- in radio galaxies. Pulsars are mostly only detected in radio regime -- neutral hydrogen, et cetera, et cetera and secondly, radio waves are more penetrating than optical wave lengths and many regions of the universe can be observed only at radio wave lengths.

For example, the galactic centers. Having said that, let me give you a few illustrations of these. Here I have a group of galaxies in what is called the M81 group and you have on the one hand the stellolite(?) distribution in this group of galaxies and on the other a beautiful radio map made by the very large array, an institution that we support at the National Science Foundation, which brings out very clearly the interconnections between these galaxies.

Next is a radio image of a super nova remnant and you can observe an extremely exquisite filamentary structure here. This structure is not obvious at optical wave lengths, although I don't have an illustration here. Another example is the neutral hydrogen disk of a spiral galaxy, which is shown on the right here at optical wave lengths and these images are on the same scale. You can see the radio extent of the neutral hydrogen gas, which is about 90 percent of the universe and how much further it extends and you can also observe some little black holes in

this distribution, which are actually voids created by super nova explosions, again, not observable at optical wave lengths.

Finally, for this slide show, I would just like to show you two recent discoveries of radio astronomy, both, again at the National Radio Astronomy Observatory. Particularly, I would like to call your attention to these huge super bubble rising above our own galaxy. This is an artist's illustration. You really need to analyze the data to come to this conclusion of our own galaxy that we would not have known about without going to radio wave lengths and particularly the hydrogen line.

Now, science is not the only reason why we do radio astronomy. Secondly, we also have spinoffs and applications of radio astronomy and I have listed a number of these that is very far from being exhaustive. A lone example of -- are, of course, have been pioneered by radio astronomers. They are used in all of the telecommunication industry today. Average -- synthesis for which Sir Martin Rile(?) and collaborators won the Nobel Prize way back in the late sixties that gave origin to synthetic -- rater and x-ray tomography, also CT scans, remote sensing satellites is essentially used techniques that were first pioneered by radio astronomers and on and on and on.

I would just like to dwell on the last one, physician determination. Most of the cell phones in the U.S. will use a method developed by the company physicians founded by astronomers to determine their position when they make 911 calls. So, it is another example of how radio astronomy has contributed very concrete examples to daily life.

Then education, radio astronomy is a very useful tool to educate electrical engineers, physicists, astronomers and last but not least perhaps prestige -- the U.S. is a world beater at radio astronomy. This is recognized the world over. People from everywhere else come to use our telescopes and the U.S. can also show four Nobel Prize winners in radio astronomy. So, it is really a prestige item in our science constellation.

Let me then show you what is the spectrum that radio astronomers use. I hope you can see the colors here. Exclusive passive primary spectrum is shown by the green lines here in the spectrum chart and shared primary by the yellow and so on and so on. You can read the footnote. The interesting thing that I would like to remark on here is that radio astronomy bands are not selected at random. They are governed by the laws of physics that have been mentioned a number of times already.

For instance, we cannot really observe the hydrogen line at any other frequency than at about 1,400 megahertz and very fortunately for radio technology, there are fairly few of these lines that occur below what has been several times referred to here as prime real estate, namely, below 3 gigahertz or two gigahertz, whatever, whichever way you want to look at it. But then, of course, nature is perverse and even though we have few of these lines occurring, about 2 gigahertz, it ratchets them very highly. Most of the universe is receding from us and this causes the rate shift in the frequency of these lines.

Actually, the line that originates at 1,420 megahertz is observed at frequencies as low as 100 megahertz. Radio astronomers occasionally would like to have access to all or most of the spectrum at some places. Here is an illustration that I actually got from Andy Clagg, my colleague at the National Science Foundation, showing the distribution, the cumulative distribution of radio astronomy spectrum.

You can see that very little of this spectrum, less than 1 percent of the spectrum, is below what is called, again, prime real estate. You have an amplified version of the spectrum below 30 gigahertz. Now, one reason why radio astronomy is difficult and why protection of radio astronomy is difficult is because cosmic radio

sources are roughly speaking a million to a million million times weaker than celestial radio sources. So it is that a cell phone on the moon, which operates and I have tried to be sort of typical here, at 1 watt of power in a 1 megahertz band width, certainly an understatement and an overstatement in those cases, but it is just to prove that actual numbers would give, ever worse, numbers 200 times stronger than the most powerful radio source in the sky at that frequency, which is Casio BIA, a super nova remnant.

The value of the radio astronomy spectrum, well, 34.9 megahertz, roughly 35 megahertz of spectrum is allocated exclusively to the passive services. I would like to emphasize that this is not just straight astronomy but also remote sensing between 100 megahertz and 2 gigahertz, less than 1 percent of the total, but that if one looks at the monetary value of the spectrum options in the U.S. below 2 gigahertz, brought in roughly $500 million per megahertz in this range.

I am referring to what I believe are mostly 20 year leases. A larger fraction of the spectrum is allocated to radio astronomy at higher frequencies, but the value of the spectrum at those higher frequencies is very, very doubtful. I don't think we have any good numbers to compare with. So, based on the above radio astronomy spectrum may be valued at something like 17, 16, 18 billion

dollars, a sum that radio astronomers would -- and government agencies that support radio astronomy, really only NSF and perhaps NASA, would be unable to pay should it come to that. In fact, even a very small fraction, our annual budget for radio astronomy is roughly $60 million. So, there is no comparison.

Well, there are other difficulties with pricing. How to value the benefits of radio astronomy is really unknown. First, a contribution of astronomical knowledge and view of our place in the universe, the way astronomy has really changed our view of the universe and the way we look at our universe.

Secondly, spinoffs that came off radio astronomy and that I have shown you a few of are not easily valued and, thirdly, another problem that has been mentioned here this morning -- I think Francois Rancy referred to that -- is that no band is exclusively allocated to a service and in this case, the exclusive passive spectrum is shared with the URTEC(?) solution satellite service and so we don't we truly know how to manage that difference.

I just would like to show you very briefly these are -- the stars indicate radio astronomy observatories, U.S. radio observatories in different parts of the world. We are currently building an observatory in Chile. The U.S. contributes about 50 percent of the total cost of that

and it is one of the super instruments that the final cost will be close to a billion dollars. It operates in the millimeter range.

Efficiency, well, we have heard a lot about efficiency, but as far as efficiency goes, beauty is in the eye of the beholder. There is no universally accepted definition of spectrum efficiency. By some measures, radio astronomers are extremely efficient. For instance, antenna efficiency, which really describes how much of the incident radiation your antenna captures, I am showing here a graph of one of the antennas of our very large array and you can see that the efficiency of that antenna at its peak efficiency, 5 gigahertz, is 70 percent, which is certainly better than most commercial applications and then it falls away from that.

Receiver efficiency, how much of the radiation that you detect once it has been received by the antenna that radio receivers, that radio -- issues are close to 100 percent efficient. That means that every last photon that is being captured by the antenna is usually captured by the receiver. It is very close to that in the full range of radio -- observation, certainly in the full range of the allocated spectrum.

Now, there are many other ways in which you can measure efficiency. Science may be measured by the number

of citations, cost effectiveness factors and I am -- these numbers come out of BSDD system in the U.K., where cost effectiveness is defined as the number of highly cited papers per year and I don't want to get into the details, and see as the capital value right off of radio telescopes and you can see that optical telescopes are in this measure more cost efficient than radio telescopes. On the other hand, radio telescopes are more cost efficient than space telescopes.

This is largely a matter of definition. So, I will not insist on this. Another measure is the number of papers that come out of telescopes and this is a histogram that shows a number of telescopes and the very large array antenna, which we support in New Mexico is by almost any measure the most productive radio telescope and by some measures the most productive telescope in the world today.

Summary, historic trends, there is an increasing trend towards broad band receivers that are required to -- that is required by the science -- radio telescopes are increasingly receiving -- well, increasingly looking at spectrum in a very broad range, a hundred megahertz to 20 gigahertz in some cases and dynamic scheduling. If the telescopes are scheduled to observing the band with the best prevailing weather, which is very important because these are very costly telescopes.

So, in summary, the value of spectrum used by radio astronomy is difficult to evaluate in monetary terms. Spectrum fees, particularly if they respond to any measure of reality, are likely to stifle or even make these services unviable. This is certainly not a unique thing to radio astronomy. It can be a set of satellites, for instance, and there would lost opportunities in innovation and scientific knowledge with -- if that would be the outcome and dynamic sharing may offer some promise but it has to be thought about very, very carefully. Otherwise I don't think it will be possible. Again, we heard this morning, for instance, that large systems do not easily dynamically time share.

I will leave it at that. Thank you.

[Applause.]

MR. TENHULA: Thank you, Tom.

$17.5 billion. That is a nice piece of property you are sitting on there. I am not sure I would publicize that too much.

Our next speaker is James Miller. He is the senior GPS technologist for NASA Space Communications and is responsible for advising senior NASA management on U.S. and international spectrum policy and technology issues.

James.

Agenda Item: Topic 4¨ User Perspectives – 4.1 Government Users and Critical Infrastructure – James J. Miller

MR. MILLER: Good afternoon, everyone. I want to thank Tom for doing my homework for me of $17.5 billion. Certainly appreciate that.

I know there has been much discussion in this forum about improving spectrum management through economic and other incentives, such as regulatory changes that support valuation and use of spectrum as a commodity, as well as the adoption of technology fixes, such as software defined radials and new ways to use spectrum, such as ultrawide bands. So, today I will give a perspective on the benefits of managing spectrum based on the societal benefits. It provides our nation when it is managed as a public good and some of the potential pitfalls when it is not.

I think that with all the economists in the room, there is no argument to the intrinsic value of our nation's air waves, but it is crucial that we look at both sides of the equation when we attempt to assess purely monetary values in spectrum assessment. From a specialized federal government entity such as NASA, spectrum is the invisible infrastructure we depend on to serve the American people.

It is a public good that needs to be protected because it is a finite resource that can be polluted.

The other perspective, of course, is that spectrum is a pure commodity to be traded, leased, sold and auctioned off to the highest bidder with the most gold. There are economic gains to be made by this, but we must be careful not to disrupt the congressionally mandated missions of our federal departments in the bidding processes.

We care about the impact of spectrum encroachment into federal radio bands because the unintended consequences in opportunity costs can be quite substantial to all of us. -- interference to safety of life signals forces constraints on critical or strategic applications, such as transportation safety or scientific research. This, in turn, could lead to forced costly upgrades to current infrastructure as tax dollars are used to replace equipment that is no longer effective in a busy spectral environment, data radio frequency interference.

The end result is a reduced return on investment for legacy system and more complex certification processes for future spectrum-based services. Finally, the rise of the electromagnetic noise floor could prevent many safety and scientific-based applications from maturing even before their potential is captured.

Here is a chart to use as an example to assess what is occurring in key bands important to NASA. As you can see, the GPS are one band used for public safety and the 23 gigahertz band used for passive sensing are only small slices on the spectrum chart. Yet, the GPS bands are under constant pressure because they are truly beach front property bracketed on both sides, both by mobile satellite service applications that are now building terrestrial networks out to expand their reach.

Technology advances and innovative services make our U.S. economy strong, but we only need to take a look at what is now defined as the ISM garbage band at 2.4 gigahertz to see what can occur if continued spectrum deregulation and widespread proliferation of unlicensed services occurs before safeguards are in place to protect critical bands.

So, with pressures building for more spectrum access, I think we all can agree that reform is needed, simply because the existing legal and policy framework for spectrum management has not kept pace with the dramatic changes in technology and spectrum use. For some, this means gaining access to more spectrum through what is termed economic incentives. To others, it means ensuring that protections are in place to ensure safety critical

operations are not eroded as the spectrum becomes more available to all users.

So, the deliverables of these discussions are listed here and I am sure everyone is quite familiar with them. I think that it is no surprise that it was challenging in addressing the inherent tensions between providing more spectrum to new users and protecting incumbents, including Federal Government service providers, but I think we did a pretty good job of addressing the public and private sector issues and concerns.

Of course, the recommendations of the two reports were slightly different from the public and private sectors, but from the NASA perspective, these three recommendations provide some robust mechanisms for protections of federal bands. Here are the three. A policy and plant steering group at the assistant secretary level, use of the White House Policy Coordinating Committee, if necessary, and formalization of the Defense Commissioner's role and also addressing critical public safety issues, as well as key military items, are all recommendations NASA firmly supports.

So, I think the key point of our workshop today is that much progress has been made in making spectrum users realize the importance of using spectrum efficiently. However, much work still needs to be done in workshops,

such as this, in designing the specific technical and regulatory methods in which we accomplish this.

From a Federal Government perspective, the NTIA will now continue putting a national strategic spectrum together, which federal departments will ensure reflects the importance of protecting critical bands, even as incentives for more efficient use are deployed. But there are still some caveats. We all know that spectrum is a very unique resource. However, caution must be used when we attempt to mark this resource into a pure commodity to be traded away.

Some uses do still require command and control management. NASA has a vision for space exploration that depends on spectrum and will bring much public good and so none of us should be so naive to believe that all the societal benefits of spectrum can be boiled down to pure economic values. New technologies must be introduced with care. Public safety services cannot become the collateral damage for the last man standing commercial market when the next hot new killer application becomes available. We all know what is going on.

Blue tooth, ultrawide band, Y-FI, they clash it out. We cannot have public safety be the collateral damage.

So, in summary, I would like to state that NASA firmly supports spectrum innovation and creativity. However, maintaining a safe infrastructure for our missions must be our first priority for the American people. We believe that the results of the President's spectrum policy initiative will help us all to find initiative to use spectrum more efficiently as long as both the private and public sectors continue working together to secure spectrum positions that truly balance national security, public safety and economic growth.

[Applause.]

MR. TENHULA: Thank you, James, for the very constructive remarks and support for a lot of those recommendations.

The next speaker is Dan O'Rear. Dan is an electronics engineer at the FAA's Spectrum Planning and International Office. He works on the future spectrum needs of the FAA and coordinates these requirements at the ITU.

Dan

Agenda Item: Topic 4¨ User Perspectives – 4.1 Government Users and Critical Infrastructure – Daniel O'Rear

MR. O'REAR: Good afternoon, everyone. I would like to congratulate such a large group making it all the way to the afternoon of the second day. Still all awake.

What I would like to do today is try to give you an idea -- to answer the question how is this group or any group that comes after it, going to incentivize the FAA to either use licensed spectrum more efficiently or share with anyone else.

I am going to try hopefully -- the challenge is to scope what the U.S. is going to have to come up with to be able to even approach that idea. One of the first things is the fact that the FAA, even though it is a government agency, doesn't have a static requirement for spectrum. It is driven day by day, month by month by both government and also by the market. You know, the FAA doesn't own any of the airplanes that are out there and so it is a significant customer that we have to work with.

As an example of how we are driven by the market, last year, aviation globally was a $1.4 trillion business. Our little agency is not going to stand up against that type of lobbying effort. So, we are going to be pushed in that direction. Basically, the market in many, many cases is going to determine where the spectrum that we use for aviation is going to be applied and where it is going to be concentrated.

On the other hand, even though the market gives that decision, the government has decided that the FAA is going to provide services anywhere in the 17 million miles of their space that we have to service. We don't have the luxury of scheduling when you get to use it or where or how. We just have to be there, provide the service when you decide you want to work there, you being a customer of the aviation system.

Also, what the FAA is really interested in doing, obviously, for aviation to be successful and profitable, it needs to be global, i.e., what we do in the United States, we want to be able to do anywhere else because each time you have to change, carry extra radios, extra navigation equipment, it is going to cost you money. Anybody that wants to come and bring business to the United States, same thing. They don't want to have to equip multiple ways depending on what country they are going to. So, we have all our neighbors around the world that we want to stay in step with. So, that is going to drive high and the way we use spectrum and more importantly, the ability with the speed at which we could make any type of change because you are also now involving in a very large group of people to come to an agreement and that is not something that you could do in the market of say the area around Chicago.

So, the question is how are we going to determine does the FAA really use spectrum efficiently? Well, I could give you several examples. I would tell you it is cyclical. Just air to ground communications band, depending on technology and the growth of the industry, there are times as we are approaching rapidly now that we use the spectrum extremely efficiently because we are almost out. It is going to take a technological solution to be able to continue forward.

Throwing out a couple more gee whiz statistics, last year to and from and within the United States, 700 million people were put on planes and moved around. By 2015 -- that is not as long from now as it was even five years ago, that is real close when we are talking about the speed at which we change, one billion people is what the industry wants to do. Only ten years more than that, 2.1 billion people per year. Okay. We only have a given amount of runways. You can only take up airplanes one at a time. So, if you put more runways or increase more airports, each one of them is going to require spectrum because each one is -- if you put a bunch of runways together, now you have got precision monitoring equipment, more frequencies.

Each person has got to talk to a controller. So, until there is another major paradigm shift or gee whiz, we

are doing person, all we are doing is using more and more of our spectrum. Okay. When we come up with a technological solution, okay, now we are going to have a surplus again, but for how long depends on the growth and these are -- it may or may not come to be as exactly as what everyone is predicting. But because we are a government agency, as the new equipment is fielded, we can't require that everybody put it on their equipment, put it on all their aircraft. So, we have to maintain bulk systems.

You think, well, okay, there should be some trans-joy period that you could set. Well, we have done that several times in the past and all you have to do when the date comes due is call your congressman and the date gets extended. So, there is no market force unless they, they, the market, the customers, the airlines, the GA pilots and our international partners make the decision themselves, we don't have a market tool of which to enforce that function. If we are not backed by our own government, i.e., a lot of the stuff you heard about, how long at time -- how much time it takes to make the changes.

So, now we have just burdened our second requirements because we have a long transition period of which we are now covering two systems, plus keeping them from interfering from each other. Even though -- even when

we are using spectrum efficiently or what I would say efficiently as in we are using it 99 percent of everything that is available, obviously, in 17 million miles of air space, there are places that is enough.

So, I know I shouldn't say this because this is blasphemy in the FAA and this is only Dan O'Rear talking, I know there is probably a technological solution that will come someday where you could probably even share with a safety of life service in a low duty cycle area, i.e., if you wanted to share in Fresno, California or El Paso, Texas or Valdosta, Georgia or Jacksonville, Florida, there is going to be a technological solution someday we are going to be able to do that.

But our fear and the reason why nobody besides me will say that is that you are going to take that thought and you are going to use that to share in the markets of Los Angeles, California, Dallas, Texas, Atlanta, Georgia and Miami, Florida, of which where most of those places, 99.9 percent of all COM(?) frequencies that are possible to use are in service.

We cannot show a few there at this time with what is available. I think I have already touched on this, but when you are talking about coming up with a new solution, trying to get it implemented is extremely difficult, given the fact that if I was a purely privatized entity and if I

could say if you want to work in Chicago, you will equip with this equipment or you can enter that and join in on all the money that is available to service that market. That is something that you could do in the private sector. It is not possible to do in -- as the government where you have to provide service to anybody. When you are talking about 320,000 aircraft, by the time you get someone to finance those changes, first even to agree to it, then to finance it and the lead time that you have to give them and the extensions that Congress will give them, you are talking sometimes things that have taken 20 years to accomplish in our past history.

So, now that I have given you the scope of the problem that I am working with, how would you go about incentivizing me to share my spectrum at the places and at the times in my history of when it becomes available? Well, the only thing that I could think of, which is not possible, which would require some type of major shift in the way the United States does business would be to allow me to be a landlord in which I could rent out the unused spectrum of which I could take back when my needs returned. But that is not something I don't think any one has addressed yet. I don't know that the United States is willing to go that way. Of course, you know, that would be great for me because if I am the one, I am the

landlord and I am collecting the rent, I can also offset my budget. So, that is a difficult problem that we face as a country of what type of ideas are -- how are we going to change the way we are looking at it. We are not talking about changing spectrum management procedures. We are talking about the way the United States does business as a government.

So, I hope you will keep that in mind as you think of ways in which we are going to fix this problem that we all know is going to have to be fixed and there is going to have to be an answer, but unfortunately I am not here to give you one.

So, thank you very much for your time.

[Applause.]

MR. TENHULA: Thank you very much, Dan. I actually kind of like that idea about being the landlord on its own land. It is kind of odd how the government agencies may not have as much control over their own spectrum as you would think they would.

Our next speaker comes the military perspective and that would be Victor Sparrow. He is a deputy director for spectrum management in the Office of the Assistant Secretary of Defense for Networks and Information Integrity.

Victor is the principal advisor, the director of spectrum management on spectrum management and electromagnetic and environmental effects.

Agenda Item: Topic 4: User Perspectives

4.1 Government Users and Critical Infrastructure – Victor Sparrow

MR. SPARROW: Good afternoon.

Most of the spectrum workshops I work in, I normally know most of the people, but I can see sort of a paradigm shift here. I have heard a lot from academia and the economists. So, it seems like there is a shift here of another discipline, get more and more interest in spectrum. In the Pentagon, the spectrum guys come to a meeting and it is oh, oh, here comes the spectrum guys. Now, maybe with the spectrum people, here come the economists and the academia.

We have heard a lot from the academia and the economists. I am going to try to be as diplomatic as possible, but I think I have to balance the equation. I apologize if I have to be blunt, but this promotes tremendous challenges for the department. I want to commend Eric, Fred and NTIA for taking on this challenge, but this has huge ramifications for the U.S. military. I don't need to explain the mission to anyone. You know what we do. It is national security. We don't do it just in

the U.S. It is worldwide. Okay. We saw the spectrum charts earlier. All of the colors there, we are in every color. Okay?

So, there isn't anything that anyone is doing that the U.S. isn't already doing or not incumbent in some way shape or form in that piece of spectrum. So, that sort of just lays the baseline and this debate here isn't new to the Department of Defense. We work very hard with the NTIA and the federal agencies all throughout the development of the presidential initiative and as you see, this is one of the recommendations in the President's report. In certain areas it says where appropriate and DOD likes the where appropriate. However, we are continuing to work with the interagency process, as well as the commercial industries to see what good can come obvious, that wherever we do see a lot of challenges.

Again, like I said, we are everywhere from D.C. to daylight space, fixed, mobile, aeronautical, maritime, terrestrial. That is what DOD does and we are mission oriented. I am not aware of any other user that has a unique requirement as the U.S. military. We are domestic, international, and as we go international, it is an individual case by case basis. Bruce could attest to that. I mean, each country we are dealing with separate

independent issues on a case by case basis. So, boy, this would open up a lot more for us to have to deal with.

Again, no geographical limitations and we all know about the war on terrorism. So, as we get into discussions on secondary leasing, opportunity costs, what we are talking about is where those -- whether it be space, geographic, where are we not using spectrum now? Well, the military, you are asking us where are we not using the spectrum today, where are we not going to use it tomorrow or ever in the future, well, that could be anywhere. But then I think if you structure it correctly if you talk to a lawyer and say, well, you can put a mechanism in place where if you need it, then it will be there for you, a preemptable basis. Well, let's just garage -- that is a totally different issue. I won't go into that. We have spent a lot of time on the Hill on that.

We are talking incentives, deficiency, spectrum value. I sort of kind of see it as a trichotomy here. I kind of don't want to merge them together and you may disagree, but that is okay. That is why I am here. The incentives piece here, I see a lot of challenges. There is a lot of speculation here, but there is a lot of work to get done. I talked to someone at lunch about a 500 page document. I think that is just one chapter, but there is legislative, physical and regulatory issues associated with

that. You can just take one piece of that. You know, if DOD gets the funds, who do they go to? Does it go to the spectrum guy? Does it go to contractors? Does it go back to NTIA? I mean, those are debates. We don't have no problem being a part of but today there are tons of issues associated in that particular area.

Now, efficiency, Department of Defense is very supportive of efficiency and we have done quite a bit of work since the presidential initiative internal in the department in what we are calling the spectrum scorecard. You may have heard that. We have talked to NTIA about that. What this does is place a requirement on the acquisition community to take spectrum into account in its tradeoff analysis, which they don't do today.

Okay. They look at cost schedule and performance. What we are trying to do is come up with a mechanism and we look for engineers, we are looking at things like frequency, agility, band width management, power management, time management. We want acquisition program managers to take those into account. That would be a tradeoff analysis and before you can get your funds, that is an incentive to look at spectrum. You don't get your funds until you look at spectrum from a technical perspective and show us that in your tradeoff analysis, as well as cost schedule and performance, you have done what

you have had to do to make sure that you are using the spectrum as efficiently as possible to make sure that you don't impact your operation or mission.

I mean, that is the overall goal to not impact the operation or mission, but we want to strive to be as efficient as possible and my office will put the policy in place. We will work with the acquisition communities to make sure guidelines are in place to mandate in the department that the scorecard or whatever it evolves into is a requirement placed on the acquisition community. Now, the third piece of this trichotomy, paying for spectrum, we took a look at that. We had an economist look at that right after the presidential initiative, before we got sort of convergent in our scorecard and we didn't end up anywhere. We diverged.

There were just so many possibilities, so many options, we couldn't come close to trying to get a value on spectrum. I mean, that debate can go -- you know, is it market-driven? If we are in piece of spectrum X and spectrum Y adjacent to it is auctioned off for x dollars, does that mean x as well? Well, if Y is auctioned off and that meets the requirement, then our spectrum goes down to zero because there aren't any other requirements. So, we know it is zero to something. We don't know, but we wouldn't mind some assistance in helping determine where

are we going to go with -- what is the template for a spectrum variable.

We know DOD is not the expert in doing that. So, we have tried to look at this. Now, is the intent here how can we get more users in the minimum amount of spectrum. How can we get more users in spectrum? Okay. We sort of do that today. We have all types of sharing arrangements. We have primary, secondary, NXK, Part 15, but if you go into these secondary markets, you know, in the DOD sense, where is the liability. You know, if we are saving lives, we are doing national security missions, that there is an issue in the middle of a conflict, where is the liabilities? Those are some questions that we haven't seen the answers for yet and there has to be an improved conflict resolution process for shared users and we have some learning lessons there.

As a matter of fact, they have a meeting this Friday with a Congressman Wolfe in Virginia on the garage door issue. So, we are continuing to learn in that particular area.

We wouldn't mind some assistance in helping determine where are we going to go if -- what is the template -- we have some learning lessons there.

Paying for spectrum - let me go back to that. Paying for spectrum. If we are going to pay for spectrum,

is it a level playing field? Does the federal bid with the non-federals, you know? Does federal bid with state and locals? I mean, those are questions that have to be in place. If DOD has a property right for spectrum, does it hold the auction? Does it keep the revenue? There is just so much to this and we want to make sure our mission isn't impacted. So, one of the things that I know that is part of the current regime is that if a federal user isn't using his spectrum, they are supposed to give it back to the regulator. If we are not using our spectrum, now we can auction it off versus giving back to the regulators. Those are conversations that decisions that have to be made.

Again, NTIA is currently the regulator. So, we are talking a shift there where property rights would sort of go from the regulator to the individual federal users. It is a very slippery slope. It has worldwide ramifications and enormous physical impact. I don't think I saw anyone come close to a study that would show if you used market-driven costs, what would be the cost for the U.S. military worldwide? That would be an impact on the federal budget process, but, you know, if it is to happen here in the U.S. we as a department feel that it would just be a domino effect to the other countries, where currently we don't pay for any of the spectrum.

Again, if the intent is to ensure spectrum efficiency and that is what we understand it to be, right now we are pressing heavily and committing funds to the spectrum scorecard initiative to ensure that it is part of the acquisition process. As outlined in NTIA's incentives report, there are quite a few deliverables in there, which we are very easily waiting to see the outcome in the draft documents and we will participate in the support of that. But at this point, I will offer the solution.

Well, at this point, we see it is apples and oranges. We see the federals and non-federals and I know depending upon who is at what end of the debate, you can all make it look the same, but we have no problem with commercials continuing to support -- explore commercial markets. The federals, who are more mission oriented, continue to exploit advanced technologies. We have a lot of transformational things happening in the department and even in other areas. Software defined radios, cognitive radios, the XG program, you heard about that yesterday. Those are various ways of technologically being able to use the spectrum more efficiently if that is the intent.

Last but not least, state and locals. Let's not forget about our state and local public safety brethren because they are in this equation as well.

That is all I have. Thanks.

[Applause.]

MR. TENHULA: Thank you, Victor.

Agenda Item: Q & A

This leaves us a little more than a half hour for some Q&A and discussion. I think all these presentations presented kind of the unique perspective of these government users that have lots of experience in the band and I think experiencing now and for the last at least few years, maybe ten years or so, you know, some threats to the use that is, you know, probably providing them incentive itself to justify their existence and to come up here and present slides that, you know, show what value, you know, is -- even though it is hard to quantify what value is created by services.

So, taking the moderator's prerogative, I will lead off with a question but please go ahead and start lining up at the mike if you want to ask some questions of these Federal Government users.

My first question kind of follows up on I guess it was Victor and Dan kind of raised is this notion of property rights in the spectrum being held by the users themselves, whether it be DOD or FAA. What are the kind of -- we heard some of the pitfalls, I guess, from Victor. What do you see as the prospect for if that -- where you have exclusive rights to the spectrum, you know, whether

you call it grandfathering or granting you basically a perpetual right to it. Where do you go to protect those rights? How do those rights get defined?

Will you take advantage of maybe more flexible use to do new technologies, lease excess spectrum? I guess the last part of that question is, you know, where do you get more? You own -- these are very complex systems, we have heard. They include a lot of things, not just spectrum. They include a lot of equipment, a lot of things, not just spectrum. They include a lot of equipment connectivity and even, you know, like for these -- some of these radio astronomy antennas, lots of land, all very valuable pieces of property that I would assume these agencies own and control and probably have to protect from trespassers, thieves and probably bad contractors who give them -- you know, to avoid getting shoddy equipment.

So, why not throw the spectrum asset into the realm of those other assets and just go back to simplify the question, what are the pitfalls and possibly benefits of doing that? Anyone want to tackle that?

MR. SPARROW: First, I would like to come at it from where the department is going and then try to come back into how this may or may not impact what we are trying to do. Notwithstanding this workshop and what it is trying to do, the department is moving fast forward in the

transformational mode and where we are going into an information age very quickly in a net centric environment. We are talking about a worldwide capability where essentially each user has an IP address and that is in its simplest form.

To make that happen, we have to do transformational things on both the user side, the radio side, as well as the spectrum management side. So, the things I am talking about early with SDR, cognitive radios, those things are going to require band width that are far beyond what we currently have in the allocation tables. We struggle today to see where they are going to fit. So, that is the initial challenges is not where we could see more efficient use and being able to sublease to say other users for revenue generating purposes, but what we see is how can we execute the Secretary's mission to become transformational and allocating the proper spectrum to execute these wide band network and wave form capabilities and we have already conceded that we can't do it just in military exclusive bands.

So, we see a technological solution being able to cause that to happen. I am not sure if incentives would assist that in taking place. It may, but to come back to your question on incentives, I think it comes down to the enforcement, the legal context of which the arrangements

are made because at no point would we want our mission to be jeopardized and at no point would we want whoever we are subleasing to be jeopardized because, again, we could be subleasing to a user who is trying to make a 911 call and we are back to the point of is a 911 call more important than a military radar turning on?

So, again, we are open to that, but we feel that there is still a lot of work to be done to go down that path.

Thanks.

MR. TENHULA: Dan, do you want to add something to your kind of idea that raised a spark, at least in my mind?

MR. O'REAR: Well, there is -- the FAA doesn't own any real estate. I mean, we just take, for example, one band, communications band. Each radio that we use we get a license for it. I mean, we do not own that property. We help the NTIA -- I was basically chairing one of the groups to help manage it, but, you know, it is not owned by us and we don't use all of it at all the time and we don't -- you know, all we do is we go to the NTIA pot and take out we want this piece at this location and so it is -- if you try to give me --

[Multiple discussions.]

I think we would be going backwards and we would

-- I mean, we are already with NTIA at least we have -- everyone has the opportunity, as long as you meet the parameters of the band and by respect for the other people in the band basically, to put it in the most simplest terms, you can come and you can use it. So, if you had to come and pay, you know, rent to one person on one piece, I think it would just be more cumbersome and we would be going backwards. You know, my comment was more on the fact that, you know, if you want to -- if we get to the point where we decide that we have to share with services that are going to be -- and you are going to allow me to -- expect me to tolerate interference, then I want to have to say where that is going to be is more what I meant to say.

[Multiple discussions.]

-- to exclude others or make sure that those others don't interfere with you --

[Multiple discussions.]

If you are going to take it to a level beyond what policies that already exist.

MR. TENHULA: Any other comments on that?

Tom.

MR. GERGELY: Thank you. I would just like to add the radio astronomy perspective. We, of course, don't own the spectrum either and I would like to point out in

addition to all the difficulties that we have, first of all radio astronomy bands are the bands that are attributed to -- allocated to radio astronomy in the U.S., are shared government/non-government bands. They are also used by private radio astronomy observatories. A number of universities have maintained very important observatories; M.I.T., University of Massachusetts, University of Colorado, University of Maryland, University of Illinois.

So, there is a difficulty right there and, secondly, as most bands, radio astronomy bands are shared with the earth exploration satellite service. So, in most of these bands, there are other passive activities going on. I am not sure how we would apportion those property rights between radio astronomy and the earth exploration satellite service, particularly because there are some users that we are not terribly bothered by, those that transmit upwards and, of course, the EESS folks are precisely being bothered and they are interfered with these folks that don't bother us.

Thanks.

MR. TENHULA: Thanks.

James.

MR. MILLER: I will just refer back to my airline days and think about how efficient really the Department of Defense and FAA really are already using their spectrum.

When you think of one navigational aid providing services to hundreds of aircraft with thousands of passengers on board, who do you really want to own the spectrum rights of that in terms of Department of Defense providing services globally for the GPS, the global positioning service. They are not just users of spectrum. They are service providers. So, it is a very interesting mix to this argument.

MR. TENHULA: Okay. So, it doesn't look like they are interested or controlling the spectrum that they currently use. I guess we will leave it up to NTIA to continue to do that, at least for now.

We will turn it over to the audience and Jim.

MR. SNYDER: Three questions for Victor. The first two, I am looking for sort of yes/no or simple numbers and the third may be a little discussion.

The first is I read an NTIA report from about a decade ago and it estimates that the Department of Defense has about 44 percent of the spectrum on a megahertz per pop; in other words, a population weighted basis. I don't actually recall what span of spectrum it is, but I think it was the usable spectrum or view. Does that number sound about right to you, 44 percent?

MR. SPARROW: What? 44 percent of the exclusive spectrum? Is that your question?

MR. SNYDER: If you look at the NCO, the Department of Commerce chart on a population -- on a megahertz population weighted basis, about 44 percent of the frequencies are controlled --

MR. SPARROW: I would have to ask NTIA. I am sure it is not that high. I can't recall what that number --

MR. SNYDER: Some of it has been given back as the defense has -- you know, in the last ten years, there has been various things. But do you have a different number?

PARTICIPANT: Forty percent of -- for national defense purposes.

MR. SNYDER: Okay. Great.

MR. TENHULA: Can you repeat that, Jim, through the microphone?

MR. SNYDER: Forty percent, I guess on a population rated basis is allocated for the Department of Defense. What is your name, by the way?

[Multiple discussions.]

Then the second question is what percentage of spectrum does the military use domestically versus internationally? It is my perception, of course, in Iraq and Afghanistan, you must be using spectrum for the defense. I haven't seen any metric to measure this but my

guess is that today the military probably use more spectrum overseas than domestically. Would you be able to quantify the relative use? Maybe there is some indirect like the amount of energy would be a good proxy.

MR. SPARROW: In numbers, no, but we use a lot more in Iraq than we do here right here right now.

MR. SNYDER: Okay. This relates to my third question, which is the more complex one. I missed the presentation on XG yesterday, but basically it seems to me is the military has the vision of sharing spectrum overseas. That is the XG, at any one time, 99 percent or so of the spectrum isn't used and the military wants to go in and use it and also wants to recognize the incumbent users, how they are using it, so you don't interfere with those users. That raises the question why should there be one standard internationally of spectrum use in the military, which is unused spectrum should be available for the military use and another standard about sharing domestically. We are even more sophisticated presumably than these other countries and yet the military seems to say no sharing domestically, but that is the policy internationally -- what?

MR. SPARROW: I don't think you heard that from me or anyone else from DOD. We share domestically and internationally and we look at the XG and cognitive radios

to work domestically and internationally. I am not sure where you got that from.

MR. SNYDER: I am sorry. Jim Snyder from the New America Foundation.

If you actually want to find out and go to the government master file to find out what the frequencies are that we facilitate sharing, those frequencies are not available. The position of the military is that the spectrum is being used is confidential. It would seem to me on all those confidential data, it is hard to share them when you don't even know they are located.

MR. SPARROW: I would have to talk to you off line about that. I mean, we currently share domestically today with --

MR. SNYDER: What percentage of the 40 percent is open to sharing? My guess is it is actually quite small in areas where it is actually used.

One last example. If you look at sort of the Strategic Air Command band between 225 and 400 megahertz, prime spectrum, great spectrum, we did a study here in Washington, D.C. and that is basically unused 99 percent of the time. There is no sharing in that band. That is great spectrum. So, there would be a vivid case --

MR. SPARROW: I would have to talk to you off line. If you have a requirement that you were looking at

sharing in a particular band and bring it to the IRAF, we send it to IRAF.

MR. SNYDER: Thank you very much.

MR. TENHULA: Jon, please identify yourself for the record.

MR. PEHA: That sounds ominous. I am Jon Peha. I am with Carnegie Mellon University. Sorry to stick you with one, again, Victor, but you made an interesting comment that at budget reviews I got this right. You review the efficiency of spectrum use on a routine basis, which means you are already --

MR. SPARROW: No, that is in our plans. The scorecard is an evolutionary -- it is what we are developing now in response to the need to address the issue of how efficiently are we using spectrum. So, that is something in the development phase and we plan to have that when it is fully blown out in the acquisition process, to have that as a requirement. When you go through for your funding, this will be one of the requirements placed upon you to show that you have addressed spectrum efficiency.

MR. PEHA: Okay. I figured you have all the answers. Has anyone figured out yet what some of the criteria you would be looking at or is it still too far out in the future?

MR. SPARROW: Yes, I mentioned a few. What was it, frequency agility, band width agility, time management, direction transmission. We are looking with smart antennas, what modulation schemes are you using and it is sort of a color coded spider web type chart. So, as you put in the different dimensions for different requirements, you come out with certain -- and it is not a binary, yea/nay. It is just for different technologies you will come up with a different result and then you can use that to associate it with your cost, schedule, performance and things like that.

But right now, we don't have that requirement to do that.

MR. TENHULA: Peter, I will let you ask a question if you promise not to say Clock Proxy.

MR. CRAMTON: I promise.

Peter Cramton, University of Maryland, both an economist and an academic. So, as Martin has pointed out, I have two strikes against me already.

I am a bit confused. It seems to me that the government's use of the spectrum predominantly is for communications, voice and data, that that is probably the primary use. Now, aside from some astronomical uses, which I don't understand, but the terrestrial use, predominantly communication, and I believe that the economics -- and

please correct if I am wrong, but the economics are such that there is enormous economies of scale in the development of these technologies and the implementation of these technologies and that the government would actually be much better off if they made much more extensive use of commercial services. They can provide services that are better, cheaper, more reliable, more secure using current technology.

I witness -- and maybe it is just me, but inefficient and rather strange technological problems with government use. One example was when I was at the Smithsonian taking a Viennese waltz class, the dance instructor was using a wireless broadcast -- microphone and while we were dancing, all the sudden the ambulance dispatch comes on over the system. You know, to me, this must be some kind of technological glitch there and that perhaps there is room for improvement.

So, I would just like to have comments on is there a scope for greater use of commercial services by the government for their data and voice communication.

MR. O'REAR: Yes, there are all types of possibilities and the technology actually exists in which you can pack those communication frequencies a lot more densely. Now, not all commercial applications are what you would say more efficient, that the -- is usually under the

requirements when it comes to reliability of somewhere four to five nines on the other side of the decimal point, so we expect or is what the U.S. economy expects of people flying aircrafts. That is one thing that we have to have, one, because communication frequencies, which that is only one -- speaking only for the FAA, you know, we have a lot of other frequencies and use for surveillance and also for navigation.

So, COM is just one part, but it happens to be our biggest problem chow at the moment because the technology that we are -- I kind of alluded to, allowed to use because we have, you know, 320,000 customers and we have to agree on their own description of the new technology before we can become more efficient. That is the scope of our problem of how you are going to make me more efficient is how do I drive the train faster to get my customers to move along at the speed the rest of the industry wants to move.

MR. TENHULA: Victor, do you have a response to that?

MR. SPARROW: Yes. I think it was two parts and I think I missed the point earlier where we are stressing efficiency, stressing efficiency, but you have got to remember the mission impact of the agency that you are referring to. In a lot of cases, the Department of Defense

is intentionally inefficient. You have got to think when a lot of the commercial wireless services are turned up, I mean, you are operating in a cleaned environment. A lot of the military systems are designed to take into account someone intentionally trying to not allow us to communicate.

So, in turn, you may become inefficient in terms of pure engineering principles, but we have to take into account LPI, LPD, which is low probability intercept, low probability detect, which sort of violates the pure efficiency model in order to meet mission effectiveness. I just want to put that in context when we are trying to have a smooth playing field here. There is some apples and oranges you have to take into consideration.

As far as usage of commercial wireless, I think you are referring to for voice and data, I think DOD is the single largest data of commercial wireless, if I am not mistaken, taking into account commercial SatCom(?) and commercial threshold services, but someone can correct me if I am wrong.

MR. GERGELY: I think what you said that you believed that most of the government spectrum is used for voice and data. That is, I believe, incorrect. Let me give you just one example. I think the full range of practically 960 to 1,400 megahertz is used for radio

location systems and on and on, I think, voice and data is a very small fraction of the total band width for government use.

MR. TENHULA: Before we move on to the gang up by the economists by the academicians, Martin, I want to know if Peter will show us the Clock Proxy waltz at the reception today.

[Laughter.]

Martin.

MR. CAVE: Martin Cave from Warwick University in the U.K.

I would like to ask Daniel a question because it seems to me that his spectrum is used for a different class of purposes than that of the other three speakers because if I understand it correctly, you are at the end of the chain, a paying customer, you know, the airline passenger, in the case of radio astronomy and defense. It is basically on a marketed product so that that doesn't exist.

One of the consequences of not having any spectrum chargee, you might argue --

PARTICIPANT: Not having or having one?

MR. CAVE: Not having one -- is that basically plane tickets are too cheap because there is a cost of providing the service that has been neglected.

PARTICIPANT: The airlines do pay substantial fees to FAA. Is that correct?

MR. O'REAR: They do, but I don't think there is anything that is calculated in there for use of spectrum.

MR. CAVE: Yes, exactly. So, if you had a spectrum fee, then you would have to recover more costs and airlines would have to pay more. So, arguably tickets would go up.

MR. O'REAR: Well, yes -- not necessarily so. See, that is the problem that I was trying to allude to. We could have spectrum fees, but that doesn't necessarily, because we are a government agency, there is a political decision on whether or not the U.S. Government pays that fee or whether or not they are going to pass it on to the paying public. So, do we take it out of your tax dollars or do we take it out of your airline fee?

MR. CAVE: Right now, governments are normally quite keen on passing it on.

MR. O'REAR: So far that hasn't happened yet. Those fees are -- what minimal fees we pay to NTIA at the moment are not passed on through the commercial sector. There is a lot of talk in trying to change the way the FAA does business in -- I guess the key word you probably heard are user fees. If that comes about, then any of those

services will have to be priced out at a market value and then passed along to the customers.

Right now, it is a -- I guess you would say that the aviation community has at the moment, that they are basically subsidized when it comes to spectrum.

MR. CAVE: I guess this is my question really. We estimated in the U.K. that if the fee for aeronautical spectrum, which was based upon the sort of standard trying -- spectrum valuation, it would increase the cost of single flights by something roughly of the order of 75 cents. Obviously, it would be different in the U.S. because of differences. But I guess it is probably the right order of magnitude. I guess the question I would really like you to address is do you think it is desirable from public policy point of view that the subsidy, which you referred to, which arises from there not being a spectrum user fee, should persist. Does it mean that in a sense that the flights are too cheap and people are making more flights than they need to and all the other consequences that go with that?

In other words, would it be better if airline passengers paid the full cost of the services they were getting?

MR. O'REAR: If there is going to be a spectrum fee, if that is the way the United States wants to go, then

I would agree with you that, yes, it should be passed on to the customer and that -- because I don't believe that that particular industry should have -- if we are talking about sharing and competing for spectrum assets, if one person pays, everybody should pay.

MR. CRAMTON: I would just like to say that if the FAA does pass on the fee, I would like to open up the possibility that they pass it on in a way that is consistent with economics and that is what would -- that the FAA would likely do if there would be a per passenger fee. That would be totally inappropriate because the communication use is not equally born -- is not equally used by each passenger. So, a 747 with 500 passengers is using their pilot communication much more efficiently than the private corporate jet. So, you would want to have it done appropriately.

MR. TENHULA: James, do you want to comment on that?

MR. MILLER: I guess as a former airline guy and Department of Transportation guy, I just feel compelled to respond. The airlines already pay overflight fees for operation of the infrastructure that provides navigational and communication services. I think a better example is when I had to pay $26 dollars to Lufthansa to use the Y-FI

network. I got some real value out of that. So, when you ask this question, who was really going to benefit?

MR. TENHULA: I think the question is paying for benefits that everybody kind of at the end user level is already receiving the passenger and kind of -- also kind of speaking of free riders, you know, GPS has been funded by taxpayer dollars for a long time, builts, upgraded recently, maintained, I believe a hundred percent by taxpayer dollars. Yet the commercial sector benefits tremendously from those signals and not just in cell phones, but in terms of your OnStar.

Does the government have any avenue of recouping any of those costs from end users of the GPS signal or any of the -- I mean, just like we are talking about with the benefits of the radio systems that benefit airline passengers?

MR. O'REAR: Again, we are talking about a political decision. At the moment, the president has decreed that GPS services will be offered free to anyone in the world. So, that would be a policy change. It is not at the moment an economic discussion.

PARTICIPANT: It could be pointed out that Galileo will not be free.

MR. TENHULA: I was going to mention that next.

James, do you have a comment on it?

MR. MILLER: I was just in Munich last week and this question always comes up. Why is GPS free? Is it really the altruistic motivation of the U.S. Government? Well, in a sense, the U.S. gained quite a bit by providing GPS for free. They got the rest of the world hooked on it and it spawned an entire industry that we are getting revenues back into the general coffers of the U.S. Government. So, now, the Europeans are building an entirely different constellation called Galileo to try to build a business model. Don't know if they will be successful.

MR. TENHULA: The GPS, the radio navigation heroine.

MR. TAYLOR: ITUI Study Group 7 and I would to follow up on the kind of mode, the trend of this discussion. We were talking about fees for aviation services. We are talking about a misconception that most government spectrum is for communication, for voice and data communication and that is not true. Most of the government -- in fact, there are laws in the United States that say where possible, all government agencies must use commercial communication systems where possible and they do. Most agencies do that.

But there is another interesting question. What about your weather forecast? What about your hurricane

alerts? What about your predictions of whatever disaster is going to happen? Do you want each individual to pay for that, too? Because at the moment, using earth exploration satellite and other sensing frequencies, the information is delivered and processed and you get to see the weather forecast on television at no cost. But would you rather have it that way for the public good, which is aircraft in the sky? As far as I am concerned, I hope nothing happens to Mr. Cave's aircraft on his way home, but I would rather nothing happen to mine and feel secure about it on my way home.

But as far as I am concerned, when you start talking about services that are provided for the public good, not what spectrum they use, that is irrelevant, totally irrelevant or even if they use spectrum, the public good, that is a function of government and they need to exercise and execute that function.

Thank you.

MR. TENHULA: I appreciate that comment. That is kind of the way I started the pane off.

We have time for maybe one more question. You know, in economics we have a pretty much settled definition of public good. I would like to figure out what -- you know, these, obviously, come closest to that definition, a lot of these services. The question is, you know, okay, is

there a way to -- the academics go back and say, okay, now how can we fit, you know, some of these services -- I mean, spectrum is a very small part of -- in the whole scheme of things, it is really part of their -- we call it missing critical communications or radio navigation systems or astronomy systems and, you know, really it is not their core mission is to -- out a communications service. Their core mission is to do something else, like fight wars or keep planes in the air. So, you know, that is part of that public good. Maybe some research needs to go into helping folks define the public good, drawing a line between those that, you know, we heard like a plea for, please, we love command and control. Keep us in the command and control scheme here. But where does that line cross because the public good and something else, you know, like there aren't quite the roads or -- I know it is even changing on the roads these days.

So, we have got time for one more question and then we will wrap up.

MR. SHEARER: A question for Mr. Sparrow.

Do you foresee the DOD's increase in the mission for disaster recovery?

MR. TENHULA: Can you identify yourself quickly?

MR. SHEARER: Tom Shearer(?) with the Department of Homeland Security, SAFCOM Program.

MR. SPARROW: I am to meet with you next week.

Yes, absolutely. With the standup of NorthCom and the post-Katrina and Rita hearings and things like that and a lot of the legislative activities that are ongoing, there is a lot of things in motion. I am aware with NTIA, the commission and DHS and SAFCOM and DOD as well. We are active and we are just trying to stay engaged and hopefully this all converges sometime soon before we have another Katrina. So, the answer is yes.

MR. SHEARER: Now, if I could some comments. I have been here for two days. I have been relatively quiet. I have heard from attorneys and economists and academia. I have heard us offer to find radio, which public safety cannot afford, cognitive radio, which is a dream. I have heard of critical infrastructure protection, which I think we are forgetting, which will probably include the FAA. GPS, NASA and everything else because of the tools that are in use by public safety using those tools.

I would like to focus on that. We are putting an emphasis on the value of spectrum and a lack of value on the mission. We have public safety agencies, first responders, volunteer fire companies that are having bake sales and spaghetti dinners just to keep their systems going. We have narrow band mandates on both the federal agencies and the non-federal public safety agencies. It is

hopeful that they will be able to meet those mandates, unfunded mandates, by 2011.

Spectrum is not a finite resource. It is not renewable, like forests or grazing areas. Once it is gone, it is gone. The protection of critical infrastructure, such as GPS and other tools in use by the DOD and public safety are critical. I have to emphasize that. These are tools that keep you and I alive. If we forget about that and our focus is on value of spectrum and commercial interests, we are in trouble.

Thank you.

MR. TENHULA: All right. That is the perspective of four -- not just four government spectrum users, but now five, a bonus only for this afternoon. I appreciate you listening.

Let's give our panel --

MR. SHEARER: Let me make one more comment.

If the commercial interests come to the table that offer a solution that is reliable, robust and redundant, which does not exist -- because look what happened down on the Gulf Coast -- then bring that to the table and approach public safety and say we have a robust, reliable tool for your use.

Thank you.

MR. TENHULA: With that, we are taking a break until 2:45.

[Brief recess.]

MR. HATFIELD: Okay. We are now going to shift from hearing from government users to hearing from commercial users. We are very fortunate to have as our moderator, John Muleta, who is a partner and co-chair of the Communications Group at the law firm of Venable LLP and, of course, as I am sure most of you know in the room, prior to that position, he was chief of the Wireless Telecommunications at the Federal Communications Commission.

John.

Agenda Item: Topic 4: User Perspectives

4.2 Comercial Users – John Muleta, Moderator

MR. MULETA: Hi, everybody. Thank you for having me here today as the moderator. I want to thank our panelists today, who are going to -- I spent a few minutes with them outside and I will tell you if we can get out by 5:00 or 4:30 or even 6:00 --

Now, for those of you that don't know me, I am actually infamous because of the Aspen incident. Are you familiar with the Aspen incident? In my first trip to the Aspen Institute thing in Aspen, Colorado, you know, I was so excited to be there and stuff like that. I also had

never been to a ski place. I don't ski, giving to the problem with propulsion and being a big guy and speeding down hills, it just quite doesn't work out.

But it was during the summer, so I said I wanted to go on the gondolas up to the hills and mountains in back. And Pepper said, I know how to get there. So, we went up there. There was a storm. We got caught up in the gondola for two hours, right around mealtime and Pepper looked like a hot dog after two hours. Man, I am telling you. It was a diet hot dog.

Today, we are going to talk to commercial spectrum. I know the press is here. So, I am hoping this -- we can talk about much more important things than the diet hot dog scenario. But the other thing is the commercial users are, you know, sort of where the rubber meets the road. I think the last two panels are really about practical application of policy. So, I think it would be great to get the perspectives of the several sectors that play in that area.

But before I kind of tell you who these people are and what areas they represent, I will also tell you another story. Michael Katz, who I think spoke here yesterday and it is unfortunate I missed him. He was the moderator for one of the first -- the second panel yesterday, and he had a great saying when he was at the

FCC, that, you know, the people that petitioned the FCC would come to him and tell him all these things and the misery that they faced and businesses are complex and stuff, but he was lucky one day to actually go up to a New York City hearing, one of these investment bank presentations and what he heard there was about how things are going so well and, you know, that they have all these advantages in the marketplace and stuff like that.

So, I think what we are trying to do here today is to really parse sort of what the reality is about spectrum, how efficient we can use it. How can we share it more effectively? Are there mechanisms in the commercial marketplace that can be used. One thing of note in terms of people that are here today, Prudence Parks, who is with United Telecom Council, unfortunately, couldn't make it today. So, we will miss her perspective, but along with her, we have Joslyn Read from Hughes Network System, which is a satellite provider and I think that will provide sort of the hybrid approach both where you have shared use of spectrum within the band in terms of allocation and then it is sort of exclusive in some degrees in the SSS base and also shared in other respects in terms of the assignment process. So, it will be an interesting perspective to hear from her.

We also have two folks from the equipment side that are representing I think the more traditional wireless side, with Steve Sharkey from Motorola, moving more and more into the consumer, whether it is through the cellular devices or it is in the sort of unlicensed devices or the sort of home computing UBT type of devices that are evolving.

On the next extreme -- not extreme, but on the next side of that is Bob Pepper, who is with Cisco and that is an equipment player that is sort of approaching it from the computer side and moving to enabling communication with computing.

Then finally, we have Charla Rath, from Verizon Wireless, who now as you know, which in about 20 to 25 years has moved to having 50 million subscribers, which, you know, on a per -- you know, just is a phenomenal number of users on individualized subscriber devices using the cellular system and she is going to talk and give us a perspective on what these large scale opportunities do for spectrum efficiency and how does it all play with the technology and the policy choices that we have in front of us.

So, with that, I think it is probably best to start with Joslyn's perspective and then move to the

equipment and then finally move to the sort of cellular mobile model. With that, I will turn it over to you.

Agenda Item: Topic 4: User Perspectives

4.2 Commercial Users – Joslyn Read

MS. READ: Good afternoon, everybody. I don't have any slides. So, I will try not to push any buttons up here.

I did want to talk a little about what the satellite industry is doing in terms of spectrum efficiency. I am a little bit of an odd duck on this group, I think, in a sense because we do satellites. We are sharing in the fixed satellite environment. We share spectrum as many of you know, based on orbital separation. So, we are in different bands, at least I speak for the fixed satellite industry, for Hughes Network System.

Many technological advances have taken place in the fixed satellite environment. We have -- and I would say over the last particularly ten and 20 years, error correction coding has improved our ability to transmit more information within the same spectrum, absolutely orders of magnitude over the last ten years. So, when modulation advances with the advances in digital signal processing, the integrated circuit design, our whole intent in the fixed satellite world is to use the spectrum that we have more and more efficiently, trying to get more

communications through, more broadcasting down, more broad bands through the pipe as we absolutely can.

Improvements in data compression, particularly valuable for multicasting and broadcasting, digital conversion actually has been an amazing improvement for us. If you took a 36 megahertz transponder here years ago, you would have to save probably 10 or 20 percent on the edges and in the center to make sure that your analogue transmissions were not interfering with the adjacent transponder of the adjacent satellites. Nowadays with the digital signals, we are actually able to get more channels through. We are able to use the capacity more and more efficiently and, obviously, load the satellites and load the transponders more efficiently and also improvements in the data transmission standards.

There is quite a lot going on, at least especially in the fixed satellite environment, that is improving the ability to use the spectrum. Actually, I would also add mesh networking. As the industry is starting to move more and more into this, we are seeing in the traditional KU and KM -- we are starting to move this into the KA as well. It is to be able to speak V-SAT to V-SAT, you know, terminal to terminal and soon we will be having some new spacecraft coming up, particularly on one of ours, the Spaceway space craft will be launched at the

end, Spaceway 3, at the end of this year, which will be having onboard processing, again, reducing the number of hops that you need to go through, the amount of spectrum that you need to use to complete our communications.

So, the issues that I wanted to talk about today a little bit are also the concerns that we have with regard to unlicensed devices. Cognitive radios and other technologies, which are designed to hop around are designed to operate around and underneath spectrum and other operators in a particular band, whether that is for licensed users or unlicensed users.

Clearly, this is an exciting technological development and there is a lot of potential for it in the right place, in the right spectrum. But the effectiveness of these radios in our view really depends on what band it is used in and what that band is being used for. Smart radios are only as effective as the information that they gather about their environment. For example, in the case of a satellite downlink band, if the signal is quite low in terms of power, which is the case when it comes, you know, 36,000 kilometers down. The cognitive radio or the intelligent radio might not pick up the fact that that signal is coming in. So, working in an environment where the spectrum is in a low power operation, such as in the downlink bands, it is not practical.

In the other direction for satellite communications, in the uplink band, the satellite industry concerned center on aggregate interference and mitigation measures, there is a lot of discussion about if there were millions of cognitive radios out there or certainly, you know, a very, very large number of cognitive radios, transmitting, the noise level from the ground could reach to a point where transmissions could no longer be effective for the satellite uplinks. How would that work in terms of feedback from the spacecraft? Are we talking about -- certainly the spacecraft is seeing aggregate, the aggregate interference and noise. How would you be able to feed that back to the radios to have them either turn down or turn off?

So, again, where the signals are strong and consistent, where the radio signals are strong and consistent, it might make sense to have the cognitive radios operating in those bands as underlays or in the shared or unlicensed environments, but in the case of the satellite bands where satellite transmissions tend to be intermittent depending on the direction, they may be low power on the earth. Cognitive radios are much more complicated and probably not practical.

The other issue that the satellite industry has faced is the issue of malfunction of the devices or if the

aggregate performance is not as expected or not manageable. These are now devices that are in the hands of consumers. These are devices which are now hard to get back and the experience that we had in 2002 with radar detectors, some of you may be familiar with, was that these were devices that actually were manufactured without shielding or without the proper shielding, the harmonics for going into the V-SAT band, the KU V-SAT bands and interfering and shutting down operations.

The commission was very responsive when we went in to meet with them. They understood that these were violations of the Part 15 rules. They took very quick action and stopped the forward sales of these devices, these particular ones that were causing the interference. The difficulty was that they couldn't get the terminals back that were already in the market. So, what our industry has been consistently saying is if you are going to put cognitive radios, unlicensed devices, whatever, into the market, there has got to be a way to get them back and there has got to be a way to enforce the rules for interference in licensed bands.

So, in sum, satellite communications do play a very important and unique role. They are essential for disaster response, both for emergency quick deployment, as well as long term recovery efforts. They are essential for

the operation and restoration of the nation's communications network, essential for the national economic backbone. That means regular connectivity among businesses with -- backup for other communications services in times of prosperity and peace, as well as in times of disaster, where essential, ubiquitous or instantaneous communications, services to the entire country.

Smart radio technology does offer some exciting possibilities to amplify terrestrial wireless communications, but their operations and impact must be carefully monitored, should not be allowed to operate in the satellite spectrum, U.S. or internationally. Aggregate interference potential is a very serious concern to us in the satellite industry and regulatory enforcement mechanisms must exist and must be able to mitigate interference.

It is critical to keep the satellite spectrum unencumbered by licensed or smart radio underlays. We provide powerful services and connectivity to this country and we believe that satellite protection and frequency protection is a matter of national importance.

Thank you.

[Applause.]

Agenda Item: Topic 4: User Perspectives

4.2 Commercial Users – Steve Sharkey

MR. SHARKEY: Good afternoon. I appreciate being here this afternoon and to give a little bit of our perspective on spectrum management and some of the areas that we are looking at and technology areas that we are looking at.

We are seeing a real shift in the industry in general and certainly for a company like Motorola we are focused on developing technology that really drives towards seamless mobility. I am sure most of you are familiar with Motorola. We serve most segments of the wireless industry, public safety, Federal Government, commercial users, cable, wire line services. One of the things that drives us is building this seamless vision of having connected devices where you can access your information anywhere, anytime and get anything you want regardless of the network.

This applies to all services, whether it is public safety, federal users or commercial users or anything in between and all the different types of networks that we serve. So, what does that mean for spectrum management? I think it means that we anticipate and need a variety of services and networks to be out there, to be deployed and that there is no one size fits all approach to managing the spectrum. Given the difference of user requirements and demands for different services, we can't pigeonhole all of the incentives into one -- you know,

there is no one single incentive structure that works for all of the services.

Certainly, marketplace incentives should play a strong role and have proven very effective, particularly in areas like CMRS. I look at it as kind of the sticking carrot approach or carrot and stick approach, where your stick can be auctions and fees that try and provide incentives for more efficient use and for, of course, assigning spectrum as efficiently as possible, as quickly as possible.

The carrot for incentivizing efficient use is to provide maximum flexibility, allowing leases, secondary markets and allowing a licensee to control its spectrum, but provides the ability for other users to come in and share or in areas or times that they are not using it. But regulatory oversight is still appropriate in a lot of cases. Our last panel we heard a lot of services that the Federal Government agencies provide. We see public safety uses where auctions and fees are just not appropriate incentives and regulatory oversight is still an appropriate mechanism for them.

That doesn't mean that we can't explore other uses, particularly carrots, to the extent that they can have flexibility to allow their spectrum to be used by others or to use other spectrum when they need it. There

is no single definition of efficiency and I think we have heard that a number of times throughout these two days. Efficiency means something very different for a CMRS licensee than it does for a public safety entity or for a private radio entity. The efficient use is going to vary from service to service.

I think one of the things that we can look at in trying to define efficient use and whether or not there are incentives for -- or that licensees are making an attempt to use it as efficiently as possible is to look over time. So, if you do a review, if NTIA FCC does kind of band by band or service by service reviews over time and you see new technologies being implemented over time. If you see a growth in user base, then I think that is a good way to look at, yes, these are probably doing the right thing in looking to maximize their use.

If you see a declining user base and stagnant equipment, it may be time to look at stepping in with other ways to incentivize them to use their spectrum more efficiently or to allow other uses. But the goal has really got to be to meet the user requirements. There is no single technology solution that is going to meet all the needs.

We often get focused on the latest technology, whether it is, you know, Y-MAX(?) or EVDO or 802-16, which

is Y-MAX and, you know, we hear a lot of times that that is going to be the most efficient technology and that is where everybody should be headed.

In reality, it depends on the user. You have got to look at what meets the requirements for a user's coverage capacity and you certainly have to take into account the existing services that are deployed and how they are going to evolve from that. Then, finally, no single regulatory structure is right for all services. Certainly, licensed with property rights, I would say maximizes opportunity for investment and efficient services. Unlicensed plays an important role for innovation but is -- one model is not going to solve -- be best for everybody.

Flexibility and certainty are keys to maximizing the potential use of -- and efficient use of spectrum and this may seem contradictory to some extent, but it is not. The flexibility for services and technology is important to allow a licensee to provide any services that its users need or its customers need and to evolve their technology and deploy a system that best needs those demands is critical, but then to provide those licensees with certainty regarding the regulatory structure and operating environment.

Licensed spectrum provides that certainty. The technologies that we are deploying, particularly in, you know, bands like for the CMRS and other services, operate closer and closer to the noise floor to maximize their use of the spectrum and to get the highest data rate to serve the broadest number of users. Underlaying unlicensed operations or other uses into there raises the noise floor and harms the ability to use the spectrum as efficiently as possible.

Certainly, clear and consistent rules for technical operation and clear licensee rights regarding the level of interference expected, I think one example of where we have seen a lack of clarity really impact the ability of a service to roll out is the WCS service, 2.3 gigahertz, immediately adjacent to the DAR(?) service. There has been very little deployment in that band in large part because of very stringent technical rules and systems deployed in neighboring bands and in the adjacent bands under rules that aren't clear from the commission, creating an interference concern into that service.

So, that clarity is critical for attracting investment and being able to deploy reliable services. Technology advances will facilitate innovation and will open up new opportunities for sharing spectrum certainly. A lot of work and a lot of focus on development of

cognitive radio, software defined radios, smart antennas. I mean, in reality we do versions of all of these things now and it is -- there is no clear endpoint to any of these. All of our radio products now are software defined to a large extent, can move from one band to another and can use different characteristics.

Cognitive radio, where certainly there is a lot of development work going on in that area and will facilitate certainly a lot of the secondary market initiatives and ability for users to have access to greater amounts of spectrum. Another mesh in ad hoc networking is another area where we see a lot of potential growth in. These technologies and we are looking at combined deployments that have both mesh and ad hoc networking where networks can be dynamically established amongst users or between users and fixed nodes and fixed access points that feed back into a broader network.

This really allows users to communicate and exchange information very dynamically, provides a way to deploy new services with little or no infrastructure, but one of the things that it has done is we are seeing as these new technologies come out and all of these products combine into multiple devices, we see that the line between traditional service definitions blurring.

Jennifer Manner really talked about this yesterday, the need to start looking at breaking down some of the hard distinctions between mixed services, mobile services, broadcast services. We are combining all of those into single devices and run into regulatory barriers as we look at actually deploying those in some cases. Smart antennas allow us to focus energy and meet more stringent antenna performance requirements that would generally be associated with fixed deployments. We can now meet with mobile deployments. So, from a regulatory perspective and one of the things that, you know, both in the U.S. and I think in the ITU, we need to start looking at breaking down some of those barriers.

So, the technical rules for services should really be -- define the protection and a lot of the traditional restrictions associated with a fixed mobile broadcast or satellite service should start to melt away.

Challenges still remain in some of this technology, however. This is an example in cognitive radio and I think we have all heard the cognitive radio held out as the solution for spectrum management in the future, radio that can sense what all the radios around it are doing and react and move into another band. Certainly a long term vision, but one that still has problems that have not been solved associated with it. This is one example of

an issue where you see a licensed transmitter transmitting. The unlicensed cognitive radio is behind an obstruction, like a house. It can't see -- it can't sense that the licensed transmitter is actually transmitting, yet the cognitive radio is within range of the receiver and causes interference to that receiver.

Likewise, if you are going to share on a very dynamic basis, you have to really look ahead in time to know what -- you know, if this cognitive radio sensed that licensed transmitter or didn't sense the licensed transmitter and began to transmit, that licensed transmitter could start up in the meantime. There are still difficulties in trying to listen while you are transmitting. So, there are a whole host of issues that -- and Charla is going to talk about some of them -- that still have yet to be resolved. The 5 gigahertz sharing where we have developed joint sharing for -- with DOD radar has been a good start and I would say the first real implementation of cognitive radio, where you can sense whether radar is on and then unlicensed places will move off a channel.

But a much more straightforward scenario, since you really, in effect, know where the receiver and transmitter are, they are in the same location for the desired band that you are trying to protect and there is a

very long time in looking ahead. Once you sense a radar, you get off a channel for 30 minutes. So, it really limits the potential for interference or eliminates it.

One of the recommendations and this was in the President's spectrum recommendations was that NTIA and FCC should each identify 10 megahertz of spectrum and provide it as a sharing test bed. We strongly support that to develop these types of technologies further.

To talk just briefly about public safety, I think one of the questions we have is kind of where public safety requirements and, again, kind of going back to what is the -- one of my points on there is no one technology that meets all the requirements. Particularly true for public safety. You know, we hear a lot that public safety should move to more efficient technology, should move to broad band as the solution for all of their interoperability requirements. That is not the solution for everything for a user like public safety.

Interoperability is key for public safety and there are multiple levels of interoperability from just exchanging radios so that you can communicate to -- as a simple list end of the spectrum to a full standards based interoperable solution, where everybody is using the same technology. I think the solution probably falls someplace in between. Our recommendations for the 700 megahertz band

spectrum that is going to be recovered as a result of the transition to digital television has been there is a combination for interoperable voice operations with P25.

The rules now allow or are set up for wide band data and we think there needs to be a baseline wide band interoperability standard, which has already been developed by TIA. Then there needs to be flexibility in that allocation for them to do broad band. So that in areas where they really have a denser user base, they can deploy broader band technologies, but in areas where broad band is just not going to make sense because of smaller coverage areas, they can have interoperable data in those wide area, more rural areas.

Then, of course, you have got the 4.9 gigahertz band, which will also provide a lot of broad band data interoperability. This is just to look at kind of the future vision for public safety, however, where what they ultimately will have and are well underway to having is access to a wide variety of networks and systems that provide the ability to recover quickly if the infrastructure is taken out and access to almost any kind of networks so they can communicate with as many people as possible with wide area data, public safety focused data, critical infrastructure kinds of operations, access to the cellular network, access to satellite from their vehicles

or from handheld units and then, of course, 4.9 gigahertz for small area real true broad band.

So, just kind of summing up on some of the recommendations, breaking down the barriers to innovations, you know, service and technical flexibility, nothing new there. Eliminating the unnecessary restrictions presented by traditional allocations, opportunities for sharing between government and non-government users.

I know of instances both ways where government users have wanted access to more spectrum in some areas that are lightly used by commercial users and commercial users want access to government spectrum areas where government are not using it. Right now we don't have a good way to really make that happen. There has been a lot of improvement, big improvement between FCC and NTIA in working together and we have things like 5 gigahertz that really prove that out, but there is a long way to go.

Encouraging the efficient use of spectrum, focus on as many opportunities as possible incentives for secondary markets so that companies don't just hang on to spectrum. They feel comfortable in allowing others to use it. They will get it when they actually need it. The idea that NTIA and FCC should conduct periodic reviews of bands to judge the relative efficiency of a band per service and whether or not it is a growing band that is improving its

efficiency or a dying service that should be looked at being moved out or the spectrum otherwise used.

Unencumbered -- one of the things that we feel pretty strongly about is that licensed spectrum really does provide incentives for efficient use and so we want to see unencumbered bands used for licensed services, a primary emphasis on that and a high threshold at looking at if those are going to be made available for unlicensed services who have to be a pretty high threshold to justify that, something like the 700 megahertz spectrum that will be recovered for commercial use should certainly be auctioned off for licenses.

But certainly unlicensed is important and we need to pursue other opportunities to deploy that. Five gigahertz is a good example where you can share spectrum without causing interference. TV white space, the commission should move forward with that and allow sharing in the TV spectrum in a way that doesn't interfere with the TV use. Then, finally, to provide that spectrum test bed.

One other thing I wanted to mention and just put in a plug for the Technology CEO Council. It is a council of I think it is nine technology companies. Ed Zander, our CEO, is the chair of it and they recently came out with a report on freeing our unused spectrum with recommendations, some of which I have discussed and there are others in here

and a little bit more information. That is available. The web site is up there, but I think it is a report worth watching.

I see Ann Morton, who did a lot of work on the report is out here. So, I think it is one you can take a look at.

Thank you.

[Applause.]

Agenda Item: Topic 4: User Perspectives

4.2 Commercial Users – Robert Pepper

MR. PEPPER: I think you are going to see a lot of similarity between what Steve presented, but I am going to talk about -- I am going to use public safety as an example, trying to enter into this discussion about spectrum policy for Internet protocol world and IP world because I think fundamentally things have changed. Architectures have changed and we need to think about spectrum and its place in our -- in the communications world differently than we have thought about it in the past. So, for us why does spectrum policy matter?

It is largely related to broad band. Spectrum and spectrum-based services are really going to drive broad band in a lot of different ways. First, for the traditional providers that use wires, whether it is the cable company or a telephone company, it either complements

or extends the fixed network beyond where, you know, if you have DSL, you are loop limited in length. You can use wireless with fixed wireless technologies to extend. Same thing with cable. You can begin to provide overlays as a provider.

You also can provide service to unserved and underserved areas, particularly rural areas, not just in the United States, but this is global. Okay? I was in India last week talking about how do you extend and provide policies for inclusion of broad band for everybody in India, including rural idea. It is not going to be stringing wires or cable or fiber. It is going to be wireless based.

It provides mobile and pneumatic broad band. It is completely a new capability, some of which Steve talked about and I will talk about some more. Now, looking backwards just for a moment in terms of -- a lot of the discussion for the last two days has been, you know, what kind of policies. Starting off yesterday, we had command and control. We want to be moving toward the more market-based approach as though we are just at the beginning of the process. Well, actually we are not. We have been doing this now for about 15 years.

So, you know, there are some lessons that we have learned. The first lesson was about flexibility. The

second lesson was about flexibility. The third lesson was about flexibility. Right? So, yesterday somebody said in the old real estate model, location, location, location. I actually think that lessons that we have learned about spectrum policy moving from command and control to a more market-based approach is about flexibility, but what does that mean?

So, the first aspect of that is flexibility and technology. When the FCC embarked on policies 15 years ago to move from analogue mobile cellular service to a digital service, we were told that we had to adopt a single standard -- and by the way, the standard that we would have adopted would have been wrong, which has been rejected by everybody. No, we actually decided to provide some technical flexibility for which we were criticized but without that technical flexibility and competition across platforms, based upon the technology, we never would have had the development of the technologies that have led to the both wide band and CDMA-2000 services.

Enormous benefits in technology diversity and competition across platforms. Now, that doesn't mean that you don't want a harmonization in some respects, but you need that flexibility. Second, you know, we used to define services in very narrow ways. Fixed, mobile, broadcast. One of the things that we learned is that those boundaries

blur. It is okay if they blur and we provide a flexibility in CMRS that it could be mobile. It could be fixed. You know, essentially it could be any -- PCS could be anything except for broadcast. We have seen a lot -- now, by the way, it is being used for broadcast. Right?

They don't call it that, but, you know, movie, TV and whatever it is, you know, you are talking the Verizon flavor of this. Yes, it is for TV. Well, you know, it is driving consumer value, consumer demand and it is all possible because we don't have these narrowly defined service definitions anymore.

Third, secondary markets. It was pointed out yesterday we have had secondary markets in the United States since 1946 with the ABCO decision. Right? It is not something new. Broadcasters and licensees can transfer licenses. They don't have to transfer the company. And that has allowed the market to make all kinds of, you know, secondary market corrections. You know, we started off with cellular cobbling the country up into 734 little areas. It took a decade but the market actually rationalized itself into large service areas through trading. That led to enormous consumer welfare gains and producer welfare. The total, you know, market developed in cellular in the United States precisely because we allowed it acquisition, trading, swapping and creating what we have

now is four nationwide service providers. It took ten years to fix that problem.

Now, yesterday we also, and today, we heard a lot about what I call false choices, the false dichotomies. It is either licensed or unlicensed or both. This is what Steve talked about. It is either voice or data. I am going to have some specific examples here. It is both. In a broad band world, if you are talking about broad band platforms, broad band spectrum platforms, you can always do narrow band voice over broad band, you know, data platforms. That is the beauty of IT.

Then there is this dichotomy. It is commercial or public safety, commercial or, you know, defense and there are some examples that Steve referred to and I will unpack a little bit at 4.9, where, in fact, it is both. Again, these are false choices and we find ourselves in the trap of false choices that don't actually lead to any productive discussion.

Now, we also need to rethink demand for spectrum in this IP world in two respects. One is, you know, IP services are going to drive demand for more spectrum as I was just talking about. But spectrum is simply a resource that extends our ability to communicate. You know, at the 4.9 gigahertz and 700 megahertz, IP applications and broad band applications going from narrow band to wide band to

broad band in terms of platforms is driving demands on spectrum. The flip side of that, which I will talk about, is we can use new IP technologies actually to complement spectrum-based services and reduce demand on spectrum in a traditional sense, which actually allows us to do more -- I don't want to say more with less but more with the same and leverage what we have on the spectrum side.

It also can push new features into old radios without changing the radios and it is extraordinarily cost effective. So, one vision for public safety is, you know, you have the in-vehicle network. Right? We are all familiar with that. It is the network in the police car, the fire engine. You also though have fixed infrastructure. You have, you know, cameras. You have sensor devices on telephone poles around a community and then you have the mobility clients, you know, the trio, the Blackberry and your laptop and in the city -- you are going to see that it is actually being deployed today. It is a combination of optical rings and mobile devices to -- high velocity in cars. Low velocity with law enforcement walking around.

One of the things that the commission did and, you know, John was bureau chief, thank you, which was great was actually the spectrum at 4.9 is 50 megahertz, was not initially allocated for a more flexible broad band service.

The commission provided for flexibility that allows fixed hot spots, mesh applications and mobility and provides for different channel widths. It is licensed and it is licensed to public safety. It has, you know, designed insecurity at layer 2. It is exactly, you know, your traditional public safety licensed service, although it is data, it is digital. It is broad band and you can do some other things on top of it. But it also because of where it is bridges very nicely with unlicensed Y-FI.

So, you can leverage off the shelf Y-FI technology. So, you have the 4.9 down here, right, and now that the DFS issue has been resolved between the FCC industry and NTIA and the commission is now going to go out with a notice of proposed rulemaking and once it gets the rules, there will be the ability to test equipment.

Companies like Steve's and my company are going to be releasing radios, right, in which the public safety user can start down in the licensed 4.9 and if they want to, based upon the circumstance, where they are, how they use it, the application they need, can migrate up opportunistically into the unlicensed Y-FI, up at 5 gigahertz and move back and forth. So, it is false to say that it has to be either or.

This is a great application that leverages both license for public safety and the unlicensed public Y-FI

for public safety applications and use. It is off-the-shelf technology, which is going to drive the cost down. So, you are going to have, you know, consumer electronics prices, at least for parts of the equipment, which means that the public safety budgets, which are strapped -- and we heard about that yesterday -- can go further.

Now, that is the good news, right? But we still have this problem of the legacy, the radios. So, we have an interoperability problem. This came home at 9/11, in Katrina. There were hearings up on the Hill. There is going to be another hearing this week up on the Hill, where we have operational silos and it is not just the operational silos of -- you know, the police can't talk to the fire or the ambulance, but depending upon the incident, you have the private users, the corporate users that need to -- you know, with their security that needs to be pulled into the same conversation as police and fire.

It doesn't work. Right? And the traditional approach to fixing this is buy everybody a new radio. The Department of Homeland Security, you know, SAFCOM, set a goal of doing this by 2023 because you are not going to -- it is going to take a long time and the estimates, the low end of the estimate is 20 to 30 billion dollars. So, it is going to be extraordinarily expensive and we are not going to get there for 17 years if we are lucky and, you know, if

you think about it -- and there are some very important new technologies, right? The P25 radios at 700 megahertz that we are going to get back in 2009, that is going to be terrific. But they are not -- but your typical public safety user is not going to give up their radios at 450 or 800. Right? And we are building new networks in Alaska at 150 for long distances. Those aren't going to disappear.

So, we are still going to have even if we spend, you know, the 30 to 40 billion dollars and take 17 years, which we can't wait for, we still are going to have the interoperability issue across radio platforms because we haven't even talked about bringing in Vic Sparrow's folks when they come in or Katrina, the National Guard down in the Gulf states. I mean, they are completely different radio systems. So, one of the approaches that we and others have developed are IP-based solutions in which you can use IP-based platforms and servers to link the radio networks and the radios together and effectively you can -- without having to change any radio or the behavior of any first responder, certainly in a transition and we believe long term, using IP back planes, you can get everybody to talk to everybody.

So, this actually gets you 90 to 95 percent of the interoperability solution at about 10 percent of the cost within about two years, three years. That is 10

percent of the time. This does not mean that you don't need new radios and it doesn't mean that we don't need new interoperable radio systems like the P25 radio, which adds additional capabilities. These are not mutually exclusive solutions. They are mutually reinforcing solutions. But you couldn't do this without IP. So, again, the advantage of IP and the power of IP gives you completely new approaches to solve problems.

So, what are some of the new lessons that we are learning in this new environment and how do they link back to the old lessons. First, demand for spectrum is coming from broad band and data, not just voice. So, we can't think about narrow voice channels. I am just particularly focusing here on using public safety as an example.

IP architecture and networks can complement spectrum reducing demand, reducing time to market and reducing cost. It is not mutually exclusive with new radio systems but it will allow a smoother migration to the new radio systems and actually because you can do more with less, you actually have more money for the radio systems.

Spectrum may not be the best way to solve all problems. In fact, it is probably not. Right? Again, so these are complementary. We need to understand the tradeoffs between spectrum and non-spectrum-based solutions. In fact, maybe at some point, you know, Martin

can talk a little bit about what the U.K. has done in terms of fees, which we talked a little bit about or John raised, because the question with fees in the U.K. is how do you determine the fee for spectrum user. Well, you look at the next best alternative, which is a non-spectrum application.

There are some interesting economic questions. I still think that the old three lessons of flexibility, flexibility, flexibility still are good going forward. So, I would recommend that we not lose that lesson because that is going to be important going forward.

Thank you.

[Applause.]

Agenda Item: Topic 4: User Perspectives

4.2 Commercial Users – Charla Rath

MS. RATH: Thanks very much. One of the benefits of being the last up is that everybody has said a lot of what I have already wanted to say, but I will still go ahead and say it again anyway, but, first, I want to say thank you for being here. It is actually kind of, you know, not only a pleasure to be here from the National Academy point of view. It is also a pleasure from NTIA point of view because it was at NTIA that I actually got my start doing work in these spectrum areas and where I met a lot of the people, who are, you know, both on the panel and

elsewhere. So, it is a little bit like, you know, coming home or a little bit like old home week.

One of the issues I noticed is that we are still talking about the same issues that we were 18 years ago when I started and was working with some of the people I am looking at right over there. We were talking about unlicensed use of the spectrum and the flexibility that it gives you, but the issues that it causes. We were talking about market incentives for getting licensees to use their spectrum more efficiently. We were talking about flexibility, flexibility, flexibility. In fact, that was sort of my mantra. And it still is. In fact, you know, just to repeat some of the things that Pepper said about just how important it is, but clearly some things have changed. I mean, critical things have changed just in terms of the Communications Act and the ability of the FCC to hold auctions now, so much so that if you look at some recent filings that people have made, we are all talking about, you know, just how they are just so matter of fact. There have been 60 some odd auctions, billions of dollars raised and the same companies, my predecessor companies, probably included, who fought it, you know, tooth and nail, are now on the record as saying, you know, auctions are great.

They are great. They are a way of getting, you know, spectrum out there, you know, into the commercial use. But, you know, without the flexibility, I am not sure that, you know, auctions always work. The good news is as the commission goes forward and looks at auctions, they are -- you know, they are not auctioning off new spectrum unless it has flexibility involved as part of it.

But one of the things that I wanted to talk about was to go a little bit more into detail on the CMRS side because I think it is important to see just how successful this industry, you know, has been. You know, there are about 200 million subscribers now. 65 percent of households have it. There are hundreds of millions of devices that are out there that are actually sharing spectrum. We have a number of devices that, you know, we sell but we also roam with a number of other devices. So, you sort of see it in the backroom types of things that take place on the network. It is not just the device itself. It is just things that you all don't even notice but the expectation that you can get your voice mail, that you can actually, you know, roam and be able to do things that, you know, 10 or 15 years ago we were happy if we actually, you know, just had a signal and we could talk to somebody. But now -- you know, I sort of like to pull out my phone and say we have all become completely and entirely

used to having these things and the things that they do. So, what is interesting to me is there has also been an incredible decrease in price and we talk about that all the time and we talk about the benefit of the consumer. But what often gets lost is the incredible increase in value because that price that we pay per minute for these phones has so much more to it than it used to have when, you know, 10 or 15 years ago.

I am not an economist. I am actually, you know, basically nothing. I am not a lawyer. I am not an economist. I am not an engineer. So, you know, I can basically, you know, speak, you know, easily about all of these things and don't have to be held as being an expert in any of them. But I think if you were to look at the value of -- you know, the value that has been created here, it is phenomenal and it is not just measured in terms of number of subscribers, number of minutes. It is measured in terms of the value that we all get out of these things.

I also just wanted to throw up some things that CTIA did a report. They had a group called OVAN(?) do a report last year that really talks about, you know, what we are trying to do is really get into what are the overall economics, the sort of macro economic benefits of this industry and it looked at the amount of -- you know, the number of employees that are either indirectly or directly

-- you know, people who are indirectly or directly employed as a result of this industry. It is just a flat out revenue numbers. You know, it is estimated productivity gains that were as a result of this industry. You know, how much tax is paid by, you know, not only employees of this industry, but by people, you know, using the phones. There are different ways you can actually evaluate the consumer surplus, but the figure in the OVAN report is $157 billion.

I have seen figures that are a little bit less, a little bit more, but that is still a lot on an annual basis and the cumulative social value is approaching around a trillion dollars. The reason I wanted to sort of go through all of these things, in a way they are kind of the punch line to what Pepper was talking about earlier, which incentives to use the spectrum efficiently.

What the commission did and what the Congress did and what the administration did in the late eighties and early nineties is really create -- they created this industry and they created the ability for this industry to be able to do as well as it is now. They did it, you know, a little bit slowly at first, but it was by virtue of things like first doing, you know, the digital cellular order back in the late eighties, which said, well, we are not going to choose for you anymore how to actually do your

technology. We will actually let you decide and at the time, as Bob just said, it was an incredibly controversial decision because, you know, we ought to go with TDMA. That is really the way to go and, you know, and my company is operating on a standard that at the time everybody said wouldn't work. Well, we actually have about 51 million customers, who operate using a standard that we were told wouldn't work.

That wouldn't have happened. You know, that kind of technology development would have happened. But more important, I think, you know, the technology piece is extremely important, but the reason that it is there is because we as network providers, if you will, have the ability to make choices about our own technology without having to go back to the commission every time. That is really why it works. You know, we were able to choose something, you know, or our predecessor companies were able to choose a technology that hadn't been truly tested, but we could make that leap. We could that economic leap and we could say, hey, we think that it is a good thing and it has turned out to be, you know, very beneficial for us and it has allowed us to go along a particular trajectory.

As I have said to people, I have been with the company six years and I have seen where, you know, we have gone from digital to another form of digital that is even

more efficient to now -- you know, doing a broad band service and that is not because anybody is telling us that we need to change out our technology. It is because for economic reasons that underlie all the decisions that, you know, as I said, all the policy makers made back in the early nineties, we actually feel compelled to use our spectrum extremely efficiently because it costs us money if we don't. You know, it is a pretty simple, you know, point of view.

I think I have actually moved on to the next slide in terms of what I am talking about. I should let you see it. So, basically I would probably add to the flexibility mantra, I would actually also add the exclusivity mantra. That is probably one, you know, to -- you know, some groups it is seen as fairly controversial because we should be willing to just share our spectrum with entities that we don't even know they are there. One of the issues that I have with that -- and I will show you some graphs a little bit later on -- is that if those sorts of policies had been adopted about eight or nine years ago, the bar would have been much higher and there was a lot of spectrum that we wouldn't even have mined now because, you know, we were operating in an analogue world. There was a lot more head room for things to come in because of the way that we had to operate. We now operate at very low power

levels and, as I said, I will be showing you a slide that just shows that we even operate in between the peaks and the valleys.

So, we are basically, you know, opportunistically as part of our network, we actually make use of a lot of the spectrum that is supposedly available to other users. You know, I would posit that that is actually a very good thing and that, in fact, the government should be encouraging all users to be, you know, trying to make the best use of the spectrum in that way. In fact, to the extent that, you know, there might be use for secondary users, to put that -- to actually give that to the licensees and put it under their control. That is, again, where the exclusivity comes in is that, therefore, you know, we like the idea of being able to control all the devices that are actually using our spectrum because what it does is it permits us to really manage the RS environment and use it most effectively.

I do use the dreaded efficiency word here but I tend to think of it in terms of economic efficiency not technical efficiency per se because, you know, one of the things that I say is that is you have a perfectly beautiful, technically efficient solution, that, you know, for example, you know, if we wanted to do mesh networking now, I could actually probably give back packs and, you

know, to all of our customers and have them walk around and have, you know, three or five or however many thousand dollar devices, but I can tell you right now, we won't be able to sell that.

You know, I am not going to say that it won't work at some point in the future, but that is a technology that may be very efficient, not one that our customers are going to buy into right now. I am being a little flip here, I realize. We will see development but what I also think is that we need to be thinking a lot about economic efficiency in this context. Technological or spectrum efficiency should actually be about economic efficiency, at least for commercial users. I think there are some mitigating factors when you go off into other territories but when you are talking about commercial users, which is I think what this panel is about, I do think it is very important.

You know, the exclusivity issue, there are things that we have been concerned about in recent years, as we have just seen, as, you know, when -- we have felt like, you know, back in the early nineties when the commission made some choices, both to -- you know, those of you who have been around as long as I have, you remember when cellular used to be a pretty -- you know, you actually had a lot of filings. You had a lot of, you know, keeping up

with, you know, all your different cell sites. You had to report back to the commission. It was actually a pretty managed type of service. What happened both with in the late eighties with the digital cellular decision as well as just sort of continuing this idea that more flexibility was better and cellular became more flexible and PCS was introduced as a very flexible service.

So, you know, as a result we went into auctions or, you know, people went into auctions, purchased spectrum with the idea in mind that you got to use it, as Bob said, for, you know, just about anything you wanted to it with, as long as you, you know, paid attention to the technical issues, the out of band emissions and, you know, you can actually even in PCS, you can coordinate with your nearby neighbors and in cellular you still actually have to file, you know, some paper with the commission but with PCS you can actually sort of make these private arrangements and, you know, just keep them on file and if anybody ever wants to see them, they have to be able to see them.

So,my point here is is that we sort of thought we actually did have an exclusive assignment. Then there were some subsequent times where we had it, no, no, it is actually only exclusive for PCS and we were like, well, that doesn't make any sense. Of course, you are not going to license another PCS user in this spectrum. But, in

fact, we would argue that we have about as close to property right as you have got and that is a good thing and you should actually let us continue to operate as though we have exclusive use of the spectrum and not trying to overlay or underlay under other uses.

So, one of the things that were a couple of years ago several -- you know, it is both on the Hill, but more at the FCC, there were several proceedings that talked about, you know, involuntary use of spectrum and, you know, we were concerned about them because, you know, again, because of the way we use our spectrum, we were feeling that it was uneconomic, you know, questionable technical utility to go in and disrupt users like us for these devices where there had not really been a lot of look into what should be the fundamental model for offering this kind of service as opposed to just sort of accepting the fact that, you know, cognitive radios were a good thing. It raised the level of uncertainty and, you know, fundamentally we are not about buying and selling spectrum. We are about serving the customer. So, fundamentally for us it is about quality of service.

So, these were all concerns that we had and, you know, we felt like it was really undermining the very incentives that the commission had done such a good job in the early nineties of setting out. I will give you a few

non-word slides here for you to look at. Really, you can't see the words on this but really the main focus is on the gold portion, the ocher(?) if you will. In the commission's orders, they looked at that as being sort of free space, you know, an area where you could come in and we, of course, because of the way we build our networks, you wouldn't even notice it because we have to build those peaks not valleys.

The reality is is that the way CMRS operates is much more like this is we actually follow the peaks and the valleys. In fact, in a very interesting -- when I talk to our network guys, there is such a low noise floor in our bands because a lot of the noise is actually caused by us so that we are actually sort of adjusting to what is one user's communication but it is also the other user's noise. So, you have to up the power or, you know, when they drop off, you lower the power.

This is done hundreds of times a second. It is actually a cognitive device, the way it works. It has cognitive techniques. So, we argued back that, you know, you don't want to be messing with this and, you know, also some of the points that Steve brought up in that sense.

I agree with other people here who said that there is clearly a role for unlicensed. You know, you have seen it in the CMRS industry, the sort of combining, the

packaging of different models. I do believe though that fundamentally for, you know, quality of service and, you know, the protection of the rights, which is really the fundamental piece of being able to provide quality of service, the licensed, you know, sort of exclusive use is the way to go with the unlicensed providing, you know, there is, as I say here, an ease of entrance and, you know, providing some of the technological innovation that we have seen.

Also, I would like to say it is also social innovation. I mean, in the unlicensed side, which has occurred on the licensed side, as well, but a lot of what we are talking about, yes, is technologically innovative, but it is also about social innovation. It is about the way people now do business with Y-FI. I mean, I look back and think about, you know, what did people do before they had cordless phones and we have just become -- you know, as a society, we have become dependent on this sort of untethered field and a lot of that, quite frankly, before, you know, the CMRS industry started, you know, building up the way it did. A lot of that really came from the unlicensed side.

Bottom line for us is the regulatory environment that will foster the development of the efficient use of spectrum. You know, we do believe that licensing is a

preferred mechanism. You know, right now there is a lot of spectrum that is available for unlicensed. I think, you know, it remains to be seen. Let's see what happens with it. Let's see where it goes, but, you know, in the model of the CMRS spectrum, the commission and the government and the policy makers have shown what can be done when you have set a proper incentive and what kind of industry and what kind of, you know, social and consumer welfare you can create.

For us, it is also important, as I was saying, you know, exclusivity, clear and flexible regulatory rules of the road, a market driven supply of spectrum. You know, there is a lot of spectrum that is coming on line in the next probably 18 months. What we like about what has been going on recently and was certainly part of the PCS auction is that this is while it is not unencumbered spectrum in the classic sense of it, it is economically -- you are able to figure out how to make it become unencumbered spectrum. So, it is a -- that was a little bit obscure, but what I am talking about are things like, you know, the microwave clearing, rules that were adopted, you know, 12 years ago, about the recent legislation that is going to, you know, set a date certain to move broadcasters off of the 700 megahertz band, which is very important.

AWS spectrum, with, you know, a number of people, again, here in the room and the ability to actually arrange to pay for people through the auction proceeds to move, which was also very important. So, while, again, it is not unencumbered spectrum because, you know, frankly in the bands that we are interested in, I don't think there is any unencumbered spectrum and it is only these kind of what I also consider very market-based kind of incentives is it is only through those that you are going to be able to see the mobile world at least, you know, continue to be able to grow with its spectrum use.

That is it. Thanks.

[Applause.]

MR. MULETA: I want to thank all of the speakers. I think it was very helpful to get their perspective on what is going on in the different areas.

Agenda Item: Q & A

Now I am going to get to the hard task of actually taking them out of their box and getting them to as I was told to get some really hard specific proposals so that we can incorporate this into what we are -- NTIA is working on.

First of all, as the moderator, I get a little bit of leeway, which means I have the microphone right now. So, I am going to take everything they have said and put it

into one sentence. Okay? You guys ready? Take a deep breath. All right. What I heard and this is something actually that was a mantra for me when I was at the bureau, which is I took a look at 309, Title III in general, 309 specifically and tried to come up with what is really Congress in its wisdom trying to do in the statute and what has FCC been trying to do about 15 to 16 years, which is we want to provide flexibility with competition being the key goal, which is to create competition or competitive at the service layer, while at the same time making the licensees experience the opportunity costs of using the spectrum. So, when you parse it all through, those are the three elements of anything that we do in terms of spectrum.

So, you can't constrain the users, but the users have to actually have to benefit society, right? You can't sort of sit on it and have all this flexibility. You need some sort of market-driven incentives so that they recognize opportunity costs, not cost in sort of what is the cost of spectrum because we don't know because Martin Cave yesterday said, you know, it is really what is the next best use for this stuff.

So, with that in mind, I am going to take this conversation to three specific areas that I think are going to have an impact and I want to ask the speakers to comment on this. We will do it in turns, but I will give you a

heads up as to what the areas are. One is sort of the notion of spectrum peaks and troughs and mechanisms, such as leasing to make use of that.

The second area is I think there is a phenomenal shift that has happened because of mobile devices, which is in cognitive devices, which is that the consumer is increasingly having a much larger say in what happens in terms of access layer. So, the question is how do you react to that environment and then the last one is what are these opportunities/cost mechanisms and how do they interplay. So, fees, auctions, how do you make them better, not whether we should have them or not because I think that is sort of

-- we all agree to some level that we ought to have something like that. So, the question is how do we do auctions better? How do we do fees better? Okay? So, that is what I want everybody to address.

So, spectrum leasing we have put into secondary market rules. It hasn't been a bevy of activity. The fundamental goal, though, ultimately, if you look at the further notice that we put out was to say how do we make this more like corn and less like land?

What is the analogy there? In the commodities market, it doesn't matter who fills your corn. Right? If you are Cargill, you need corn. You don't care if it is

coming from Kansas or Texas. All you need is corn so you can make something with it. So, the question is if Verizon Wireless on football day at Redskin Stadium, at FedEx, if they need capacity because all their subs are there, is it in the public interest to actually let them starve or should we have the federal spectrum that is available, can they tap into it? That is an example.

So, the question is are there any things that we can do specifically to encourage that sort of collaborative use -- and this is a term that I use, which is collaborative spectrum usage -- that you guys can think of. I will start with the equipment side of the world and then move on to the service side.

So, Steve and Pepper. We can reverse the order. How about that?

MR. SHARKEY: I think some of that is technology is getting there, though -- will allow faster sharing between users and users who switch back and forth. I think probably a lot of it is actually a trust element, too, you know, particularly if you are talking about sharing between sharing between federal users and non-government users. The users have to feel comfortable that when they -- that they control the spectrum enough so that when they need it, they are going to get it back and they are not going to

lose it to whoever they have allowed to use their spectrum temporarily.

It is probably trust on all sides. I mean, some of it is going to -- it is something that takes a -- I mean, and there is certainly incidences where that, you know, it hasn't worked out well and particularly I think for federal users, where they have allowed some use of their spectrum that they anticipated to be not permanent and it has turned out to be permanent. It is hard once you get somebody in there to get them out.

So, there has got to be some way to have some dynamic control over that.

MR. MULETA: Let me sort of take that a little bit to a specific proposal, which would say should we require some sort of preemptive capability into devices as a rule that, you know, NTIA FCC puts in and says, look, you know, we want all devices to have the -- you know, I think if you take a look at the Preston XG thing, you know, in that policy rule that allow you to sort of turn down if you are using borrowed spectrum.

MR. SHARKEY: Five gigahertz is a great example of where we are started, right, with dynamic frequency selection where, you know, DOD, NTIA, FCC, industry work together, you know, sat down in a room and hammered out what are the share and restrictions going to be, what are

the constraints going to be. There has been testing done to prove the concept. It has been a very cooperative engagement.

So, I think that these things take time and that was, I think more difficult than a lot of people anticipated to be, but, you know, we made tremendous progress and with just great cooperation by everybody. And that does have -- we will have mandatory requirements for building these things in and ways to confirm that the approach works.

So, you know, that is an approach that hopefully we will be able to follow in the future in other instances.

MR. PEPPER: I am not sure that -- I mean I think that the 5 gigahertz with the DFS and the particular needs for the DOD community, they need it to go through the process the way it was done. That is a great example. I think going forward if you are talking about commercial users negotiating with other commercial users, I am not sure the FCC has to have a rule because the commercial user is not going to -- Charla is going to say, hey, you are not going to use my spectrum unless I approve the device. I don't think you need the FCC to do that. I mean, Verizon Wireless can do it. There is some market-based approaches to -- so that you can have the opportunistic use for under

a contract that is negotiated that allows for, you know, greater utilization.

Funny, you know, we actually have something like that. They are called roaming agreements. We actually something like that. It is where you have companies that are leasing spectrum to do a virtual mobile network and VNO. So, it is already happening based on sort of market negotiations.

MR. MULETA: I agree. I think, though, the leverage -- I think part of the concept here maybe would be to allow devices to have that capability built in because if I am Verizon Wireless, if I can't verify and if I can't trust -- you know, from a business perspective, you might be willing to entertain the idea of using the spectrum or sharing the spectrum, but if you -- what I think Steve said is if I can't trust that I can get you off the network, I think we heard from Joslyn also was once unlicensed or, you know, lots of devices are proliferated, we can't turn them out. So, maybe a rule that encourages these things as a sort of registration or the turn off capability built in could grease the skids to these business relationships.

MR. PEPPER: But if you think about the circumstance that Joslyn was talking about was that it would be because the FCC passes a rule that says that all

of these devices that can go in there without having to negotiate with Joslyn. Right? On the other hand --

MS. READ: Without them having some kind of mechanism for being --

MR. PEPPER: Some mechanism, but the point is you wouldn't let them in if there wasn't a mechanism to get them off if it was within your control is the point.

MS. READ: That is the point I was trying to make. It is not always within our control if they are just being introduced as unlicensed by --

MR. MULETA: So, sort of, again, the capabilities, people can come in as underlays or overlays and whatever, I think that has been proved, but the question is how do you trust and how do you verify and how do you get them off when you are going to share it. I mean, what we are trying to do is manage the exclusivity that Charla talked about with the ability to collaborate and share and if the economic principles are there. So, Charla, I don't know if you had any --

MS. RATH: I was just going to agree with Pepper in part because what we would look at is that, you know, to the extent under, you know, an exclusive use property rights type of model, it would then be incumbent upon the users to come to us and negotiate a deal with us, you know, either that the manufacturer, a Cisco or whomever and, you

know, we want to use your spectrum or we want to make it available and then, you know, we are internalizing the cost of, you know, potential interference. We can actually say, well, okay, that might be a little more interfering for us at times, but we will charge for it and it is worth it to us.

But I think that you are actually talking about something where, you know, maybe where users would not -- where it would be sort of negotiated separately outside of the --

MR. MULETA: I think the specific proposal here is I would look -- I went to law school on a lark. So, I am going to take this from the business man's perspective, which is if I have got a resource, I might want to use that resource and have economic gain, you know, by leasing it and short term, whatever, but I need to figure out a way of getting that control back, you know. I can't just let the devices -- so, the problem it seems to me is that the commission has never asked -- let me step back one more. When we are at the commission trying to get public safety and commercial networks, the main question from my perspective was preemption. How can you manage preemption? How can you make the network available on a need basis and then get them off when the need no longer is?

One of the things that might be reduced transaction costs would be to have somebody like the FCC step up and say build in this capability to be preempted in one form or another, whether you are a consumer or a service provider or whatever. So that has already been negotiated. The NVO concept, really the NVO folks the people that run the networks, basically turn off whenever --

MS. RATH: We are very comfortable sort of in the legal environment of doing contracts and negotiations. I think that is in part because there -- you know, when we need the spectrum back, it is because we need to serve some other commercial need and you might be talking about setting different type of standards for public safety organizations that when they need the spectrum back, it is to deal with some sort of national security issue or -- whereas, we are happy to sort of negotiate the deal and if the guys don't comply, we will bring them to court. We will turn them off and bring them to court and we will do our own internal ways of turning them off.

MS. READ: I just want to make one comment. I think what is really important that Charla is making the point of is -- you know, where we have got spectrum and where we can manage our networks, we actually don't need the FCC. I mean, what is happening is in the satellite

world, in the SSS world in any case is, you know, we might have troughs in the middle of the night. But there are a lot of companies out there that could use that spectrum. And they could use it at night. That would be just as satisfactory for them. And we make those deals and sometimes we lease a whole transponder and we don't need the whole transponder. So, we resell it.

So, there is a constant and quite dynamic market going out there, which is not something that is regulated or required to be regulated by the FCC.

MS. MORRIS: Adele Morris from the Treasury.

So, having listened carefully about what policies need to be changed with regard to the capacity for federal agencies, to engage in the kind of contracts you guys are talking about and so there is one policy category I want to -- an example I want to raise and then I am interested to hear from Steve or the rest of you whether there are other examples you think we should be able to accommodate.

This model will go something like this. I am a federal agency. I have a frequency assignment and I have a mission requirement. I take both of those things to the commercial sector and I say, look, I have this mission. I have to have access with this high probability when I need it. I need to be able to perform my mission in the middle

of Montana. I need to have this level of encryption or security or what have you.

So, I have this very clear articulation of my mission needs and I have an assignment and I say, okay, you guys, I am going to be the anchor tenant on this assignment and you guys provide the service I need with all the criteria I have just laid out and you get the residual of the spectrum. Then I don't know what other kinds of exchanges or barters or what you go along with that.

Right now, federal agencies are not really allowed to do this sort of arrangement, but that is -- so, the anchor tenant idea is one thing and so one of the challenges, though, for the policy community is if we build the capacity for that arrangement, I mean, it is a pretty big policy change were we to allow it, would anybody be interested, you know, if we build it, policy-wise, will they come is one question.

Another question is is there something else we should be building instead? So, I welcome your thoughts.

MR. SHARKEY: I mean, I think the question of will they come would depend on how attractive the offer is. The agencies are not -- they are not in the business of selling spectrum or selling capacity. So, you certainly have to provide them incentives to do something like that. So, they would have to get some return into their budget

that they know that Congress isn't going to immediately turn around and take that money back out of their budget. So, it is a zero sum game for them.

You know, I think that if it was the right structure, they would certainly be interested in doing something like that. Again, I guess, you know, 5 gigahertz is one that there is no real benefit to DOD to doing that, but it was done on a cooperative basis, but there is certainly interest in that, in using that spectrum and to making sure the equipment can comply with those requirements.

MR. PEPPER: If Vic and the folks he is representing building systems for want to be a customer, everybody wants to be his vendor, right? He is a good customer. The real question you are asking I think is what kind of -- No. 1, Steve had a really important point and that is would Congress let the department benefit and keep the benefits or would they merely turn around and say, oh, now we can reduce your budget. Oh, you got this for free because, you know, a bunch of companies, you know, are going to build this and you get to have priority use when you need it. Now you don't have to have new -- you know, we can reduce your budget. Well, that doesn't create -- I mean, we are talking about trying to align incentives. Until you can align incentives, you are not going to be

able to do the kinds of things creatively that you are talking about.

I think that it is actually a great suggestion because if you can create the anchor tenancy and the control so that, you know, Vic actually has the buttons and say, okay, I need it, click, I am using it now. There is no negotiation here. You can actually begin to envision a way in which this could work. Technically, it can be done.

MR. MULETA: If I can suggest, before we go to Jim, one of the ways to do this is to not to have a hundred percent if the games go in, but have a more distributed mechanisn. So, I think you want to do a gain share with Treasury or, in effect, what I think do with Congress and what I am trying to say is when I was at the bureau, we looked at efficiencies and we wanted to make sure that -- this actually comes in the context of sharing resources with other offices and bureaus within the commission.

So, if I am running a significant database and I can incorporate all these other things, other activities, how do we share these proceeds? So, we throw out some.

-- managing director and I think what you could do is say, look, if I saved 50 percent, give me 25 so that I can put it into other areas that are starved. I think people tend to think it is a hundred percent gain to either the project manager or the Treasury. It should be sort of

a 50/50 split or some number, I think that would give an incentive to do both.

Jim, you have a question?

MR. SNYDER: Yes. I have a comment and a question primarily directed to Bob. The comment is you framed the license versus unlicensed debate as -- it shouldn't be either/or. It should be both. My comment is I think in the year 2006, that is not a helpful framing of the issue. I think in 2002, that might have been helpful, but in 2006, we want to know how much unlicensed and how much licensed spectrum we should have. If I ask that question to the room, I don't think anybody would disagree that we should have licensed and some unlicensed, even Charla, whose company has filed dozens of commons attacking a license has gotten up there and said we need both.

Is there anybody in this room who would say otherwise? There might be a few. So, my question to you is how much licensed spectrum and how much unlicensed below two gigahertz should we have? I would also just like to note that since 2002 in the FCC's report saying we should have both, we have added approximately 600 for flexible use licensed and we have taken away 10 megahertz for unlicensed, amazingly, quite different than the rhetoric we often hear.

So, how much licensed and how much unlicensed should we have below 2 gigahertz. Right now it is about 1 percent unlicensed below 2 gigahertz. Should it be 99 percent?

MR. PEPPER: The question is what do you want to be using the unlicensed for, right? And a lot of the unlicensed use, in fact, because of the nature of it being unlicensed, it is for relatively low power and managed distances. So, I am not sure that the right question is to be asking how much unlicensed below 2 as opposed -- because if you take a look at what was added to unlicensed, including those 5 gigahertz and what can be done with that, including some relatively long distances, I am not sure again this is an example of trying to frame the question in the wrong way. It shouldn't be about, you know, how much unlicensed in a particular place. Talk about the functionality. What do you want to be doing with the unlicensed and a lot of spectrum was added for unlicensed devices at 5 gigahertz and let's, you know, see how that plays out, hot that is absorbed and the kinds of, you know, products and technologies and services that are developed.

We have, you know, all kinds of at 5 gigahertz people talking about, you know, new mesh networks, ad hoc mesh networks, all kinds of using high gain directional antennas for longer distances, in addition to the stuff

that was added as licensed. Clearly, if you are looking at -- by the way I will also add in the unlicensed some of the stuff at very short distances in the oxygen absorption bands up at 60 gigahertz and there is some very cool stuff that is being done up there. So, I am not sure that just focusing on, you know, unlicensed below 1 gig is the right question.

MR. MULETA: I think also we have to differentiate between the methodology that we get to the service layer application. So, I think what a lot of times unlicensed is defined as low cost, low entry barrier, self-managed networks, I think. That is an application. It doesn't really matter what the access methodology is. So, there is a lot of confusion as to, you know -- I have a question as to why we can't get to that side of the world, but that is different as to whether we should have a precise number of licensed or unlicensed spectrum.

So, with that, I don't know if anybody else would want to comment on this.

MR. SHARKEY: The only other point I would make is, you know, Bob's point about the covering large distance is a good one and unlicensed spectrum for that. You know, I have certainly heard some of the ISP, the service providers that are providing service providers that are providing service in rural areas in unlicensed spectrum

talk about the need for more spectrum so that they can do that. I guess one of the things I would ask is why aren't some of those guys going to Charla and looking for secondary market use of licensed spectrum in rural areas where there shouldn't be, right -- to meet some of those requirements because there shouldn't be a shortage of it in those areas.

MR. SNYDER: So my one sentence summary, the balance is pretty good, I think, is what I am hearing right now, certainly for low frequency licensed versus unlicensed that we --

MR. PEPPER: I think for the moment until we see how the market absorbs the additional stuff at 5, what the future demands are, you know, whether there really is a need, you know, for other propagation characteristics. You know, I think that is --

MR. MULETA: I think also one other issue is that I think Joslyn put it very well, which is unlicensed devices by their very nature until we find a different way of licensing them are very hard to control, right? The very elements that make it attractive are also the things that make it unmanageable. So, that is where I think the part of the things and part of the challenge that goes on if you increase those -- and it is also, you know --

interference is allowed. So, it makes it a very difficult thing to manage.

Let me move on to sort of what I call cognitive issues, cognitive devices, unlicensed and consumer devices, but the specific question is, you know, when you have all these combination of capabilities in these radios, it is beginning to put a shift -- more of an emphasis on consumers having control or having a greater say what bands they want to use for what purposes and things like that because you will have multiple chips that use multiple radio frequencies on a single device.

So, the question I have for you all is how does this affect your business models and how are you dealing with it? Anybody who is willing to answer. And is there any policy construct that we can advise these folks on?

MR. SHARKEY: I mean it is exactly that seamless mobility idea of having devices that are intelligent enough to access their or your information wherever you are whenever you need it regardless of whether of whether it is a licensed network, an unlicensed network. You can tap into the best way to get your information and, you know, we are building devices now that will seamlessly hand off a cell phone call from a cellular carrier into a Y-FI network with the user -- I mean, you can set the device. The user wouldn't even be aware of it at all. But it all does come

back to a very sophisticated network management. You can have a lot of intelligence in the devices, but to handle your information and make sure that your information is there, there is a lot of back end network structure that is tied to that.

That is what, you know, consumers really want is a device that is easy to use, you know, that they don't have to switch from network to network manually or search for their information or figure out to get it. They want it delivered to them and to, you know, not have to push a lot of buttons or have a lot of interaction necessarily with the device itself.

MR. MULETA: I think we have run out of time. I apologize for cutting it short.

I want to thank all the panelists.

[Applause.]

[Pause.]

Agenda Item: Wrap Up Panel – Dale Hatfield, Jon Peha and William Lehr

MR. HATFIELD: We chose our final panel, which has been called our -- we chose the panelists because of their academics and having heard the discussion this afternoon, I don't know if that was wise or not. I am a part time academic and, of course, Bill Lehr is from M.I.T. He is a Ph.D. economist. I think both of your degrees are

from Stanford, the two of you, yes. He is an economist, of course, and Jon Peha to my right is from Carnegie Mellon. His Ph.D. is in electrical engineering.

What we did is you may have seen us out at lunch. We sat down and tried to sort of pull out some of the common themes that we have heard, potential areas of agreement, not really conclusions or recommendations, but rather just some common consistent themes that we heard throughout the last couple of days.

Of course, that was a rather dynamic list because it was changing from minute to minute. So, what I am going to do is turn it over to both Bill and Jon to go through our sort of notes and I would emphasize that we are just going to put these up there as a way of stimulating some further discussion in the time that we have remaining.

So, Jon, Bill.

MR. LEHR: What we are going to try to do is sort of a free for all with interruptions.

MR. PEHA: We have six slides here. We did our best in a short lunch to wrap -- you know, to pull together some of the thoughts we heard. I am sure we missed quite a lot but this is what we got.

Areas of potential agreement and note the question mark. First, that the issue is inherently interdisciplinary. Clearly, that an economic neutral

technology solution, as Bill said at lunch, or a technology neutral economic solution all seem to run you into some trouble. You know, there are legal, political, social issues.

That market-based mechanisms are important and I tried as I could in real time to steal -- where did he go -- Jon's statement from the last session about describing that, that gives spectrum users enough flexibility to have competition at the service level while spectrum users experienced the true opportunity cost of the spectrum they use.

What this actually means, though, is very different for commercial and government. So, we are going to talk about each of those separately. So, in the commercial world -- I don't know where you want to jump in, Bill --

MR. LEHR: You are doing fine.

MR. PEHA: -- commercial world something resembling property rights is important and exactly what that means may differ in different people's minds at this point. How and to what extent should it be flexible? Should it be adaptable over time with technology or markets or whatever? Should it be a perpetual right or a temporary right? Should it be exhaustive or limited in some way?

We have heard discussions about that you must have some mechanisms for international negotiations, based on some other countries' experience, that there must be enforcement mechanisms somehow, that markets require access to complete information to work well and that there are some challenges there and that you must find a way to support sharing of some kind, there seemed to be consensus for, that there may be sharing among equals.

I hesitate to use the word "commons" because it seems to be used in so many ways, but a commons perhaps. A different way may be opportunistic use of spectrum that we heard about in XG, for example. I put a question -- we put a question mark there because there seems to be a little more discussion on that. If so, issues like liability and conflict resolution were brought up.

MR. LEHR: One of the other things I thought we heard pretty clearly was when you talk about trading licenses and the idea that those might be secondary markets and you are talking about let's say someone like a mobile provider, that the nature of those sorts of licenses , the sorts of control and expectations and regulatory certainty, the definition of those property rights, to make that commercial function work are pretty clear and probably pretty different than the sorts of frameworks that you would need for spectrum that you would want to operate as a

commons or in some sort of infrastructure sharing model or in these other things.

We shouldn't be confusing those two arguments. We should be able to ask the question about what are meaningful, useful agreements and then, you know, we will get to it, but, you know, questions like, for example, is something as simple as what they did in Guatemala? Is that the right kind of license format? Or do we need something a little bit more complicated or a lot more complicated? But not that, you know, that we are not going to find these. The bulk of our property rights regimes, there are different sets of property rights.

MR. PEHA: It is in the slide, but I probably didn't state this clear enough, related to that, that we heard from several speakers today, I think, that without a clear definition of what the rights that everybody understands, you also can run into a lot of problems, whatever those definitions.

MR. LEHR: I think we come to it. But another thing is the point about -- to complete information is that we heard from a gentleman that what they are doing is they provide information of what licenses -- what are actually out there. Before you can even have a market, there have to be some way to exchange the products and the goods and know who is using what when and those mechanisms have to

be in place if you are really going to try and move them forward.

MR. PEHA: This is still supposed to be the easy part, by the way. The harder part is coming.

As for government spectrum, we think we heard that we need some kind of market-based incentive that reflects opportunity costs in some way with specifics to be still fought over, that it may be somewhat different from the commercial users and that it must reflect special needs of government users. Those might include the fact that missions are not always -- are not profit driven, but in some cases there are national security concerns, that in some cases, such as air traffic control, you have to make sure you are protecting the central services and there may be differences in how fast an organization can react to a market with a government user versus a commercial user.

That raises the issue also of even if you know where you want to go, what is the appropriate pace of reform. Look at different ways in which we can try and internalize opportunity costs. We heard discussion of fees. We heard discussion of negotiations. Actually we didn't hear a discussion of this, but it came up over lunch that some sort of alternative currency other than actual dollars might be able to -- you might be able to build in some kind of incentive mechanisms.

All of the above requires a great degree of transparency if you are going to have any kind of, you know, opportunity costs, market type of mechanisms in place. We think we heard that more spectrum sharing could be beneficial.

MR. LEHR: I think it came across really clear and I think it is obvious for people that have studied the economics of government agencies that they are not like independent private market firms. Their ability to control and react to the constraints that are imposed upon them are fundamentally different and while the aspiration I think from the economist is to move towards a harmonized kind of mechanism. We understand the political realities of doing that in the near term are going to be, you know, challenged and I think Martin Cave's comments that everybody seemed to agree with is that, you know, even as an economist, he may not like it, but some sort of interim solution that gets these incentives there in a practical way is the sort of thing we ought to be working toward and not be trying to expect the same kind of efficiencies that we would expect in the dynamic markets of CMRS commercial spectrum to be immediately realized with Federal Government spectrum.

MR. PEHA: All right. Now two slides of areas where we thought we heard less agreement, which we characterized as needing more work. The first one related

to spectrum use issues, loosely categorized. How do we define spectrum rights in the first place? To what extent are they flexible? How do you adapt them? Like I said, some of these came up before.

Are they perpetual or not? Are they exhaustive or not? Are they the equivalent of zoning restrictions that limit what you can do with them? Restrictions and obligations. What kind of easements or overlay capabilities are allowed within spectrum rights as we understand them?

MR. LEHR: I think one of the other things that came across clearly is that, you know, this is not really an interesting question if you ask it as, you know, you have the answers for all spectrum and all bands at all times. It has probably got different answers if you say what should we do for this chunk of spectrum that is in play versus that chunk of spectrum that is in play. You know, some of these things, there are aspects of this that, you know, you might have more general things, too, but, you know, it is not something that is going to be -- that has really helped if you sort of ask this just in the question of not specific to the bands you are talking about.

MR. PEHA: We heard some discussion and we think not consensus yet on what an optimal band plan is even initially. The extent to which it is nationwide, original,

large band -- rather wide bands, narrow bands and also should it be adapted over time. Clearly issues of enforcing rights is going to continue and some issues of to what extent is this dealt with ex ante or ex poste.

How serious are transaction costs? This is a pretty important issue in deciding whether some of the sharing mechanisms in secondary markets and actually other sharing mechanisms other than secondary markets is useful and, you know, if it is a deal killer, can we find ways to reduce it and how do we encourage the license holders to participate in these kinds of arrangements in the first place came up.

MR. LEHR: Yes, I think with respect to the transaction costs, it sounded to me like there weren't any wonderful stories about really robust secondary markets. There were some preliminary signs of hopeful progress in that and there was a lot of notice of things that need to happen there to make those better. I don't consider that in any way damning to the goal of getting secondary markets in place, but issues of liquidity, getting them in the right places, not trying to make them happen where they don't make sense, those are some of the kinds of things, I think we need to work on, but it needs to be a joint work and you need on both sides. You have both the people that have the spectrum to have an incentive to want to share it

and they have to -- when they go share it, there have to be technologies and users on the other side that might want to actually take advantage of that.

That is going to be an evolving echo system that is going to take some time to evolve.

MR. PEHA: We heard questions in the last panel about, you know, how do you remove devices from a band after they are in place when you find that there is a problem. That was a hypothetical. I was personally thinking of Nextel during that portion of the discussion.

MR. LEHR: I think, again, that is one of those things where you have obviously, very different circumstances depending on whether you are dealing in something like licensed spectrum where your goal is to allow some private firm entity to make the decisions about how it is managed, in which case it seems to be it make little cause for such a call, but in certain other spectrum, like, you know, if you were going to mandate an underlay, you might want to think about mandating something like that. The question is who is the right party to do that? Would it be the IEEE specifying the protocol to manage it, where it is an industry collection or is this something that a regulatory body needs to do?

I think these are questions about which we don't really know what the right solution would be.

MR. PEHA: As an engineer, part of the issue is we work very hard to predict what kind of interference, what will happen in advance. It is hard to be a hundred percent right.

Last slide on areas needing more work, that is, areas which were raised as important but which we did not hear consensus on. More general than the first slide. How do we define what efficiency is? How do we measure the extent to which we are using -- the extent, but how do we measure current spectrum use, however you want to measure it and current background noise levels.

How do we measure or quantify non-priced benefits, like improving public safety? By what metrics do we determine whether reform is working? If we start down this road, how do we tell we are on the right path or not?

From an administrative structure point of view and authority point of view, what is the role of FCC or NTIA? Is there a need for reform or change of authority within NTIA or IRAF? What are the transitional mechanisms? We are talking a lot about where we want to be and even if we know exactly where we want to be, how we want to get there.

MR. LEHR: We expect the transitioning mechanism. I heard general acceptance of auctions as really valuable element in this and there is clearly a huge amount of

theory there and learning that has come, a lot of it very technical. So, we don't want to hear about the clock -- but I am saying but also there is another transitioning mechanism that is really important is trying to figure out how within the global context of reform are we happy with the ITU model in the World Regulatory Council or do we want to try and think towards other models or how to make that process work better so that, you know, if 15 years from now we say, okay, we still need to make further changes, how will we do that and what can we do about that.

MR. PEHA: And that sort of leads into the last slide, which is we are looking way ahead, are there things that maybe are ideas for NTIA? Is there a sponsor to think about in the short term. It was Peter Pitsch who said this is done inch by inch. So, some of the things we discussed, an inventory, current use of federal spectrum and make that information widely available to start the process, increased transparency at a number of levels.

Seek new easy areas where you might at least have government share, users sharing with other government users with appropriate mechanisms and seek at least in easy bands where monetary valuation might be possible and luckily we have seen a number of models on how to do that, that different countries have gone different ways.

MR. HATFIELD: We have got about ten minutes. Reactions? Peter.

MR. CRAMTON: I just comment briefly on the secondary markets because I do think they are very important and I do think that it is an inch by inch approach that will be followed and has been followed. There is a lot of secondary market activity going on right now and a lot of it is actually barter sharing arrangements, roaming agreements and the like.

Before we have a truly robust spot market for spectrum, we need to have a couple things happen, really three things. One is that for it to be feasible from a regulatory side and I think that has already happened, people can trade. So, that is step one and I think it has been done, perhaps it could be done better and more intensively.

The second thing you need is on the technology side you need to have devices that have sufficient flexibility that they can move around so that, in fact, it is like corn. It is not going to be just like corn. It is actually going to be more like electricity because it is location dependent. So, it is going to be location and band width that we would be talking about.

Then the third thing, the regulation technology and the third -- and maybe that is all we need. Let's see. I thought there was a third thing that was very important.

Oh, plentiful spectrum. Right. Because if we actually have just a very little bit of spectrum, if there is only, say, a hundred megahertz of broad band spectrum -- spectrum available for broad band commercial use, then what would happen is there would be an enormous amount of market power. There would be tremendous incentives for hoarding spectrum and Verizon would be extremely reluctant to let somebody step in for fear they would be a bad tenant or the person that would step in would be a competitor and they would want to keep them out. So, you need some amount of -- the more quantity that you have available, the more it is going to look like a homogeneous good, which can be freely traded.

So, that I think is the third critical element and I think that the FCC and NTIA need to work hard to find ways to free up more spectrum so that we can destroy market power in the provision of services and that is what is really going to benefit consumers and public safety and the military and everybody else if we have robust competition because that is where we have seen the absolutely enormous consumer gains coming from the doubling improvement of the quality of the devices that we see about every 18 months.

MR. HATFIELD: Do you see in the interim any positive incentives that could be created for people to share beyond what is there in place now?

MR. CRAMTON: I actually don't -- I actually think that this is not so much on the commercial side. I think there is already lots of possibilities there and the incentives are basically in place on the commercial side to do business transactions. So, that will happen and you just have the market power issue, but, in fact, there is a fair amount of competition.

I think actually where you need to focus on with respect to improving short term incentives is on the government -- the non-commercial spectrum, the government spectrum and the like because that is where the incentives are not there at all. I think Jon's suggestion that sharing the gains is a good one. I think there is a lot of things that you can do with auctions that are revenue neutral, where people are -- the property rights aren't -- implicit property rights are taken away. Everybody is compensated and actually enjoys some of the gains from trade that the improved efficiency creates.

MR. HATFIELD: We have time for maybe one more question.

Jim.

MR. SNYDER: Can you add a little flesh and blood to your first bullet point up there? Inventory, current use of federal spectrum. Is that an engineer's inventory where we are talking about frequencies and geographic -- is it economists or is basically the GMF file? How does it differ, this inventory from say the GMF inventory? What does this inventory consist of?

MR. PEHA: More detail is good. It is bare minimum if you went band by band and said what kind of devices are there, where are they located. Tell me enough about them so that I can get some idea of whether they can be interfered with or not, how often they are in use. If you can jump to that to real understanding of economic use and all those other things, all the better.

MR. SNYDER: When you do an inventory of Congress, for example, you attach a dollar value to the tables and the chairs and what not. Do you attach a dollar value, for example, to the spectrum?

MR. LEHR: I think we would be happy if we could walk before we run and I think that one of the problems with the second point is we are very cognizant. There are really significant values with pricing things that are social public goods. So, the value of defense, the value of a life and different people have different ways of doing that. To even begin to do that analysis in a credible way,

there isn't going to be any one analysis of that that anybody should believe, but to even begin to get good academic work that can begin to inform that debate, we have got some idea. And if we can know about all of this, that would be great and if it was a database that would facilitate trading, but I would be happy if we could start department by department and sort of say, okay, can we really understand what your special needs are and where they overlap and where they intersect with this particular thing so we can get some sense of this, you know, as to how that works.

I think to ask for more than is possible may do damage to get what is actually possible and reasonable to expect.

MR. PEHA: We are wondering if there is a table there.

MR. HATFIELD: I think we probably are just about running out of time.

John, did you want to offer some closing thoughts?

Agenda Item: Closing Remarks

MR. KNEUER: I know everyone has been here for a couple of days and this has been an intense time. So, cognizant of your time, I have cut my deck down to 45 slides.

No, I very much just want to thank you all. This is very, very important work that you are doing here, something we value enormously. It is something that is a very, very high priority of not just the Department of Commerce but of the entire government. If there is any question on how much of a priority this is, we need to only look at why we are gathered here today and it is because the President directed us to come, directed NTIA to undertake this effort.

We have had two executive memorandums from the President of the United States saying how we manage this resource is of critical importance not just to our economic security but our national security and we need to strike that balance, strike it appropriately and get it done.

That is why you here. That is why I appreciate all of the hard work. Dale, thank you for your yeoman's efforts in this regard. Fred Wentwin(?) and his team and our Office of Spectrum Management worked tirelessly on these efforts. Eric Stark, who wore himself out and went home to his sick bed around 3 o'clock this afternoon, deserves credit.

I would also like to thank the Academies. have always wanted to say that. I appreciate their hard work. I appreciate all of your perseverance and patience and thank you all again.

Enjoy the weekend.

[Applause.]

[Whereupon, at 5:00 p.m., the meeting was concluded.]