UNITED STATES OF AMERICA

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FEDERAL COMMUNICATIONS COMMISSION

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SPECTRUM POLICY TASK FORCE

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SPECTRUM RIGHTS AND RESPONSIBILITIES
PROTECTION PUBLIC WORKSHOP

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FRIDAY,
AUGUST 9, 2002

The workshop was held at 9:00 a.m. in the Commission Meeting Room of the Federal Communications Commission, 445 12th Street, S.W., Washington, D.C.

Present:

Michael Calabrese, New America Foundation
Martin Cave, Warwick Business School (U.K.)
David Farber, University of Pennsylvania
Michele Farquhar, Hogan & Hartson
Bruce Fette, General Dynamics
Joe Gattuso, NTIA
Tom Hazlett, Manhattan Institute
Thomas Krattenmaker, Mintz, Levin, Cohn, Ferris, Glovsky & Popeo
Michael Kurtis, Kurtis & Associates
Larry Miller, LMCC/AASHTO
Peter Pitsch, Intel
Charla Rath, Verizon Wireless
David Reed, Reed.com
Gee Rittenhouse, Lucent
Steve Sharkey, Motorola
David Siddall, Paul, Hastings, Janofsky & Walter
Steve Stroh, Focus On Broadband Wireless Internet Access
Victor Tawil, MSTV
Jennifer Warren, Lockheed-Martin
David Wye, AT&T Wireless

Present From the FCC:

Michael Powell, Chairman
Kathleen Abernathy, Commissioner
David Furth, SPTF Member
Paul Kolodzy, SPTF Director
Lauren Van Wazer, SPTF Deputy Director

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P-R-O-C-E-E-D-I-N-G-S

(9:10 a.m.)

MS. VAN WAZER: Good morning. My name is Lauren Van Wazer and I'm Deputy Director of the Spectrum Policy Task Force. Welcome to the fourth in a series of four workshops on spectrum policies. This workshop will address issues related to spectrum rights and responsibilities.

We are fortunate this morning to be joined by Chairman Powell and Commissioner Abernathy who will deliver some opening remarks, but first I wanted to mention that we have the availability of sign language interpretive services for anyone who needs them and if you could identify yourself, we'd appreciate it.

With that, I'd like to introduce Chairman Powell.

CHAIRMAN POWELL: Good morning. Welcome to all of you. I want to take this opportunity to thank all of you for your participation and thank you in advance for your public service which is desperately needed and I also want to thank Lauren Van Wazer and Dr. Kolodzy and the others, leaders of the task force who have put this function together and have continued to be

invaluable assets as at least this branch of government continues to struggle to try to make some sense of spectrum management reform. It seems to me that's kind of what we're all trying to do.

I thought about my first point in my talk this morning. It's sort of what is it all about? I have never worked on an issue that has so much smoke and nobody can find the fire.

(Laughter.)

Since Professor Kolodzy's first similar article, we have had academic conferences, economic papers, academics debating the merits of FCC spectrum policy and only a modest amount has ever changed and I think that that is a great frustration to many of us who continue to see the obvious merits of the need for change, but yet the inability to somehow transform mere academic or conceptual thought into pragmatic changes in policy and in the markets.

But I think that somehow as we all sit here this year, there's a sense, a feeling that somehow the stars may have aligned and I think that I believe that as well. I think things have finally started to come together in a way that presents a unique and important opportunity to

exploit some of the changes that have provided a chance to put some of those concepts into practice.

Those changes have been in the technology and in the markets and politically. I think there is a sense that with the explosion of wireless services, a certain mass consumer acceptance and growing demand for new and innovative wireless services, we suddenly have a fourth man on the field and that man is the grass roots consumer who increasingly screams out not only to their neighbors which are often me in my neighborhood why can't my phone do this, why does my WiFi network do that? But as a grassroots constituency increasingly are a powerful element in trying to entergize the political process in the Congress to be much more intently focused on issues dealing with wireless spectrum and I think that has been a very important development that suddenly wireless is not a foreign thing to the average consumes. It's becoming an indispensable thing to the average consumer and that changes minds and changes policy. I think that's really, really important.

We also finally have what I think is unequivocally a market environment of strong

competition and strong growth. There is a very serious and aggressive amount of innovation going on, competition going on, all of the factors are very positive and I think that's brought a lot of wireless services to the attention of many of the people in the know. And I also think that the pace of innovation in wireless technologies is accelerating, that is, even in the five years that I've been here, I have been astonished about the number of breakthroughs in the area of spectrum just in that short period. I remember hearing that satellites could never provide video services on an effective basis until they started doing it. I heard frequently that you couldn't do broadband or wireless connections. It was physically impossible in certain ways being done on a commercial basis today. Devices like the Ipac sitting here on the desk that are receiving signals or wireless networks, all of this is stuff that's come into our knowledge horizon only recently and I think that again that accelerating innovation gives a sense of excitement and in political and in policyspeak that means in a sense of momentum and I think it is momentum that brings about change in the political process. And you've seen that manifested,

obviously. You've seen that manifested in a number of Congressmen and women and Senators who suddenly want to be spectrum management reform guys. The problem is they don't really know what that means.

And then an Administration who increasingly is focused on it as well. I think we have an NTIA in the Commerce Department who is extremely focused and active and aggressive in trying to bring about change in this area and of course, here at the Commission as well.

But going back to the point about everybody wants some spectrum management reform, but they don't really know what that is. I spend many days talking about legislators and they want to champion this and then you say Senator, what do you mean? I don't know, but something is wrong, right? Yes, something is wrong and they realize that the mission of both this task force and all of the other entities that are working on this which is to begin to give some meaning and understanding to what we're talking about, help define what the spectrum management reform exercise is in the first place, not only in the sense of what incrementally needs to change, but with some focus on what much more boldly and dramatically needs to change. And

then to try to convert those concepts and principles which are sort of at a 50,000 foot level at many of the conferences I go to into practical principled solutions and proposals for specific kinds of changes. You can't go to a legislator and say well, there ought to be more market based policies in this way. You have to say here's the language, here's what ought to change, here's what words you change in Section 309(j)(4), whatever. And that's what we have to start to do is convert policies and principles and theoretics into pragmatic principles, specific proposals for change. It's one of the reasons we founded the task force. It's one of the reasons we're excited about it and if this group does its job, which it seems well on course to do, we will begin to have grist, something to focus the debate and discussion that hopefully transforms into things we can actually propose and hopefully advocate.

And then we also need to build the institutions and the platforms for which those changes will be launched. It is still somewhat murky to me, exactly where reform comes from. It's clear to me that it will require some legislative change. Will there be a congressional major

initiative. Will there be an Administration-sponsored initiative. Will the FCC be the champion of it. The FCC will be the champion of it, but always curtailed and constrained by the legal regime in which it operates. So clearly it will have to partner. It will have to partner with other aspects of the government to make anything happen in a more bold and dramatic way that will continue to work incrementally.

And we somehow have to figure out how to do this by resisting the pressures of self interests, but quite bluntly. Let me tell you something which everybody knows. Companies don't like competition. It's the biggest red herring and garbage I've ever heard in my life. They like to not have to compete. They like to be able to sit quietly where they are and go home at 4 if they can get away with it, cash their check and go to the golf course. I like that world too, if I could achieve it.

And so you will find constantly a lack of principle at times in the context of the course of this debate. I've seen many both companies and policy makers are taking very principled positions at the academic conference until it's time to

change the rule and it moves from the academic to the self-interested and suddenly principles of competition and market use a spectrum that seems so meritoriously are suddenly the end of the universe as far as that particular company or set of companies are concerned.

That's not to be disparaging of them. It's only to be challenging to those of us in policy to try to look past that and if you really mean change you're going to look past the short-term self-interest of people whose change will ultimately provide difficulty or compromise or nobody likes change. And so that will be difficult.

So I don't know. What does it consist of. That's what I and others will turn to you, but I thought I'd give to you at least four points that seem to me to be meaningful.

More efficient use of what we've got. I start with this and not with more spectrum. I think the time has come to realize there ain't a whole lot of spectrum in the closet back here that we have at the FCC that hasn't been put out yet. If there was, I assure you, we'd roll it out here and get it out of here. The problem I think

increasingly is the demand and the kinds of innovative uses that are coming and far outstrip the amount of spectrum available and just like IP technology and burstiness, the real challenge is how to get more use out of spectrum that 80 percent of the time lies fallow.

And I think that the answer there relies on the empowerment of technology that will allow for more innovative uses of existing technology like software-defined radios, like perhaps receiver standards, like perhaps other ways to use technology to use the same amount of spectrum in a better way.

Sharing. We have had a major ideological struggle this year with very different constituencies, Department of Defense and others about the basic notion that somebody can be in your backyard and that is okay, as long as you can protect against the kind of technical interference which often is true, but often is a huge red herring which really masks the objection to the basic principle that anybody would have to share my stuff. It's important to remember it's the public's stuff at the end of the day.

And the unlicensed band which has been

an incredible font of not only innovation, but a way of showing us a vision of the way, alternative ways that spectrum can be used that are outside the traditional service provider or command and control model.

Secondly, there is no question we have a problem that we need to be able to deal with unpredictable and dynamic change. How do you get spectrum once used for one thing to a higher and better use quick enough to be meaningful in the market and to consumers? Right now, the laborious process of government command and control which has served the country well up to a point is just futilely too slow to rapidly move things to new and better and innovative uses. I don't think this is ideological, to then say you have to look at market mechanisms which is the only thing in the history of the world that I've discovered in my reading of history that has been effective in dealing with rapid changes in uses and moving things more quickly to new uses. So it necessarily means more market-based mechanisms and less command and control.

Third, unquestionably, the government and the commercial sector have to improve both the

balance and the processes used for reconciling critical governmental uses with commercial uses. There has to be at a minimum better process for the management of those challenges. I think there has to be a more unified consensus about what the concepts and principles of the use of that spectrum are. Is sharing off the table or part of what will always be a legitimate consideration? I think we have fought for the principle that has to be part of a general governmental understanding that sharing is not an

off-the-table thing, for example. But that has to be improved and I would applaud NTIA who I think has taken on some nasty challenges in the last year, everything from 3G to ultra-wide band and I have been in those meetings and there's blood on the floor in an effort to find the handle and a process to improve that. I think that needs to continue.

And finally, where I always like to end, with hopefulness about the future, there always has to be air for innovation. There has to be oxygen for the things that none of us can predict right now, have no ability to foresee and as sure as I'm standing here, before my next

birthday, somebody is going to have something we hadn't quite thought of and there always has to be a home for that person, that kid in the garage has to be able to come out and find a place and I think that we need to think more aggressively about how we accommodate that in a system that has a tendency to move toward established users and I think we have to have a serious consideration of everything from how do you expand and exploit the values of the unlicensed band, as we've seen in some ways or maybe even other newer and innovative ways to promote innovation that we have yet to think of.

If we don't do that, I think that all you do is freeze yourself in time to the detriment of the market, the technology and our citizens. So that always has to be at the top of our list too.

So we're really excited. I thank Paul and all of you for coming. I really, really look forward to reading the product of this group and I look forward to being a champion for what it proposes to change.

Thank you very much and have a great day.

(Applause.)

MS. VAN WAZER: Thank you, Chairman

Powell, for sharing your vision with us. We certainly do have some tough challenges ahead. I was happy to find out that we do have a few months before your next birthday, so I think we have time to make some headway.

I'd like to introduce Commissioner Abernathy.

COMMISSIONER ABERNATHY: Thank you very much. It's always a pleasure to be here talking about spectrum issues. As I look out at everyone who's been intimately involved in these issues for so long, I think well, why are we in such a mess today and why are we really needing to revise and revamp the way we look at spectrum? And I think it's because, I used to think it's because it's mostly guys.

(Laughter.)

I thought well that is the problem. If we were in charge of it -- but then the Chairman comes out and he lays out this great vision --

CHAIRMAN POWELL: That's my feminine side.

(Laughter.)

COMMISSIONER ABERNATHY: And he creates this task force which is fabulous. He's got Lauren

and Paul working on it. So I have hope now that we will be able to address many of these issues.

As you know and as the Chairman mentioned, spectrum policy continues to challenge this Agency to be at our best, to work our hardest, to be our most innovative and I appreciate that spectrum is so critical to the jobs that all of you are out there trying to perform because for much of my career I have worked in businesses that rely on spectrum to survive, to compete. The first satellite and the then the wireless phone business without spectrum, there simply was no product, there was no service to offer. And both of those traditional spectrum-based services which are very much with us today are only part of the challenge. Today, unlicensed services have begun to assume an even more prominent role in the lives of Americans. I can remember when he'd give speeches about unlicensed devices and it was baby monitors, pretty much, and garage door openers. That was about it. And now we know there's just so many other products and services out there that are beneficial to consumers.

Now over the past few months, I've laid out my views on the future of spectrum policy and

the licensed and the unlicensed bands and there's widespread agreement, I think, in this Agency that flexibility and allocations and service rules absolutely advance the public interest. And the Commission has substantial discretion in formulating the bundle of rights that are associated with that flexibility.

In developing these rights, however, interference protection remains one of our most paramount concerns because once the allocation of service rules have been developed, consistent with interference protections, we then have to determine how to distribute that bundle of rights and that's when I think it's safe to say we've got the heaviest lobbying from all parties because everyone wants a piece of the pie.

So what should be our licensing goal as an Agency? I think it is to maximize the efficiency of commercial spectrum used by promptly getting as many rights as possible into the marketplace while protecting the licensed user from harmful interference. And I think when you look at this distribution of rights, the spectrum can be analyzed as a continuum between two paradigms. We've got the full property-like rights model to a

pure commons model on spectrum and I think the private property-like model is basically a lawyer's dream. It's a distribution of all spectrum rights like any other piece of property that we might have. Ideally, this occurs mostly in a secondary market with limited government intervention. The Commission has, in recent years, utilized the flexibility granted in the Act to move towards a quasi-property rights model and under this approach, maximizing flexibility and service rules and allocations serves the public interest by allowing the property to be developed to the greatest degree. And there's limitations on this model because of statutory language that goes back to who actually owns the spectrum and it's never owned by the licensed entities. But it's a model that we've used and I think it's been very effective.

In contrast to the private property approach, there is the pure commons approach and this is more of an engineer's dream. These are the unlicensed bands, and as you know, they do not provide for any real interference protection or for any exclusive licensee rights to the spectrum.

It's a big free-for-all in some respects. So guided by technical limitations, the bands are open to all comers, so long as they operate approved equipment. And this openness eliminates the entry barrier that can be created by an auction price, but it also creates a different kind of barrier by imposing more detailed technical rules on common use of the spectrum. So that's what we've been using in the past.

And in light of these two kinds of use, what's our regulatory response, what are we supposed to do? I think at this point, we're well-served by utilizing both the property-like rights approach and the commons model. It's no different than a city that has private land that's linked together by common roads and parks. So I think too, that the spectrum community can enjoy and fully utilize both the property, the private property approach and a commons approach. But the key to making this work is an effective regulatory regime that defines and vigorously enforces the spectrum rights and the responsibilities and creates a framework for allocating this very valuable resource. And that's why the work that all of you are doing today is so very, very

important to us. We need to improve on that. We need to get more rational about how we do it and as the Chairman mentioned, there are limitations in the Act. We may end up needing some legislative help too.

I look forward to hearing more about what you guys accomplish today. You can rest assured that the product of these sessions will significantly influence and shape my consideration of future spectrum issues because it's one of the most critical areas that we are addressing as a Commission. So thank you very much for taking a lot of your free time, on a Friday in August, to work on these issues.

Thank you.

(Applause.)

MS. VAN WAZER: Thank you, Commissioner Abernathy for your thoughtful remarks.

And now I'd like to introduce Tom Krattenmaker of Mintz Levin who will be giving us a historical overview of spectrum rights and responsibilities.

Tom?

MR. KRATTENMAKER: Thanks, Lauren. Mr. Chairman, Commissioner Abernathy, nice to see you

all here this morning.

I'm not sure why I was selected for this task, although of course, I will try to rise below it.

(Laughter.)

I've always wanted to begin addressing a crowd in Washington with the phrase "I am not now and never have been", so I will do that. I'm not now and never have been an electrical engineer.

(Laughter.)

My capacity or my credentials in electrical engineering extend to the fact that I do know how to turn my television set. My wife claims I don't know how to turn it off. But I still can't figure out how those little tiny football players get inside the tube. So I'm not going to try to do that.

And as I guess I've already showed, I just don't have the Chairman's capacity for staying in touch with my feminine side, so I'll have to try to play to some other strength. Therefore, what I thought I would do is I do think I know something about FCC regulatory history and something about the economics of telecommunications policy. So I'm going to try to suggest some basic principle that

history and economics teach us about spectrum policy and since I did also used to work at the Federal Trade Commission, that means you've now been warned. A lawyer has gotten up and said he's going to talk to you about economics and history. So here goes and you'll be the judge.

A little bit about history. How did we get where we are? Well, the way I think about this, spectrum policy, together with just about every other policy the FCC enforces, began in 1912. And I think that's why when you walk inside the Commission you see these big roiled waters that are -- and you say why is that? That's the wake of the Titanic when it went down.

(Laughter.)

In 1912, the Titanic sank and the government seized the airwaves. The story that went out and it may be true, I don't know how we could verify it, is that the Marconi Wireless Telegraph Company received signals of distress from the Titanic, but was unable to relay those signals to public safety personnel because there was so much interference along the East Coast from nascent commercial broadcasters who had heard about this wreck and started putting out some chatter on the

airwaves and so the rescue signals were to some extent drowned out. As a result of that, whether that story is true or not, Congress believed it and they passed the Radio Act of 1912 which laid down this very fundamental principle that no one could broadcast without a federal license.

At the same time, I think the Radio Act of 1912 inaugurated a series of spectrum policy traditions that continued to the present day. Let me mention a few of them.

The first several I want to mention, I think we've come to regret, but not all of them. One thing that traces all the way back to 1912 is the fact that spectrum policy is largely reactive, not planned. Again, both the Chairman and Commissioner Abernathy have already sounded this theme and I'm not going to apologize for repeating some of the things they're saying. Maybe it would help to underscore the wisdom that I believe they brought to this matter.

For example, although it was a spectrum crisis in common carrier type operations that led to the Radio Act of 1912, by the time World War I was over, all the spectrum policy issues were about AM broadcasting. It has always been a reactive and

never a planned system, spectrum policy in this country.

Secondly, spectrum rules have been typically been command and control rules. Do this, don't do that, do it this way, don't do it that way, use this kind of an antenna, point it in that direction, not a rule that specifies you have a certain kind of right or you have a certain kind of duty not to interfere with someone else. Again, Commissioner Abernathy, I think, already sounded that theme.

Third, ever since the Radio Act of 1912, we've had an awkward and not carefully legal worked out split between administration of the spectrum for private sector needs and for administration for public safety and national security needs. It's still, at best, a very informal, ad hoc, not legally structured process for determining which spectrum gets used in which of those two type baskets or three, if you prefer to think of it that way.

Fourth, at least at the beginning a complete disdain for markets. The Radio Act of 1912 had nothing to do with trying to facilitate markets and spectrum and indeed, that tradition

carried right through. In 1927, 75 years ago, almost -- I forgot to look at the date, if today were the date, I hope it's not the Chairman's birthday, but it could be the birthday of the Federal Radio Act, the drive to create to Federal Radio Commission was largely on the backs of incumbent broadcasters who wanted a federal agency that would seize authority over AM radio and prevent expansion of the AM radio band. That is, spectrum policy was producing too much competition in 1927 and we needed to use spectrum policy to put a stop to that.

Finally, in my litany of stuff to trace my way back, the 1927 Act added the pretense, if not the reality of uncertainty. Instead of licenses being stable and secure, licenses outside the public safety national security area realm for commercial transition, excuse me, for commercial transmissions were to be of very limited, shall be to revocation according to a broad and imprecise standard.

Many of these policies still today remain in some form or other and I think we've come to regret each of them. There are a couple other traditions that I think trace back to 1912 that I

think are very positive, but I'd like to mention them for a minute. One is a willingness, notice I said willingness, not eagerness, a willingness, if not eagerness over time to innovate. The Commission has, for example, allocated spectrum for narrow specific purposes or for broad flexible use. The Commission has tried several different ways to assign licenses for allocated spectrum. Among them are comparative hearings, unlimited sharing, mandated sharing, first come, first serve, lotteries, auctions, and in what I call a spectrum policy oxymoron, the Commission is even authorized unlicensed services. So I think that there is in this 90-year history a rich variety of innovation, sometimes it wasn't always the Commission's idea, sometimes it dragged kicking and screaming into it, but there might be an awful lot of information we could glean by looking backwards.

Another positive part of the tradition that's now been with us for 90 years, I think, that deserves note is that this spectrum policy has been carried out first by the Navy, then by the Federal Radio Commission, but since 1934 by the Federal Communications Commission, with the almost complete absence of scandal or self-dealing. This is an

area that is fraught with danger for scandal or for misbehavior and I think it is noteworthy and important to say that although the Commission may have made mistakes, they have been made in good faith by women and men of integrity and I think that everybody who works for the Commission and I've been privileged on two different occasions to be such a person, should in my view be proud of that fact and I would hope that the task force will take note of that fact that spectrum policy has been conducted with integrity and will pay attention to the need to make sure that that is something that continues as part of what its final report will note.

So much for my historical look back. What about the economics? What are some of the lessons we've learned in the past 90 years? Why do we reject many of these early policies, as I suggested we have?

Well, I think the most important lesson we have learned is that Nobel laureate economist Ronald Coase was largely correct, although I'm sort of tempted to say Commissioner Abernathy is largely correct because she described a set of rules that would have made Ronald Coase very, very happy and

like her, I agree with it.

In my words, not his, Professor Coase said what we need are first of all clearly defined spectrum property rights, very much like the rights a business or a person might have to a piece of real property, like the land on which you put an antenna or the rights which you might have to a piece of personal property like that antenna. You should have the same kind of rights in spectrum as you do in real or personal property.

Secondly, it should be a right to be free of interference from others with the use of that property. The basic right is to be free from interference with the exercise of the right.

And third, you should be able to hold those rights with security so that people are willing to invest in those properties and in order to implement these kind of rights, finally, accept where market failure is predictable we can leave the rest to bargaining in spectrum rights markets. If we lay out the principle that we create spectrum property rights in the same way that we create other kinds of property rights, that this is largely a right to be free of interference from others and a duty to be free of interference with

others and that we hold these in a secure fashion so that people are willing to invest in the technologies that ride on them. We can then largely turn to markets.

But the other lesson I think we learn from economics and I think this is why the Chairman described this as such a complicated area and one that has attracted so much attention from so many people, there's a second lesson that qualifies the first, I think, from this little quick trip through economics and that is it doesn't mean that one can go immediately to uncontrolled markets in feasible spectrum rights. One reason is that the United States has clearly defined obligations under international law that we're bound to respect and international law doesn't always rest on these kinds of principles. Another reason is that markets may not always work well, although as both the Chairman and Commissioner Abernathy suggested, I think we have to resist the tendency to be constantly concluding that oh well, the market won't work this time, rather, there ought to be a presumption that they will, but certainly,for example, where one group holds the transmitters and another group is going to hold the receivers, it

can be difficult to make markets work.

It could also be difficult to make markets work where one use is particularly well suited for a particular piece of the spectrum, particularly if another use is located side by side with it. That makes it very, very difficult too, to simply rely on markets. And then we are in a transition period. Since we didn't start with markets, you can't immediately go to them or you've got to be careful about immediately going to them because you may create problems retroactively.

So it's not a simple matter, but Dr. Coase, I think, laid down a path by which we could get there.

Well, with Coase establishing a framework, and using history as a guide, can we discern some hard and fast rules for sensible spectrum policy? I think we can. I'll take the Chairman up at his challenge or suggestion to start with the easy and go to the hard or to start by noting some things that I think we've probably achieved and then try to what did you want me to do, think boldly? Let me turn off the tape for that part.

What I've got here are six possible

rules for spectrum policy and my goodness, I know there to be others as well and I've got them in increasing order of the difficulty of implementing them. So the easiest is first.

Number one, whenever possible, let markets, rather than the Commission determine who are suitable providers of particular authorized services. Auctions aren't perfect, but unless the best is to be the enemy of the good, they should be here to stay, I think. I think that's a policy that's easy to implement because it's largely enshrined in law and one that I think the Commission is in touch with already.

Next, most difficult, but I think a good basic principle is that for newly authorized spectrum, you should put as few restrictions as possible on the use to which the assignment can be put. I think we've learned that we're not well served by having a Commission decide what is the use for which this spectrum will be made as opposed to leaving it to the flexibility of the licensees over time, as markets, technology and consumer demand change.

Third, basic principle I would suggest and now it gets a little harder because we may have

to and I didn't take the Chairman up on his suggestion, I'm sorry to draft the statute and show you exactly where it goes, but I would be happy to do that at a subsequent time.

I think that another policy should be that in specifying the licenses to be granted, we should focus not on what one may do or transmit, but on the extent to which one must refrain from interfering with others and is entitled to be free of interference from others. The catch phrase for that would be that you don't focus on inputs. You don't have rules about what antennas to use, but you focus on outputs. You focus on okay, this is a license that says you're entitled to be free of this amount of interference and you're entitled to create no more than this level of interference to anybody else. I think moving away from command and control licenses, and I noticed from reading what's been going on, that these kinds of issues have already begun to be discussed, for example, in the context of software-defined radio and other issues before this panel and I would applaud that.

Fourth, adopt the policy that is planned, not reactive. This will not be easy to do, partly because there are so many issues on the

table at any one moment. But if we are going to dig out of the apparent morass of issues that are staring us right in the face, I suggest the only way to do it is either to put them behind us or at least have a group, hopefully, it will be this one that puts that behind us and looks at trying a planned spectrum policy that looks at least a decade down the road as to where we hope to go. And what uses we hope to put spectrum to.

Fifth, and getting terribly difficult, I would hope that the Commission would adopt as a principle that when spectrum is allocated it has a plan for what to do if it doesn't work after the licenses are granted.

Now, of course, I wish the Commission did this all the time. I wish every Commission rule had at the end of it here is a statement of what we're trying to achieve and if the following things don't happen, we'll repeal the rule.

The Code of Federal Regulations in Volume 47 would shrink substantially were that done. For example, but what I mean here is if a new service is proposed and spectrum is freed up for the service, I think the Commission would be well served for it to identify clearly what should

happen and when if the service doesn't materialize, whether that's for technical reasons or economic reasons. The most important question to address before the question is in front of you is if that kind of failure occurs is the Commission going to try to quote fix it by finding more or better spectrum for the existing service or by authorizing new service for that spectrum or will it leave the quote fix to flexible use licenses? I think thinking out those problems when you are authorizing the service in the first place is the way to avoid the politicization of some of these issues. I know it's a very difficult thing to do.

Finally, and most difficult to implement, but I think a basic principle that would serve the Commission well is take responsibility only for the spectrum, not the service. This is the hardest rule of all to implement, not because it requires a change in the law, but because it requires a change in attitude and violating a cardinal tenet of Agency practice. That tenet is that you do not ever concede that you are not omnipotent.

(Laughter.)

You do not ever concede that you can't

fix any problem. On the other hand, we all know that we are not omnipotent and not even the Federal Communications Commission, where I've already told you I've been proud to be an employee here on two different occasions.

So when confronted with a new technology that appears capable of interjecting happiness into the lives of consumers or huge efficiencies into the balance sheets of producers, or preferably both, I think the Commission would be well advised to promise that service to no one, to make spectrum decisions that permit the service to materialize should it turn out to be economical and practical and to make it clear that we can have the service when and if we're willing to pay for it and if we're not, we won't. I know that will be a hard one to implement, but I suggest it would be.

In any event, those are Krattenmaker's six principles for the panel to think about. I decided to leave for the end the title of my remarks because I thought it would make more sense at the end. I've decided that this should be entitled "Thank Goodness Dr. Coase was not on the Titanic."

(Laughter.)

Thank you and good luck.

(Applause.)

MS. VAN WAZER: Thank you, Tom. Tom was my anti-trust law professor more years ago than I'd care to admit and you were a tremendous professor then and it's a privilege to continue to learn from you today.

Now we've got his lecture on tape, so if my notes aren't good enough, I can review the tape.

With that, I'd like to introduce Dr. Paul Kolodzy, Director of the Spectrum Policy Task Force.

DR. KOLODZY: Good morning. And I guess I play dual role today. Usually, I'm up there talking about what the task force is about and passing it on to the moderators. Today, I'm going to do a little bit of both. I'm going to actually help in the moderation task.

First of all, I'd like to thank both Chairman Power and Commissioner Abernathy and Professor Krattenmaker for their great remarks this morning. They teed up a lot of the issues that we're trying to deal with. In fact, today's panel, excuse me, today's workshop on rights and

responsibilities actually tries to address a lot of those issues and I hope that we have some lively discussions today and I hope to hear a lot from the audience for their comments.

The Spectrum Policy Task Force, for those who do not know, is trying to take a future look at spectrum policies and trying to understand exactly where we're going. So we're trying to actually address one of those issues that, in fact, came up which is how do we look forward and how do we actually try to be more proactive versus reactive? And so the Task Force is focusing on that and in fact, since this is a large activity, we took four workshops to actually pull off all of the information, try to pull all the information together. This is the last of those workshops and for those who do not know, you can actually go on the web, on the FCC website and actually get a whole of these workshops and actually review them at your leisure. And I recommend you do that if you have any questions in the sense of those four areas. If you remember, we had areas on license and experimental use. We also had things, a workshop on interference, on spectrum efficiency and then finally this workshop.

I'd also like to take a few moments here, this is the last workshop. We pulled off four workshops in 8 days. I think that's a record in somebody's books here at the Commission and I think it really comes -- the reason we were able to do that was because of the hard work of Lauren Van Wazer. I think my Deputy did an unbelievable job to try to pull all of this off and all of the support people that were -- that helped her put all these pieces together and I think that we couldn't do the things we're doing today without their dedication and help, so I'd like to thank them personally for all their help.

I also would like to try to tell you a little bit about the schedule what we're on. Right now, we are on the fourth workshop as we've been saying. We're going to be trying to put together recommendations and putting out a report probably by the end of October. That's the goal. And hopefully, we'll be having interactions between now and then for certain folks, but the idea is to actually put out a report for recommendations to the Commission in that time frame.

Today, this panel, the panel is entitled "New Technology in Spectrum Usage Right"

is asking really two basic fundamental questions. One is what's happening in the technology area and how is it impacting, what kind of rights we may be wanting to put together. Or second of all, is new technology really an answer to those rights, meaning do you even worry about the rights, you worry about the technology. So should it be technology focus with the rights impacting the technology or should it be that the technology impacts the rights?

And I am pleased that I have a co-moderator, Charla Rath, from Verizon Wireless, who's going to help me out today. In fact, hopefully, she's going to take a lot of the lead. I can sit back and listen because one of my roles here is to actually listen to most of the commentary and try to help formulate new ideas.

We're going to start off basically by going across the panel and letting them introduce themselves. I've asked each one of them to probably spend no more, like a minute or so, talking a little bit about who they are and what their perspective is, because again, what we're trying to get accomplished today is to actually have the interaction between the panelists and the

audience and so please when we break every so often to ask for the audience participation, that is your opportunity to actually come forward and ask some questions. Or make some comments. Either if you have disagreements or commentary that you'd like to bring forth to the panel.

With that, I'd like to start off with Peter Pitsch from Intel.

MR. PITSCH: First, thanks for inviting me and I want to say I followed a number of the panels and I found them very educational. As Paul said, I am now at Intel, but I did spend 8 years under the black lights of the eighth floor at the FCC and I've thought about these issues for a while and I'll probably be giving you some of my personal views as well.

I'm going to try to set a good precedent on the one minute. I want to do basically just give you a gist of what I'm going to say, plant a few seeds and then come back to these ideas in the Q and A.

First, i want to incorporate by reference an awful lot of what Professor Krattenmaker said and Tom was a professor for me too, I have to say.

(Laughter.)

First, I want to say a word about problems, a word about causes and then two reforms that I want to press and give you an idea, hopefully over the course of the morning, some concrete practical ideas about how to go forward. Just a word about problems at the outset. Fundamental problem, artificial scarcity of the spectrum. It's man-made. All things are -- many things are scarce. Most things are scarce, but the problem here is that we have scarcity due to mistakes.

Secondly, the cause, again, a lot people have referred to it. The spin I want to put on it is yes, this process is cumbersome and inflexible and so on, but it fundamentally lacks two elements that markets have which is producing objective, decentralized information that can be used in a very decentralized people by people who have an incentive to use it. We'll get into that later.

And the reforms, I think the Commission needs to ironically create more flexibility and freedom in two very different ways. It needs to create more spectrum that can be used in commons or

explore this opportunity; and two, it needs to create through something I'll explain in more detail, a simultaneous exchange that defines rights and creates voluntary opportunities for spectrum to be more to higher valley uses. I'll get into that in more detail. But basically, I think these are complementary ideas and the Commission needs to move forward on these quickly.

DR. FARBER: The name is Dave Farber. I'm a Professor of Telecommunications at the University of Pennsylvania and also a faculty member of the Wharton School. I guess I should comment also in my past that I served for a marvelous year at the FCC as Chief Technologist which probably forever distorted my point of view on things for the better.

When I came here I was a technologist who had sort of an interest in public policy and now I find myself totally confused to whether I'm a person, a policy wonk or a technical nerd and hopefully a bit of both. And I commend that that's probably an important thing in the future. As a side bar, I'll be going to CMU for a year where my task is to get the nerds to talk to the wonks. It's going to be interesting.

My point of view on spectrum policy is I think well outlined in the submission that Gerry Faulhaber, also of Penn, and I submitted to the FCC's on-line system, copies are available on request. So I won't go over that, except in the Q and A. Let me just make some brief comments outside of that paper.

I think one of the most interesting events of the last several years is the tremendous surge of interest in the unlicensed spectrum, 802, the WiFi systems. And that's had several important things. First, it's become a keystone in the way computer deployment is done nowadays. When I was over in Tokyo a little while ago, Sony now makes a TV set that talks to the bay station over a WiFi link and you can carry the TV set with you. You don't have to carry everything else with you. It's just becoming ubiquitous, access points are now the size of a pack of cigarettes. That's done two things. It's made wireless something that every citizen sees, I hate the word consumer, every citizen sees and it's turned on a whole generation of young kids who never thought that there was anything interesting in the radio space and suddenly you're beginning to see kids who now think

of things like agile radio and software-defined radios as an interesting thing to look at as high school kids and maybe as career. And that certainly is productive for all of us to do.

Agile radios, the software-defined radios, I think are going to be an extremely important technology in the future and one of our opportunities is to make the policy make the technology in these areas.

I have two additional brief points. Security is becoming a much more important part of our life after certainly 9/11, but it's been that way for quite a while. Current attitudes towards it in the airways, to put it mildly, amateur day and getting secure, reliable, robust technology is going to be increasingly more important. Many of the new technologies allow us to do much better in that area. We have to make sure that our policy doesn't stop it which it has occasionally in the past, not FCC as much as other policies.

And finally, I can't resist a comment that I think the Chairman said that I have to slightly amplify and that's the Congress. When I was here, I remember a marvelous visit to the Hill where a Senator, I won't mention who, called me up.

He wanted to become the internet Senator, so I went up and spent two hours and he started with "now tell me what is the internet?"

(Laughter.)

MR. SHARKEY: I am Steve Sharkey. I'm with Motorola. I'm the Director for Spectrum and Standard Strategy in the Washington Office here. I admit that I also spent some time at the FCC, 11 years, winding my way through various bureaus and working on spectrum issues. I'm seeing it now from the other side and an interesting perspective to go back and forth between the two, but I know a lot of difficult issues that the FCC is dealing with and they are difficult issues.

One thing that I think we are seeing in a lot of the Commission's or Chairman's comments hit on is the need for greater flexibility of services and that is a good thing to allow different services to develop and not put a lot of constraints on the type of services or technologies that are implemented.

One of the things I think we need to keep in mind though is these have to be done in a coherent, technical framework that helps to limit interference between the services and provide some

certainty about the operation of a licensee. That will also help ensure some efficient use of the spectrum, that there's not a lot of the spectrum that's use for guard bands are wasted, kind of protecting yourself against incompatible neighbors or large changes in neighbors.

Also, one of the things that do need to be addressed is the need to clearly define the licensee rights and a number of the previous speakers touched on that, but again a certainty to drive the investment in deployment of large-scale services really goes to that need to define the licensee's rights, to be protected from interference and while also allowing some evolution of services.

The Chairman also hit on one of the keys here too and I think Peter's comment about the artificial scarcity of spectrum is a good one, the need to work more closely and align our policies between NTIA and FCC and that we have a system now that is a difficult system to work with, no real coherent way to work between the two agencies and no consistent policies between commercial and government uses of spectrum. So that is certainly an area that we need to address and I know the

Commission and NTIA have both made a lot of strides in working together. I think we have a long way to go to get beyond some of the difficulties the agencies have in moving past the -- you know, protecting their constituencies and kind of going off in the corners to do that protection and to look for new ways to share spectrum and to make the most efficient use possible of that. So I look forward to discussing these and the panel. Thanks.

MR. TAWIL: Thank you, Victor Tawil, Senior Vice President of the Association for Maximum Service Television. It is a technical trade association. I've been there for 14 years. Prior to that, I worked for the Commission in various bureaus, primarily in the wireless service and in the OET.

I have a small statement. I think that Federal "Titanic" Commission did extremely well for the past 90 years. It stayed afloat and that's good. And I hope it will stay afloat the next 90.

In terms of focus, my focus today will be primarily on responsibilities, spectrum responsibility. I'm not going to deal that much with spectrum rights, but I do believe spectrum responsibility is the key. Interference mitigation

is important. I do think flexibility is the key for innovation.

That's it, thank you.

DR. KOLODZY: Thank you. Actually, we jumped a bit from that side in.

Bruce?

DR. FETTE: Good morning. My name is Dr. Bruce Fette. I'm with General Dynamics in Scottsdale, Arizona where I'm the Chief Scientist at General Dynamics. We have recently developed a software-defined radio and have been delivering that to the Department of Defense.

In addition, I sit on the Board of Directors of the SDR Forum and I am a large company representative on the SDR Forum Board of Directors and am the Executive Chair of the SDR Forum's first conference to be held on software-defined radio technologies in November in San Diego and we look forward to seeing many of you participate in that conference coming up.

Relative to SDR technology, I'd like to say that we have developed the SDR technology with the expectation that it can accomplish dramatically more in functionality than a traditional radio and that in fact we expect that it will be able to

demonstrate for the Department of Defense some of the principles that we're trying to expect when we begin to talk about spectrum commons, non-interference, the kinds of protocols that would enable the principles that we're going to be talking about today.

Thank you.

DR. KOLODZY: Gee?

DR. RITTENHOUSE: I'm Gee Rittenhouse, Director of Wireless Technology at Bell Laboratories. To Professor Farber's point I freely and completely admit that I'm a technology nerd and that I have absolutely no experience with the policy, so I actually am really looking forward to this panel session and describing some of the technologies.

I do spend quite a bit of my time developing the technologies to make spectrum efficient, both in terms of multiple antenna systems, as well as wireless systems and we've also spent a great deal of time in some of the unlicensed technologies as well. So from that point of view, I think I can contribute a bit.

I also thought it was very interesting with Paul's point to see the disposition of

technology and policy. My personal view is that those two actually go hand in hand. In order to make spectrum efficient and to have efficient use of that spectrum, you have to have policy rights as well.

Thank you.

MR. SIDDALL: I'm Dave Siddall. I have also have worked a lot with regulation and technology, putting the two together, actually. I spent the first 13 years of my working career down on Capitol Hill where I specialized in communications at an organization called the Congressional Research Service. That meant that I was the resource for any question coming into any Senator or Congressman or committee staff regardless of parties or nonpartisan organization. If they didn't know how to answer it or wanted to have expert advice, they often referred it to the Congressional Research Service. If it had something to do with communications, it came to my desk.

I think I would date my initiation to this subject to that time, two decades ago. One of my clients was the -- and often in touch with me was the Chairman of the Senate Subcommittee on

Communications and there was a period during which he was sending me these constituent letters that kept coming in about I have this new idea, this new service, the FCC is a roadblock, they're not allowing me to find some spectrum to initiate my service. And we had back and forth with the FCC staff and with his staff and I met with his constituent. Finally, after about a year, he called me up one morning. We didn't have Caller ID in those ideas so I actually answered the phone and he said I just got this letter from the Chairman of the FCC and this had been going on for two years now and the letter says there's no more spectrum. And if I can find it, my constituent can have it. So what are we going to do, David?

Actually, one of the things that did come out of this a year or two later was Section 7 of the Communications Act which was I think the first attempt to actually address this issue. And it was put in by the Senator behind the scenes because it was an Omnibus Budget Reconciliation Act of 1982 that inserted it. And it said that the FCC shall rule on any requests for new technology within one year and if it doesn't rule, the technology shall be authorized. Easy said. We

kind of look at it back then as this will be interesting and the history of that is it's very difficult to implement.

Ten years later, I came here to the FCC. Ten years later, actually, I was the Chief of Spectrum Allocation and in some regard in charge of making sure we complied with that very statute, so every good deed is returned.

(Laughter.)

We also have the pioneers' preference and I think that would be the second major blip on the historical chart of attempts to find ways of getting technology out to the marketplace. I cannot take any responsibility for that. I was in charge of administering it. I came into my job one month after the Commission had adopted the rules on that. So I had nothing to with its formation, but I had everything to do with trying to carry out that rule.

And as many of you know, during my 13 years here at the Commission, as I spent 13 on the Hill, 13 here at the Commission, the job from which I retired was the wireless advisor, media advisor to Commissioner Susan Ness and again, we dealt with spectrum.

And again, in case you want to put too much weight on anything I say this morning, I have to tell the story that when I first met her to brief her on the PCS which we were in the middle of a rulemaking on Personal Communications Service, she was asking me how this all operated. This is not a job interview, but a regular, you know, I'm going to be a new Commissioner type interview. When I explained it to her, I said there's one thing to remember, in spectrum decisions, there's 50 percent of the parties are going to be really mad and 50 percent really happy. So what you want to do as a Commissioner is we'll brief you on it, but we'll take the hit on the staff, we'll do it as a staff-delegated action with your knowledge of what we're doing. You'll never have to deal with it and you don't want to because it's very messy. And because I was very wrong with that and now the spectrum issues are way up in elevation.

I wanted to say two points and then I'll shut up and turn it over. One is if the results of this task force is something like one size fits all, I can guarantee you it's wrong. There is strength in diversity. There are many different types of services, many different uses of

spectrum and the real trick here is to somehow accommodate all the different uses under some regulatory scheme at 10,000 feet, but to make sure that when you get down into the details, that the diversity is still there and I think that requires some differences in regulation.

I would draw the direct analogy to property rights. I own a house out in Great Falls. I wouldn't be here today. I would be really retired and a multi-millionaire if I could -- it's a two acre piece of property. If I could just take that one acre and put a McDonald's on one end because we don't have a fast food restaurant within 10 miles of where I live that's decent, if we could put McDonald's on one end and maybe townhouses on the three quarters remaining acre, I'd be very rich, but there's zoning requirements that go with that property. There's rights of way. I have to be careful when I dig because there's electrical lines and gas lines and cable TV lines going through that property. So when we talk about property rights in the abstract, it sounds very good, but when you really look at the details of property rights that are what we have today, there are different rules that apply and I think the same

thing probably will apply to spectrum in the end. And we just have to keep that in mind because some people use the property rights rubric to mean no regulation at all.

Now at least my experience in land ownership or at least I inhabit some land that my mortgage company owns, is that there's a lot of restrictions on what I can do. I hope the spectrum property rights actually will be a little less restrictive than my property rights.

The second thing is when you get all done your recommendations, I would urge you to take one last look at the package and see if there is a self-adjusting mechanism so that changes in technology and spectrum use can be accommodated with either minimal or no additional regulatory action because it's very easy to lose that point, to come out with a lot of different proposals, but when you do the final look at it with that in mind, you say well, what have I done? I've just written a new set of regulations that fit today's technology. The paradigm shouldn't be to fit today's technology or yesterday's technology or even tomorrow's technology. The paradigm should be I don't know what's coming down the line. Is there

a way that those who use the spectrum can adjust to the new technologies without the delay that is inherent in governmental action.

Thank you.

DR. REED: Hi, I'm David Reed and I'm not currently full-time with anybody. I'm an independent consultant, although I do have affiliations with the MIT Media Lab and with several other organizations.

I'm basically a systems designer, mathematician, computer scientist and a sometime person who's taught himself economics, at least as far as it applies in my field. My career started out at MIT as a student and professor and wandered through 10 years in the personal computer industry where I, among other things, was Vice President and Chief Scientist at Lotus Development for 7 years.

In my student days at MIT, I was involved in the initial design of the internet protocols which was a distributed process across the country and I represented MIT in that effort and I probably am best known in that time for some architectural principles that have characterized the internet, in particular, the end to end argument which I co-authored with Jerry Salzer and

Dave Clark.

I think this is a very interesting proceeding. I was especially hardened by Commissioner Pell's remarks where he seemed to put everything on the table and recognized a tremendous economic opportunity that we face or economic challenge and my feeling is that the challenge we face is very similar to the challenge we faced in the early days of the internet back in the 1970s, 25 years ago when I was involved, recognizing that we didn't know what the best applications were, but we knew that this new architecture was going to support a very rapidly growing activity and one that it would be foolish on our part to try to predict what was going to happen. Instead, we had to open up the opportunity for lots of innovators and lots of developers. And the end to end argument was part of the architectural argument to enable that very flexible model which I would point out had nothing to do with property rights.

I'm a great fan of Coase, but not because of his FCC paper per se although it's well reasoned, given what he knew about at the time, but I am a great fan of what he won his Nobel prize for which is the argument about when you introduce

transaction costs everything flies out the window and it's that part of Coase's argument that I support and I think it turns out in the long run and I will argue that his argument about the FCC, while historically interesting was incorrect in the technical basis for it and therefore needs to be revised.

I think at the same time, Claude Shannon who is one of the greats formulated the problem much more, in a much more interesting way. He recognized that spectrum was not the resource. Wires were not the resource. Bits between communicated entities was the resource that needed to be managed or increased and it turns out that many years, now about 70 years or not quite 70 years after the current 1934 Act was based on an incorrect understanding of how a radio works, we are finally starting to understand how to apply Shannon's understanding of information to radio networks and discovering that, in fact, there not only is scarcity artificial from regulation, but the scarcity of communication capacity and other economic utility in the spectrum and has very little to do with spectrum as a resource and has a lot to do with architecture and innovation.

In particular, the notion of interference, that we know and love, it's been enshrined in the law is extremely poor and even Coase recognized that in his famous example of the confectioner and the dentist where he talked about the idea of a dentist that was disturbed by the neighbor which was a confectioner generating large amounts of vibration that made it very difficult for him to carry out his activity. What Coase pointed out in some of his writings was that it wasn't just the confectioner that was responsible for that interference. It was the dentist for choosing to locate himself where he was and he could equally well take the burden of minimizing that interference. And that's very analogous to the receiver exercise that we talked about earlier.

So with that, my main point is and I will stand up for it today that the idea of a commons based architecture where the market is in the equipment and tool providers space is a much better model for regulating radio than the model that somehow all the goodness of radio coming from the electromagnetic ether and therefore all economic returns should go back to those who hold artificial licenses. So thank you.

MS. RATH: Okay, we're now going to move to the interactive portion of the morning. I just want to state for the record that I am a wonk, not a nerd, but -- Paul will be the nerd in the moderating session.

(Laughter.)

What I'd like to do is begin with a sort of an over arching question, that basically is the question of this workshop which is how does the so-called lack of access to spectrum, not necessarily spectrum, spectrum scarcity, but lack of access to spectrum impede technology development? And the basis for that is we sort of talked through this issue is that some contend that all valuable spectrum has already been assigned, has already been licensed and thus is an impediment to the development of new technologies that might be seeking a corner of spectrum. Others have actually contended that, in fact, this very scarcity drives people to innovate and drives for more spectrally-efficient use of the spectrum and may actually, in fact, lead to some sorts of technology innovation. But then as you sort of look on the new frontier and we talk about things like SDRs, you talk about possibility of spectrum

holes and the ability to fill spectrum that may not even be used even though licensed.

What I'd like to do first is just ask Dr. Reed and Dr. Farber to sort of talk briefly about this, with maybe some follow-up by Dr. Fette and Rittenhouse and then obviously can join in that they want to, but I wanted to sort of start with the two of you on sort of defining the question.

DR. REED: Sure. Actually, there are a couple of things I'd like to point out. First of all, the idea that there's a possibility of spectrum holes, is a funny way to phrase it, in fact, if you actually look at the available capacity of the spectrum, even with today's technology, there's a huge amount of capacity wasted by very high powered transmitters and a variety of other technologies that might have been the best you could do in their time.

We have, if you -- there's the famous example if you take a spectrogram of the radio spectrum in any point in the United States, you'll find that it's 99.999 percent unused by anybody and actually, if you look at a second order point, is that if you actually look around for places where the spectrum is used, and you look at the --

whether there are any receivers there, for example, to receive the signal, you'll find that there's almost no receivers there. So what we actually have is a vast desert. It's all hole and very little use.

Nonetheless, if you try to use any of it you run into government-granted rights that will be used against you if for nothing else, as Dr. Powell heard, Commissioner Powell mentioned, to keep you from being a low-cost competitor. So that's the first point.

The second point is that we've in the last 10 years including technologies such as ultra-wide band which I had a little bit of involvement with back at Interval Research, software-defined radio which several on the panel know a great deal about and radio networking which started out with packet radio networks developed by DOD and have evolved well beyond that which provide a kind of gain called cooperation gain. That is if you house several transmitters and receivers cooperating in a system, you can get a lot more effective bit capacity.

All of those things mean that we're in the current situation getting almost no effective

communications out of our totally allocated spectrum and since the technology is available now to do that, we need to find ways to enable that technology.

MS. RATH: Dr. Farber?

DR. FARBER: Thank you. It's always difficult going after Dave. He says a lot of what I wanted to say, but let me emphasize two things. I remember talking to Paul Baron once sitting in his living room as he was scanning the spectrum. For those of you who don't know Paul, he was a force in many, many areas of both radio and probably the one who originated packet networks. And the spectrum is largely empty. And part of our problem is it's like going to parts of the United States back in the old days where nobody was around, the land was empty, but there were barbed wire fences all over the place and if I dared walk into your property, I'd have to go through the barbed wire and once I got there, somebody might shoot at me. As opposed to the world that exists in other parts of the world where I have the right to walk across your property, provided I don't meaningfully interfere with you. And I think that term "meaningfully interfere with you" is a key

word. We talk about interference in some abstract sense. I guess if there's nobody in the forest who will hear the falling stone, if there's nobody using the spectrum, and I use it, I'm not interfering with anybody provided I get out fast enough when they want to use it.

We're at an era where the technology allows that and I think that's the key. It's a combination of software-defined radios which give us the flexibility. A lot learned from the internet. The internet and its development taught us a lot about how to deal with cooperating, almost friendly, sometimes hostile units working together for a common good. There's a lot to be derived out of that which has not been applied to radio space.

There are some examples in the past and if you separate technology from commercial success I aim you at a system that again Paul Baron built called Ricochet for Metricom which was a marvelous example of a very efficient use of a limited bandwidth with cooperating radios and in fact, probably was the first example of mesh radios in existence.

We have the technology. I think we have an understanding of how to apply it. But it's

not an overnight thing. We've ignored this area for a long, long time. There's been precious little research done in the area.

DR. FETTE: I'd like to open with the following observation. First of all, many folks have paid dearly for a chunk of spectrum for which they expect to be granted a certain quality of service and I think the reason those people defend that chunk of spectrum is that they feel that they have the responsibility to protect the customers that they serve with a certain degree of quality of service.

An example that's particularly illustrative there might be the public safety service sector in which while the spectrum is not used highly, when the need arises to use the spectrum to communicate, they certainly don't want to have interference.

The example of the software-defined radio which could in principle do a CSMA type collision recognition and recognize opportunities to use available spectrum implies that such things are possible as spectrum sharing.

It's important in such cases to be able to get off the air as soon as the spectrum is

required by its primary user and to assure that the quality of service is not degraded in any way for those users.

The example of public service is perhaps a little bit easier to deal with than the examples of satellite communications where it's difficult to recognize when communications is actually going on.

The principles of an SDR-type system with specified set of protocols and I think we can expect that the protocols will advance in sophistication and complexity and that the SDRs that implement them will advance in sophistication and complexity as time marches on.

I'd like to, in particular, point out that the technology advances both by virtue of a resource need and in the case of spectrum a resource need has been recognized, but also for other reasons other than spectrum resource. In this case, the SDR advances because the technology allows it to advance to the point where we can do so much more than was originally expected of a radio, for example. We can do multimedia source coding, web browsing and such things and because the technology allows it and allows it to become

economical at some point, then those who recognize that point of inflection jump in with an attempt to demonstrate those technologies and subsequently to demonstrate business opportunity deriving from that.

MS. RATH: Gee?

DR. RITTENHOUSE: Yes. I take somewhat of a different view, although I freely acknowledge that unlicensed spectrum and interference avoidance has its place for a crucible and the test tube of new technology development. I also want to acknowledge the fact that in the property rights model, because of the expense that has been put into that spectrum, we have also seen an evolution in spectral efficiency. In my field of expertise, the cellular communications, we are seeing a constant migration from amps to digital to now we're just rolling out 3G technologies and beyond. And so the fact that there are -- that spectrum is a finite resource or high quality spectrum is a finite resource also puts economic pressures to push towards higher, more spectrally efficient solutions detect and collision avoid type methods in the internet also allows for a multiplexing gain among users. And so within a particular spectral

band, you do get a packing efficiency. But if you look at some of the WiFi, particularly the more recent ones, type technologies, they are horribly spectrally inefficient compared to the 3G technologies and the corresponding shared high speed data channels and those type of technologies.

To Professor Farber's point of Ricochet, Ricochet largely failed, not because of a technology point of view or an efficiency point of view, but from a coverage point of view and the lack of ubiquitous service. A provider has to be able to predict in that present value of their deployment of the infrastructure that goes into that spectrum. And if they're not guaranteed that, or not able to predict it, then rolling out such a service is very difficult.

Thank you.

MS. RATH: I think a couple other people wanted to comment and then we'll go to the audience for some questions.

Steve?

MR. SHARKEY: Dr. Farber used an interesting term and looking at meaningfully interfering with an incumbent. And I think that's a key to this is when you're allowing new

technologies and we do have to have room for new technologies, but that's what a lot of the debate has been about is when are you interfering with the incumbent and more often we see in the FCC rulemakings the term "harmful interference." So whether you're talking about harmful interference or a meaningfully interfere, it's often a very different idea of what that means, depending on whether you're the incumbent or the new service provider or the new entrant.

And that's probably one of the key areas that I think the Commission can really work on is to try and provide a better definition of what "harmful interference" or "meaningfully interfere" is to better define those, the rights of the incumbents, to provide the certainty. That was a lot of the debate about the introduction of ultra-wide band technologies is whenever there is any introduction of a new technology that's going to overlay or impact or use the same spectrum or adjacent spectrum, there's going to be some impact so I think getting the certainty about what level of impact an incumbent has a right to expect or must be expected to live with is one of the critical things that would ease the path of the

introduction of new technologies and get around some of the debate that goes on. And that allows some of the innovation that Gee was talking about, the certainty for innovation in license services while also allowing introduction of some of the new services or new innovations.

MS. RATH: Thanks. Peter?

MR. PITSCH: First, I want to say Intel does support creating more common spectrum and I think the noninterfering easement idea that Professor Farber has suggested has merit and I am going to argue that these approaches, the rights approach and the commons approach are complementary. Not only do they co-exist, they are complementary. But as the Commission looks at the issue of commons versus rights, it needs to look at three factors: first, scarcity; second, transactions, costs; and third, practicality. I think the third point has been woefully ignored.

Professor Farber and Faulhaber have laid out the importance of transactions costs and scarcity. When we talk about scarcity it isn't enough to say well there will be no interference. The 2.4 gigahertz allocation had a very low opportunity cost for low power uses, right? We all

know why, microwave ovens. Similar arguments were made at 5 gigahertz. The nonlicensed PCS spectrum had a much higher opportunity cost, okay? So as the Commission thinks this through, it needs to consider scarcity. Transactions costs cut differently too. You can make a very compelling argument for ultra-wide band that the transactions costs, buyers and sellers getting together, are quite high. So the Commission was quite right to do that. For agile radios and mesh networks, the transactions costs arguments are much weaker.

Now just briefly on the proctocolitis point, again, I think the Commission was wise to go forward with ultra-wide band, but let's realize that we live in a real world here and that that was a very long process and many people believe came up with very conservative criteria. What if the alternative for agile radios, the efficiency alternative is not to limit them to two microseconds. Maybe it's different. Maybe equipment costs or the quality of service could be much higher. What if that happens much faster if you have a rights alternative for radio technology to be deployed? What if it happens in a much more efficient way? So again, complementary.

Also, nontrivial questions about squatters' rights. What if we create agile radios and yes, they have to look before they transmit and then get off and then we give flexibility to the incumbent user and they come up with a new technology which means that they're occupying the spectrum much more often and we have all these agile radios up there counting on the fact that they've in the past always got access or got access quite often and no longer can. Is the Commission going to have the credibility to deal with those problems?

So we need to be very pragmatic in how we move forward here as well, consider those considerations.

MS. RATH: One more and then that's it.

DR. FARBER: I just wanted to add one thing. Talking about technology for a moment. I think we're going to see a very interesting thing happen over the next year or so as cell phones come out with almost everything in them. Qualcom, the chip now has Bluetooth, WiFi, everything and the kitchen sink in it which gives you an interesting environment, that one phone is very agile in a way and how that develops in the marketplace is going

to be amusing, I think, is a nice term. You might get some indication by the fact that DoCoMo is going to spread WiFi all over Tokyo so they assume a technology there and believe there is an interesting market. How that develops I think may give us a lot of insight.

DR. REED: Yes, I have a very brief comment, since it will probably come up quite often. This notion that there needs to be certainty in order to support innovation is proven wrong in several different ways. I'd like to point out that in the semiconductor industry where huge investments get made in the billions and nearly trillions of dollars in new fab capacity, that is based on a bit and based on a reasonable expectation that somehow those things will be able to be used, but it's not based on a guarantee of return, especially not one provided by some kind of government grant of rights to a market.

So I think that might be a red herring. And in general, and my experience with the internet leads me to believe this, the most efficient economic architecture is the ones that actually support the most innovation, are the ones where there's the most uncertainty about the future

payoff, so while it may not be comfortable for people to invest in either licenses or new technologies without certainty, that's the game we're in especially with the technology rate of change and the government shouldn't try to make those investment payoffs. Let the investors do that.

DR. KOLODZY: Thanks. What I'd like to do is we're on the area -- there are spectrum scarcity issue to begin with and the second question, this is a follow-up sort of was asking the area of technology and how does technology impact that? I'd like to turn it over to the audience if there's any questions or comments basically in that area or anything that the panelists have commented on up to this point?

(No response.)

Well, if there isn't -- you do?

MR. SNYDER: Jim Snyder, New America Foundation. A comment and then two follow-up questions.

The transaction costs seem to be a favored concept that economists have been using frequently at this conference and I think it's a good word, but I would encourage you to use

switching costs a little bit more which is a variant on that idea. And why I like that better is I think it explains a little better why incumbents and I think the FCC are terrified about the implications of software-defined radio for spectrum policy because of the impact on switching costs. The last thing an incumbent wants is to make it very easy for, I think, consumers to comparison shop and shift around and SDR offers that in heretofore inconceivable way and also as to specificity, it's always been associated with telecommunications and spectrum policy where assets are closely tied to spectrum and SDR disentangles the two with I think really revolutionary consequences for thinking about spectrum policy.

So my first question to you is really what are the implications of SDR for spectrum policy? I certainly don't think the FCC has remotely grappled with those implications.

And secondly, what is the political analysis of SDR? Why does there seem to be such resistance to thinking through the implications? Is this just because it's a novel technology or it's economics are not -- poorly understood? Or is there some political dynamic that mitigates against

it, efficient use of technology to eliminate scarcity.

DR. KOLODZY: Okay, does anybody want to take those on? I think the second question I want to push back a little bit, it's a political question and I don't know if that's a bunch of technologists that we have here and being an technology oriented panel, we might not be able to address that, but I think the first question is a darn good one. Does anybody want to address that?

I'm looking at Bruce.

DR. FETTE: Actually, I'd like to take on the second question a little bit.

DR. KOLODZY: Okay.

DR. FETTE: The service provision of cellular telephony, for example, requires a tremendous infrastructure that hides behind the cell phone. We all see the device that fits in the shirt pocket or hangs on the belt clip as a very small device and yes, it's true that when you have a software-defined handset, it's possible to provide that handset with a wide variety of functionality and provisions, but the infrastructure behind that is really what the customer is paying for when he pays the monthly

bills. And it's very easy to forget that the investment associated with the infrastructure behind the cell phone is truly a remarkable investment and while our cellular providers have rolled that out rather quickly, the fact is that they expect a return on that investment and sometimes that return on investment takes a very long time and because it takes a very long time and the technology evolves during that time, an SDR is actually a way that the infrastructure can keep up with what people are expecting to get in the way of service provision at their handset. So I would like to share that idea with you.

The more sticky problem of how the FCC grapples with the implications is -- back to you, Paul.

MR. SHARKEY: You know, I guess, your point on companies being afraid of this new thing is a competitive aspect. I haven't heard that when -- in discussions on SDR and I think one of the -- it seems like it's been more of an implementation issue on technical interference which obviously can also be used to to mask competitive reasons, but I think the reality is SDR technology, there are many levels of it and while radios are developed and are

here, I don't think consumers are going to be to the store and making a choice between SDR and the cell phone any time soon. The costs are very different for an SDR radio right now and you're not going to put it in your shirt pocket. I think that there are very different expectations from what a consumer wants from a cell phone and driving the costs down, getting it out to as many people as possible and deployed as widely as possible, then you would get from an SDR, at least in the near future.

MR. SNYDER: If I could just interject. When I use SDR, I'm talking about something much more ambitious than I think you have in mind. I'm thinking of Vanu Bose's zero to 2.5 gigahertz system. And when you think about some of the oppositions, just think of number portability. You're in the cell phone business and the resistance of the cell phone companies to number portability. People have been talking about it for decades. The last thing Sprint or Verizon or anybody else wants is for you to easily be able to switch from one cell phone company to another so there's this infinite resistance and this is a trivial element of switching costs. We're talking

about a complete revolution where you could go up and down the dial and buy the cheapest bit. I mean no incumbent is going to, I think, want that type of scheme because it would make it so much more efficient and they'd lose their market power.

MR. SHARKEY: And I don't think that that technology is ready to be deployed in that way either.

MR. PITSCH: Could I jump in?

(Laughter.)

I want to answer the second question to. Intel is a great fan of SDR. I don't know if Mike Shardier is here. There he is. He's on the forum as well with Bruce.

MR. SHARKEY: Motorola is a big fan of SDR too.

MR. PITSCH: Okay. And I think we need, what the Commission needs to do is come up with mechanisms. As I said commons and rights approaches will actually, could enable SDR and other technologies much more quickly than we have in the current environment. But to respond to your second point, that goes to the practicality question because can curse the darkness or we can light a candle. Okay? I mean people have rights.

The United States is a country of laws and people have a constitutional right to come in and tell the Commission you can't allow this new service and they can raise lots of legitimate interference questions and guess what? They can be secretly in the dark of their heart motivated by fear of competition reasons, right? Okay. But how do we solve that problem? I mean we can blithely say well, oh let's just impose a noninterfering easement over all the spectrum or we could blithely say let's propertize, if that's a word, everything. But those things aren't going to happen easily and in the near term. So let's be practical, okay? In the next five years, let's look rigorously and practically at creating some easements, creating more common spectrum, getting more five gigahertz on license spectrum and let's also look at creating a simultaneous exchange where we can create flexibility, define property rights, use voluntary mechanisms which guess what, are going to be politically easier to do than simply going in and taking things away from people. Let's look at both.

DR. FARBER: Yes. I was spittering and spattering. All my instincts say that if you

create the marketplace, you'll find a software-defined radio in my pocket within a very small amount of time. Right now the marketplace isn't there to really push it and that's something the FCC by changing its rules can encourage.

There may be actually, a little aside, one of the big problems that a lot of us see is that a lot of the spectrum is controlled by our friends over across the river in the Pentagon and that spectrum is a very valuable space for them. On the other hand, they hardly ever use it, especially in the continental U.S. Their problem is when they want to use it, they don't have to have to negotiate with anybody to use it and that seems like, in fact, an ideal place for innovation for software-defined radios, for agile radios who can get, who can use space, but get out of the way when the owners need it. And it's probably an area where, in fact, one could do some meaningful research and meaningful application as opposed to challenging say a TV company whose main value is the alleged value of the spectrum quite often.

One other thing and I'll shush. No, I won't --

(Laughter.)

I've mentioned the word research. One of the big problems I see coming down the road is that we have very few places to do advance research now in this area. The economic situation, the decline of almost every major research laboratory in the United States is going to have a big impact on our ability to move. As a sidebar, I point out that, in fact, a broad -- some research labs are growing fast. Ours are declining. Somehow we have to respark the research that got us largely where we are and that's a nontrivial job.

DR. KOLODZY: I'll just make one comment. Actually, one of the things that you mentioned there about the technology with the defense world is that actually there's some projects going on at DARPA right now that people can look into and actually try to address some of those questions.

Dave, you had one quick question or comment?

DR. REED: Yes, just a quick comment on software-defined radio in the cellular space which you raised. It's very clear that software-defined radios that can support at least the agility among all the different types of cellular technology and

all possible bands that we might bring into use in the future are there today at the infrastructure level and what's interesting is the argument that Bruce made that what seems to be the economic barrier there is just the spectrum. In fact, we could have a lot more competition for the same handsets and so forth technologically just by allowing an operator to operate a software-defined bay station network that could handle all kinds of things and then capital investment of the operators could be much lower. And I think that type of thing would benefit, would immediately benefit everybody if the regulations enabled that and they do block it in many ways today.

DR. KOLODZY: Okay, now we have lots of questions coming up there. Ed?

MR. THOMAS: Yes, I have a question for anybody in the audience or the panel, vis-a-vis software-defined radios. Is there anything in our rules right now that are inhibiting to their development, especially when you look at the flexibility that's in the unlicensed rules and a couple of a years ago we did, in fact, authorize software-defined radios? So is there any big obstacles in our rules right now that inhibits the

development?

DR. REED: The main thing is licensing by use that Commissioner Powell referred to which is the tying of specific uses to licenses.

MR. THOMAS: Okay.

MR. STEVENSON: Carl Stevenson, Ager Systems and I had a question for Mr. Rittenhouse. Did I hear you or mis-hear you when I thought I heard you make the comment that Wi-Fi was spectrally inefficient?

DR. RITTENHOUSE: It's spectrally inefficient compared to the shared channels that you find in 3G systems.

MR. STEVENSON: Okay, I think my colleagues 802 would probably draw and quarter me if I went home without refuting that. We've constantly improved our spectral efficiency and our data rates. We've gone from 1 megabit to 11 megabits to 54 megabits in the same spectral mass. The spectral efficiency also comes into play because of the low power and the very, very small cell sizes which allow an incredible amount of frequency use, so I would disagree vehemently with your contention that Wi-Fi is spectrally inefficient.

DR. RITTENHOUSE: Yes. Those peak data rates certainly do go up, no doubt about it, but just the multiple access schemes tend to be very inefficient with respect to a shared channel scheduler, for example. So the average throughput is -- would be the more appropriate, not the peak data rate.

DR. KOLODZY: Questions?

MS. ARBAGAST: Rebecca Arbagast with Legg Mason. Now as I've been listening to the comments this morning, I've been struck oftentimes by tensions or at least potential tensions between various goals and objectives that people seem to have and that's not a criticism. I think my experience at the FCC was that that's just a fact of life that makes the job much more difficult.

One of the tensions that I'm wondering if people could speak to is the desire on the one hand to have more precise definitions of rights and on the other hand having a regime, a regulatory regime that allows for greater flexibility and the ability to evolve across time. In my experience in trying to draft rules that was to me the hardest thing that we grappled with. And I guess I have a two-part question. The first is when folks are

saying that they would like to see greater precision and certainty in definitions of rights which I think we would all agree is a goal and now in my job trying to persuade investors that there's a place to invest in this industry, I think one question I have is what else are you talking about besides a definition of harmful interference? Are there other aspects of that property right definition that are important to you all?

The second question is if you're talking about definitions of freedom from interference and an acceptable ability to give off interference, is there a way to do that without, in effect, curbing the range of uses that a particular spectrum can be put to. Those are my questions.

MR. SIDDALL: Rebecca, I guess to try to answer that, let me first of all back into it by answering Ed's question on software-defined radio. Let me use the example of personal communication service. There is no technical standard. You can put anything in that band and provide PCS. I'm not the -- I'm a lawyer for this purpose. I'm not sure what the technical aspects would be, but at least 15 or 30 megahertz you can aggregate by buying your neighbor's as shortly the spectrum cap comes off or

will come off. So in rural areas you can do that. So I'm not too sure that your rules are inhibited that way. PCS specifically was not defined by the service provided, nor did it adopt any technical standards.

Rebecca, with regard to the flexibility property rights thing, I guess I would see the Commission would be beneficial to move to something that I call the constitutional model and that is in the U.S. Constitution there are many provisions written by our forefathers 250 years ago. Around the edges we're still arguing about what some of that language means.

(Laughter.)

I guess every day down in the Supreme Court, but you can define areas so people understand without getting so specific as to constrain future options and allow things to move in the natural way and to the extent the Commission can define spectrum rights in a way that can be interpreted and flexible, not to specific, but not so amorphous that nobody knows what the heck you're talking about, I think that's the model that should be followed and would resolve some of these issues because it would have meaning today, but there's

the flexibility that it would still have meaning through some interpretation in the future.

MS. RATH: Do you have an example in mind?

MR. SIDDALL: With regard to?

MS. RATH: I'd like to actually understand that piece a little bit better and I don't want to jump ahead to the solution sections of our questions, but that's -- it's a really wonderful thing to say, but then to give an example of how you would actually do that, I think that's the challenge to the Commission.

You could do it, if anybody could.

MR. SIDDALL: Well, in fact, I tried to do it 10 years ago which is why I used the PCS. If you look at the PCS rules and I think this is an example that already exists. You have certain limitations with regard to the power that you put out. That actually defines what the interference rights are, assuming that the spectrum owner of the spectrum licensee has exclusive use of that spectrum. Now with that information, you have a geographic area. You have a right to emit up to certain powers. They're limited at the boundaries of that geographic area. That's what I would call

a constitutional solution, to be honest. You can put in any technology, including software-defined radios with or without repeaters. Do it any way you want. So it has the possibility of evolving with technology. And yet everyone knows what that is today. It can be something very different 20 years from now.

MR. PITSCH: I would build on David's points. They're excellent points and PCS is the model and you only need to contrast it to the early days with cellular, where the Commission got so many things wrong and in PCS they got so many things right.

This is an excellent question. If we're going to be serious about this, we do need to define rights. I give all the credit here to Evan Kwerel and John Williams and people before me who worked on this, these ideas. But there is an opportunity to identify a swath of spectrum and the Commission would have to go in first on the interference questions and focus on outputs as Professor Krattenmaker said which means emission set boundaries, geographical and spectrum and PCS took that approach.

The other kinds of definitional things

that have to be cleared up have to do with not having exhaustively assigned spectrum. UHF is a great example. The Commission has on a demand basis allocated and assigned a lot of spectrum to areas, so if you look at the spectrum today, you have holes. The Commission has to assign the swiss cheese part, right?

And the point here is by doing that, creating those rights and defining them better, you allow for efficient transactions to occur. Because if you don't have good output restrictions, if you don't exhaustively assign a spectrum, then you're not going to enable voluntary efficient transactions to occur where they should occur. And just to lay out and complete the idea where which I'll want to discuss some more in the solution section is the Commission could do this under current law, an awful lot of this. I'm not today going to say what 300 megahertz the Commission ought to identify, but it could do that. It could say we are going to create a simultaneous exchange. We are going to give people on this 300 megahertz flexibility. You can voluntarily participate or not. And if it were to do that, there would be many benefits. The most important

would be it would dramatically reduce the scarcity of the spectrum and I would argue it's that what would drive SDR. That's what's holding SDR in new technologies.

MR. TAWIL: No. What I'm hearing from Peter is reasonable in the sense that you need to use the spectrum more efficiently, but one issue here is once you define the property rights and interference rights, especially the interference mitigation rights, I think you could do a lot.

The key is you have to make sure that you keep enforcing the interference rights and that's what's been happening in the past. In the broadcast band, we had interservice sharing rules in the 478512, the interference boundary was defined. Both services are working more or less, but the problem right now is people are relaxing those interference rights. But interservice sharing, once you to define the property, both services have flourished. And the key is to define them and enforce them. Enforcement is a very important part.

DR. KOLODZY: Any other questions?

MR. LEWIS: I had one, Paul, which is for the whole panel. I heard Jim Lewis of CSIS.

People talk about commons and of course from a historical point of view, the problem with the problems is it guaranteed inefficient use of resources. And so the issue is how do you transition to a better use of the resource or a more productive use of the resource? And that sort of is issue 1.

Issue 2 would be you've talked about a system designed for AM radio and that's bad because the technology has changed. Yet, we seem to be focusing on an SDR so the question I've had is you take those two things, the problem with the commons is how do you transition to more efficient use? The question I'd ask is how do you not only transition to SDR, but how do you have a process that will let you transition out of SDR when it's time to do that?

DR. REED: I'd like to just comment, a couple things. One is the commons model is actually, although popular, is kind of a misnomer because the traditional definition of a commons is a fixed resource that needs to be shared and in fact, the capacity of the spectrum appears to have no particular limits, if proper understood Shannon's law -- Shannon's work and what's built on

top of it in multi-user information theory indicates that it's at least feasible and looks like the developments are at our doorstep to make a situation where the commons is such where the sheep bring their own grass, as we mentioned in an earlier session. That is, the more sharers in a region of spectrum, the more capacity if they organize their activities right. And that's quite different. That means that manufacturing spectrum is possible by end user investment or intermediaries that they pay. Manufacturing capacity. They can't manufacture spectrum. So the commons model is basically applying the idea of everyone sharing to a resource that is not limited as the commons so we probably should call it something different.

The second thing that relates to that is how do you make a transition. I think there is a danger in the transition and this is something I tried to emphasize even though I strongly think we should make the transition that the first -- it's sort of the potential for what I might call carpetbaggers invading the truly unlicensed space who decide that they're going to use old, badly designed radio system architectures, transmit at

infinite power and act, in general, badly. In the long run, those kinds of things won't be a problem, technologically, because in fact, there are ways to isolate even bad actors as long as they don't form the majority of users, but that relies on technology advances we haven't seen yet and we need to sort of ease the transition into that space and I think the kind of ease of transition that's important is some kind of certification of software-defined radio, a certification of network protocols that is lightly imposed, not used as a tool of competitive economic challenge, but such that it continues to allow that process to pass.

MR. TAWIL: The reason I've been quiet is I haven't figured out how to get myself to define radio and broadcasting. We use our spectrum. We transmit on the spectrum. We probably transmit it with a very high powered transmitter and we transmit all the time on all that spectrum. We don't have holes.

DR. REED: Actually, maybe I should comment on broadcast because there's an assumption that broadcast needs to be high power. We do broadcasting on the internet today with internet broadcasting through a network architecture

approach where there are repeaters distributed through the network and so forth and in fact, experimentation has happened in the past with what was called single frequency networks which allow spectral re-use, even though the content is literally broadcast to the end points and that single-frequency network uses a lot lower power and so forth. You can do the same thing with ad hoc mesh networks in the long run where, in fact, the bits of the broadcast are constantly being made available to the end users without transmitting all that energy and interfering with other users.

So in the long term, I'd like to see us evolve away from these legacy architectures that were great when radios were really expensive, but are pretty inefficient, given the state of the art.

If we were to try to build a broadcast network today for typical commercial television content, we wouldn't build it the way we do.

MR. TAWIL: I don't disagree with you on that, but the fact it has been built, it was built for 50 years and the question is you need to transition it. That transition will take time.

Obviously, flexibility in the way you assign that spectrum for that broadcasting would be

able to transition to that. But you have to realize one of our biggest problems is we have a legacy issue. We have a 250 million sets out there that have the legacy issue and sometimes we always are very much interested in moving, but we have the problem that you've got to build the receiver end of it. You have got to worry about the receiver end of it because you don't own that portion of it.

DR. REED: Right. That is analogous to the PC world, for example, where we have natural evolution of the architecture. We don't still use DOS machines used 30 years ago to do our work and the customer expects that. I think a combination of changing customer expectation around the value of their legacy sets and realizing that even if we were to pay off every owner of a television set $100 to switch to something new, that's a tiny fraction of the kind of cost we're talking about imposing on the future, on our children in terms of innovation costs. So that's worth thinking about, if not definitive an answer.

MR. TAWIL: Again, I do not disagree with you, but you have to realize it's a very, very mammoth effort here.

DR. FARBER: You also don't -- we're

talking about technology, guys. You don't have to, even though it would be pleasant to throw everything up in the air at the same time, I think it's reasonable to not do so in practice here in broadcasting because of the large number of legacy. It's going to take time to wiggle its way into the future. That doesn't mean that one should use as an excuse for doing nothing, with the rest of the space.

MR. TAWIL: I have to disagree with you on doing nothing. I think the broadcast industry and -- we have done a lot. I mean we have done a lot. If you look at the history of spectrum and 50 years ago, we actually operated on 500 megahertz of spectrum. Today, in the next 5 to 7 years, we'll be operating on 280 megahertz of spectrum. We did a 40 percent reduction. We're moving from analog to digital and we're doing it.

DR. FARBER: I just can't resist. You should come and visit me some time and watch the terrible interference that my receivers get from stations that just dramatically interfere with each other.

MR. TAWIL: I'm sorry, could I go on more?

You have to understand this is an open system, broadcast to transmit, and it's an issue of who built the receiver. And if the receiver doesn't have the proper immunity, you've got some problem. So let's make sure when we put the blame on here is we -- broadcasting is an open system. We control one part of that system. The second part of it is not controlled.

Receiver standards are important. I think there's a lesson, historical lesson here. We have for the past 50 years, probably developed building a receiver out there and guess what, they don't perform any better than the first receiver that was built in 1952. It's too late now, but I think there's a lesson to be learned here. You can't only look at the transmitting end and forget about the receiving or the collector end of it. That's how we're going to deal with interference.

DR. KOLODZY: Questions?

AUDIENCE MEMBER: Listening to the course of the conversation, it becomes easy for me as a nerd to accept the fact that the technology is such that the frequencies space is largely unused and not very limited. Now that I'm a self-admitted nerd, attempting to think like a wonk for a second

here, I examine why there might be inertia to giving up portions of allocated frequency space. First of all, I will admit that I'm not familiar with how long these allocations are in effect or whether there's a fixed cut off date or how someone can lose that space other than through direct FCC decree, but it seems to me that one of the economic reasons for that inertia may not be so much -- certainly there's a possibility of the unwillingness to accept competition, but it seems to me that some previous statements that were made about the costs associated with existing infrastructure provide a viable service now even with a company that's a good player is a factor here. The question I have is is there any type of in conjunction with defining what is a inappropriate interference or incorrect interference, purely from a technical point of view should there be some type of economic set of models with respect to those infrastructure costs that are also taken into account in the equation when you make that type of decision that might be played into the rules for allocating frequency spectrum in the future.

MR. PITSCH: Actually, you raised a

number of good points and I'll try to be very brief, but we talked a lot today about the problem of incumbents opposing change for economic self-interest reasons. Part of the irony is that their economic interest is not properly defined. Part of the problem with narrow definitions, we don't have this so much in PCS anymore, but in the traditional use is that in one sense the licensee views the opportunity costs of the spectrum as zero. To society, we know it's quite high, but their choice is I use it for this narrow purpose or I turn it back to the government. Well, you can imagine then that inefficient uses endure long beyond new technologies and so on. Now if you move flexibility in place and that's why flexibility has become more and more a part of the Commission's allocation process, then suddenly the opportunity costs becomes much larger. Now the PCS operator thinks about new technologies, thinks about new uses and now let's transfer this to UHF television. I'm just going to throw this out for illustration purposes. What if the Commission initially created on the 400 megahertz of UHF television 10 40 megahertz nationwide assignments and said okay, and said okay, we'll have four 10 UHF broadcasters.

Initially, we would have had probably something closer to 10 networks and they would have made all of the internal co-channel and adjacent channel two boot decisions themselves and they would have been internalized and then guess what? Ten years later we decide, let's put flexibility in place on these guys and suddenly they decide that they want to do PCS, okay? And that's what we're talking about here. We need to put in place incentives that channel market forces to move new technology and new uses in place and it isn't just new technologies. It's new uses as well. And people, and Victor makes a good point. I mean you can't look at bits per hertz per second or whatever. Bits value are valued differently. Hertz are valued differently and so it's a very complicated process.

DR. KOLODZY: Questions?

MR. SNYDER: I'd like to respond to Ed Thomas' inquiry about the policy implications of software-defined radio. I think one of the most important implications is it creates the possibility of having micro licenses. Until now, the FCC has generalized licensed in terms of years or even decades and I think the underlying economic

reason why that made sense as because of high acid specificity. If you're going to invest a lot of money in the business, you need to get a return. But that whole logic changes with software-defined radio and a lot of the talk on software-defined radio focuses on the receivers rather than the transmitters, but you can have flexibility on the transmitter side as well.

So I guess my question here is what do you think about micro licenses? You can imagine that any incumbent would utterly hate the idea of micro licenses because in effect you're saying well, you're going to buy your license on the free market. I'm talking about a minute by minute license possibly, geographically flexible. It's essentially like saying I'm going to take your license away. We're not moving necessarily to an unlicensed regime --

MS. RATH: Just a little clarification. Who's actually selling the licenses or is it the FCC distributing it or -- how do you determine that?

MR. SNYDER: Well, it could be through the private market. I would suggest that the FCC become an information broker. Instead of making

these licensing decisions so rarely, it doesn't -- in a free market environment, it becomes an information broker of licenses, so the FCC distributes micro licenses minute by minute on a bit basis. There are a lot of ideas like this out there, but we separate the equipment business from the ownership of spectrum. And you can imagine why incumbents would dislike micro licenses. So I think that's a major implication. This is not an unlicensed idea, but it's sort of neither the traditional licensing or a license -- we're here talking about what does the license of the future look like? We talk a lot about interference rights and what not. We're not talking about the time and duration and other things which become possible in the new era.

DR. KOLODZY: Next comment? Any other questions?

Steve, I'm sorry?

MR. SNYDER: I wanted to ask your opinion of micro licenses, if anybody --

DR. KOLODZY: I'm sorry.

MR. SHARKEY: I was actually going to address that. I was going to come back to this, but I mean innovative ways to do licensing, I

think, is good. I mean the technology is there to do that type of thing. I think that's good. But on the economic model, there are a lot of things that I think that you can do to encourage the innovation and a lot of ways to encourage it. I think economics is a great way to do it. And there are a lot of like four in the PCS band, I think they've got a lot of economic incentives. I mean there are some -- the spectrum has been auctioned. Not that we're for trends of auctions and what that does to the cost of spectrum, but that's a real economic driver for making efficient use of that. I think applying some sort of economic model across the board to -- and more evenly across the spectrum that's used, whether it's federal government, commercial or other licensees is a good way to help drive up that. And the other side is, I think some of the things that Peter's talking about too, the carrot of providing incentives to licensees to be allowed to trade spectrum or licenses so that it is -- they realize some economic gain when they do that.

But you brought up the consideration of infrastructure too. I think that there is a role sometimes for the FCC to take a more directive view

towards things and again, back to FCS where there was a decision of we're going to move fixed uses above 3 gigahertz and that that was in everybody's interest to do to make room for this new service and the economic interest of those licensees were taken care of, the costs were paid, so it was a transaction that worked for them as well as for the new licensees. I think we're seeing that model applied. The recent Martin Cave report on making available 3G spectrum that will, where the incumbent will be reimbursed for their costs and for transitioning their systems, I think is a good one to really make that -- make implementation of new services reality while considering the infrastructure costs being imbedded in infrastructure.

DR. KOLODZY: Does anyone want to comment on the micro licensing?

MR. SIDDALL: Actually, I will. I'm not sure -- if the software-defined radio, assuming as the FCC has been going that the equipment and the software possibilities for it have been approved through the device authorization procedures at the FCC lab, i.e., the spectrum is defined in which it can roam and what its power and

antenna gain are, if that's the case, I don't know why you'd need a license and I think if the concept of software-defined radio is followed to its natural end and actually is involved, I think that you will move to more and more unlicensed spectrum structure and there would just be no need for a micro license.

DR. KOLODZY: Bruce?

DR. FETTE: I'd actually like to amplify a little bit on your concept here. First of all, by saying that one has to recognize that whether you call it micro licensing or cost of spectrum, second-order sharing and so forth, there will need to be an infrastructure to support the hand off and the micro transactions associated with that kind of activity and there's a cost for that infrastructure that would be not unlike the cost of the infrastructure we have today for commercial cellular.

So as an alternate, I suggest the concept that we saw in the development of the internet in which the communications infrastructure was essentially a free resource to the development environment with the exception of the cost to the routers that were provided by the government during

those early days and that by providing that free infrastructure, significant evolution of technology created a marketplace today and that in a sense similar sense I think that if software-defined technology results in a commons capability, an RF commons capability that we will see that create an interesting and exciting infrastructure in the future.

DR. REED: Yes. Let me point out, I do think that micro -- at one point in time I was very interested in this idea of micro licensing, as you call it or the idea that somehow one could clear the rights for different kinds of transmissions, rapidly and efficiently. There's a problem with that. It takes two parts, a technological problem and an economic problem. The technological part is that if we look at the kinds of architectures that lead to the most spectral efficiency, and cellular is kind of a first stage in that, but there's a way to -- a lot farther you can go, the kinds of architectures that support that are what I call cooperative architectures. That doesn't mean friendly cooperative architectures, necessarily, but architectures where, in fact, messages often carried either on multiple hops or through the

cooperation of an infrastructure that understands its interference environment and understands what else -- what the rest of the demand is on the shared medium and negotiates to get all the signals through more efficiently. And you can go to my web page and see a lot of details of those kinds of emerging architectures.

Those architectures have enormously better scalability than ones where you have a transmitter transmitting directly to its ultimate receiver. The problem with that in economic terms -- so the micro transactions architecture would have to be much more complicated because it involves not just clearing the right for one transmission, but clearing the right for a whole set of cooperative activities that are competing with a whole set of other cooperative activities.

That in economic terms raises the bar. It basically means that if you take the property rights model, every transaction involves not just operating on one person's land, but involves negotiating with nearly everybody in the system. It's what's often referred to as the tragedy of the anti-commons. And the transaction costs tend to go up exponentially in terms of negotiating clearing

to rights when the whole system needs to clear the rights in every round of negotiation. It's not analogous to the stock market. It's just not reasonable to take those architectures and try to map them into peer-wise transactions.

So you need a system that self-organizes and does that kind of stuff. Probably won't self-organize around peer-wise transactions efficiently.

MR. SNYDER: I have one quick response to that. If the spectrum goes into the existing telecom network, I think you could avoid a lot of the complexity that you're suggesting. I mean it's just that last little section --

DR. REED: That's basically a short term solution to a specific problem, but if we're talking about the general problem of enabling all kinds of wireless communications, many of which we can't anticipate, then you're basically optimizing for one thing, last-mile bypass, which we optimized for AM radio. Is that the next thing or should we do a more general job?

DR. KOLODZY: Okay, I want to get back to the audience a little bit because there were a

lot of questions that were out here a few minutes ago and I don't want to pass that -- Dave, do you want to make a quick comment?

DR. FARBER: Yes, just quick comment. I feel obliged to repeat something I said earlier, that one of the issues in the future is going to be security and I don't mean this just in the national defense issue. The spectrum is going to be used for a lot of applications, most of which we don't understand now, but some of them are going to be critical applications to at least the individual. And unless we design the security into those systems, especially software-based systems, we're going to be in deep, deep trouble, even if our spectrum space is available, so I think we have to pound on that and it's not something that my experience at the FCC says that they worry about all that much.

MR. STROH: My name is Steve Stroh. I'm editor of "Focus on Broadband Wireless Internet Access." And one of the things that Chairman Powell said this morning really struck me. He would really like to hear concrete proposals for how we get to the ideal of more of a spectrum commons model, flexible use and away from the

private ownership model.

One thing that strikes me is that Mr. Tawil stated that they had gone down to using 288 megahertz of TV spectrum and what frustrates a lot of the techies and I've watched the 2.4 gigahertz thing band evolve very incredibly, long-range, very high bandwidth, many users, very dense deployments. They're making all that work in 83 megahertz of spectrum with some really onerous rules like very low power and they're making it work in that little chunk of spectrum in a very bad part of the spectrum for things like tree foliage.

The TV broadcasters have a total of 288 megahertz of spectrum available in the prime part of the spectrum and yet in any market, there's a handful of those channels that at most that are in use, 20. I'll be charitable and say 30. Why not evolve a model that lets a radio use the channels that are not being used for broadcasting and the radio has got to have a very specific limitation that it listens on a particular channel and if it hears TV broadcasting it just positively locks that up. There's no possibility of override. The radio just cannot go there if it hears a TV broadcast.

But the 75 percent of the other

channels that aren't in use, that's legal, and it listens on a periodic basis every 10 minutes and that will encompass the ability to hear low powered TV stations, even somebody who's using one of these little rabbit transmitters that transmit on Channel 3 or 4 inside a house, it wouldn't interfere with those. That's a way to get -- that's a way to at least start the transition into a more flexible use model. It's frustrating to hear the idea that that broadcast spectrum can't go there, no way, no how.

MR. TAWIL: Let me answer that one. In fact, I didn't say that. I think we're limited obviously if you use less spectrum, we will. But there is something called the legacy issue. It's something called a television receiver, you have in your home that when you use your idea, even though I'm transmitting on my 6 megahertz channel and giving you that service, that TV set receives all signal and guess what, when you put that low transmitter or even if you have five channels, it disrupts that TV set. So the issue is not actually the transmission, it's the reception and for the past 40 years there are no attempt to actually deal with the receiving component of it.

MR. STROH: Wasn't the decision just

yesterday in five years the TV receivers will be required to receive digital and if it's not a digital TV transmission, it simply won't be displayed?

MR. TAWIL: That is correct, but guess what, they still haven't decided on what the receiver performance is or what the interference is. It's still the same TV set. You still have the same interference immunity with that spectrum that you have in the analog world.

MR. STROH: If an interference is being encountered, isn't that incentive for the TV owner to go buy a new one? If you're interfering with --

(Laughter.)

MR. TAWIL: I'd love them to buy a TV set that actually operates only on the 6 megahertz it transmits and doesn't -- and leave the other spectrum for other use, but it's not. The issue here is the chicken and egg issue. You're trying to be on the transmitting -- interference occurs two ways. It occurs because the transmitter is spreading spectrum outside its band or the receiver is not selective enough to deal with the interference.

If you only deal with one end of it,

there's no way you're going to get there. You have to deal with both ends of it to be able -- broadcasters are not against more efficient use of the spectrum. Broadcasters are not against flexibility. What they're against is having -- against disrupting the service and they don't have control over it. That's what they do.

It's something that you would like to move forward and we can go up there. It's an open system. We can't go up there and buy a TV set and give it to the consumer and make sure that it works properly and it's interference-free. That has to be done from the consumer end.

DR. KOLODZY: Bruce?

DR. FETTE: I'd like to observe that again on the subject of software-defined radio, if you recognize that it's conceivable to define wave forms which are sufficiently orthogonal to the video and audio tracks of TV channels that you can define a wave form that is sufficiently orthogonal, that it will not interfere, even with TV sets that have moderately poor design of the RF front end and mixers. In fact, that's a subject of research at this time as to how multiple types of wave forms can be designed which are sufficiently orthogonal

to each other to provide essentially overlapping spectral utilization without interfering with each other.

MR. SIDDALL: I want to address the broadcast issue just briefly, because I think there's a little misunderstanding of what the FCC rules and the statute provides for today.

First of all, TV spectrum is already shared. There are millions of medical devices and hospitals all over the country that are on TV channels, as a matter of fact.

Second of all, there's public safety services in 13 cities around the country that also use certain TV channels, but I'm not here to defend broadcasting at all. But I do think it's important to understand it is in a transition to digital. When that transition is over, there are no more UHF tabus. The digital transmission system has been designed to allow the use of adjacent channels and when the analog turn off, at least when I left the Commission, the intent was that there would be decisions on whether the interstitial channels would be auctioned for broadcast use or for other uses. But we're in the middle of that transition now. And I think that that is recognized. The

more important public policy issue that is involved is to what extent will the statutory provisions allowing broadcasters flexibility will be implemented. In 1997, Congress amended the Act and provided that broadcasters transmitting a digital signal need only provide one video channel. Otherwise, they have flexibility to provide anything they want within -- that can be provided using that digital system. It's subject to a fee if it's a subscriber based service.

The question is will broadcasters move to that model and use that excess capacity of the digital for other services or is there no excess because the demand and the economic model dictates that they provide high definition which requires more bit rate. They can even provide two high definition channels, signals within the 6 megahertz actually through compression techniques and it will probably be 4 in five years the way compression is working. And Congress already answered the question about broadcaster flexibility. So what you see today, don't assume that that is tomorrow. That's been addressed and I think that needs some time to work out.

The other -- because I think there is a

lot of flexibility built in there for a lot more spectrum efficiency. That was one of the things really addressed and I hope to see that. I just want to put that on the table. The one last comment, because maybe being the second person in this room that has ever put a wire on a receiver from 0 to 2 gigahertz and looked at what's there, I can tell you, I can give you two different results. I can do that right here in this room. You will find 95 percent of the spectrum unused.

I can go up to the roof of this building, connect to that log periodic antenna that the Comm's Room uses here at the FCC. And in fact, there is one of these receivers in the Comm's Room right here in the building for those FCC staff that want to look at it and I will show you very heavy spectrum use through most of the spectrum. It depends where you do it and it can be very deceiving these little things.

In cities is where the problem -- I think from a policy standpoint, the better issue to address, the more important issue is rural versus urban. In urban areas when I put a receiver on a decent gain antenna, there's a lot of usage. When I go out into rural areas there's almost no usage

and to the extent that services are required in rural areas, I think there is a policy issue about trying to make one size fit all.

I was out with some of the FCC folks in Arizona back a couple of years ago and they were talking about bringing cellular service and they laughed because I said look, there's a lot of surplus analog cellular systems out here. You guys don't have phones. Get some of the surplus analog stuff, stick it out here. Yeah, it's a spectrum hog, but spectrum -- you've got all the spectrum you could possibly need. It would actually be a very good thing to do and very cheap to bring phone service all around here. You don't need the digital services to start with perhaps. One size doesn't fit all and I go back to what I said at the beginning. I hoped that the recommendations of the policy force -- policy task force will recognize that in different areas of the country, different policies should apply and for different services, different policies should provide. I'm sorry, but I had to try to set the record straight on what the digital rules are since I was here and had quite a bit to do with them along with a lot of other people sitting in this room.

MR. VAN WAZER: Hi, my name is Tom Van Wazer. I work at a private law firm. Following up on what David said, one of the problems about the spectrum flexibility that does exist for digital broadcasters is I don't even think Congress understands that there's digital flexibility. If you've read anything in the last two years about some of the networks' plans to develop their digital spectrum, any time any one has suggested that they're going to do something other than broadcast pictures, they've been punished one way or another, either by Congress or by others. And maybe one of the major contributions of this task force would be to recognize that flexibility needs to be something that the Commission embraces everywhere and not make it such a terrible thing to even think about because if you want companies to invest in more efficient distributed transmissions or single frequency networks, etcetera, you need to have incentive to do so and you can't -- the spectrum that's currently allocated to these companies, not just broadcasters, needs to be -- they have to have some incentive to do so and so flexibility has to be recognized.

The only other point, I've been

interested in watching the debate between Mr. Reed and or the debate or the points that Mr. Farber and Mr. Reed have made versus others about property rights and following up what David said, how he was lamenting the loss of all these research labs and how everyone is sort of failing to invest in research labs like they were, it seems to me that that's an outgrowth of this what I view at least academic view of the commons that's unlimited, where the sheep bring their own grass. The problem is there isn't a sufficient incentive for the companies to invest in these research labs to develop the technology that you're interested in. So I'd like to hear your comment.

DR. REED: Actually, I'll make a quick comment since you addressed it to me.

The return on the kinds of research that I'm talking about is a rich and vigorous equipment market that would -- and what you might call software tools and protocols. What is going on and it's sort of exemplified by the experience of Interval Research which got started on ultra-wide band back in 1993 or 1994, and participated by funding a whole lot of policy activity here at the FCC to try to get ultra-wide band addressed,

Interval also spun off a company, Phantasma Networks which developed a lot of that early technology. That company was put out of business because its investors finally said you know, we just can't wait any more. We can't wait for the flexibility. We're just going to sell off the assets and so a lot of good people went. The assets were ultimately bought by a company called Xtreme Spectrum so we may see some of that value at some point, but in fact, the investment market is not about spectrum. I really think that's important to make. The investment return -- because someone can hold spectrum and make money on it without ever doing anything unless the FCC takes it away from them. The investment is in the new technology and the pay off is in the equipment.

DR. RITTENHOUSE: I would like to also make a comment on research in general and in particular, the industrial labs. Research continues in the industrial labs, particularly in these types of areas because of the popularity of wireless technologies and trying to investigate, it is done in collaboration now which I think is a very positive thing with a lot of academic labs as well. So instead of expanding a lot of the labs

and the research in the labs, to the extent that it can collaborate with other labs and academics is a very good thing. So we do get a lot of that sampling now through the collaboration as well.

MR. PITSCH: I wanted to jump and sort of give a spin on your question which is that I think these two approaches, concrete rulemakings, looking at creating noninterfering easements and more commons, 5 gigahertz and so on, and also creating a simultaneous exchange, are complementary for two reasons. One, I've heard some people say well, from the commons side well, we can't do that. That will entrench people and so on. The kind of thing we're talking about, incumbents have got the stuff already, right? And just do a little thought experiment. Imagine your most hide-bound spectrum holder. Don't say names out loud or anything, but now ask yourself will they will be more hide-bound and more inflexible if you give them flexibility or if you keep them the way they are? Okay?

The second point I'd make is that if we move forward on both fronts, on the market-base side we're going to facilitate aggregation, relocation and so on. That's going to make it possible for some of these market-based solutions

for the new technologies that people are talking about.

The third point is huge which is that any reduction in scarcity helps both approaches. If the commons approach reduces scarcity, then it becomes easier and the incumbents have less reason to oppose market-base reforms and vice versa and I already suggested that there's a potential benefit to new technologies because if you bet your whole wad on noninterfering easements or commons approach, you may be foreclosing in terms of time and efficient result some opportunities that could be pursued on the market front.

DR. KOLODZY: That was one heck of a question.

(Laughter.)

DR. FARBER: Well, can I?

MS. RATH: Go ahead.

DR. FARBER: I was stuttering and sputtering, etcetera with the comment that people don't invest in research because structural, whatever it was. My experience is a lot of companies don't invest in research because it's deferrable and when things are tight, they defer right off the end.

The telecommunications industry has done this, not all places, but large numbers of them but I point out just endlessly, that there are companies who see a future and maybe it's the environment they live in, maybe it's other things, but look at DoCoMo which has almost doubled the size of their research lab over the next year. The question is, to use military terms, 6.1., 6.2, or 6.3 money is still a question, but the only way you're going to move this field is to do the investment now in basic research which will pay off in 5, 6, 7 years. It's not going to pay off tomorrow, but if you don't do it, it certainly isn't going to pay off.

DR. RITTENHOUSE: Fortunately, there are some companies that remain that continue to do the basic research, right.

MS. RATH: Actually, one question I had is as I listen to all this, as an industry, is the wireless industry underperforming in terms of its research, development and technological innovation as compared to other industries?

DR. FARBER: My own view from some experience, I should give a little bit of experience, I was on AT&T's advisory board for a

number of years and I think it under performs in the advanced research side of the house. It does very, very well in the -- what we call advanced development area. And doesn't do what it needs to do and there are exceptions, all cases, but I don't think it devotes the long-term research it needs to different ways of doing its business.

MR. SHARKEY: I'm not sure I would agree with that. We certainly invest a lot of money in research and continue to develop new technology, new products and I think one of the things that you see in the cellular and PCS industry though is that it's kind of similar to the broadcast industry. There's a large incumbent base, so whenever you're looking at making changes and it is -- it's got to take into account that base, and the new technology has got to accommodate that and it's a more gradual transition probably and the technology has got to be very well proven before it can be actually implemented in a large scale in that type of service.

MR. SIDDALL: There's one thing that has been brought up several times in different contexts that we really haven't directly addressed and that is receivers and the necessity of

receivers being in some way addressed by the FCC. I mean historically, the Communications Act specifically declined to give the Commission authority over receivers generally which is why you have these provisions sprinkled throughout. Section 302 allows the addition of circuitry to prevent interference from what was CB transmitters or other transmissions. Section 303 has certain provisions that related to only TV receivers or the V-chip, the closed captioning, the All Channel Receiver Act.

Otherwise, pretty much the FCC doesn't have authority there and maybe there will be someone to address should the FCC have more authority over receivers.

I'll start it by trying to put a little bit of controversy on it and saying traditionally it's worked that you regulate the transmitters and the receivers are left to themselves because if they don't get the intended transmission, they'll be thrown away and some manufacturer will succeed. That can receive it successfully. So it's not obvious to me that at least in some context and I'm thinking of the broadcasters example that was brought up earlier, it's not obvious to me that

there need be authority and regulation of receivers as something that would be an extension of authority over an area that traditionally has not been within the FCC's purview, but if others have other thoughts in a different context.

DR. FARBER: Just an aside, it's been a number of years, but I think a counter-example would be the FAA which does, in fact, strictly regulate the receivers and that's the way they've been able to move that technology much, much faster, because otherwise you'd have the Wright Brothers complaining about the fact that their radio can't receive that new standard.

DR. KOLODZY: David?

DR. REED: I just wanted to comment. It's really -- it's not a good idea to break receivers off from transmitters because, in fact, they're both parts of the same system. They both -- my best model of the shared medium that we're dealing with is something like a pond. We're all living in the same pond and every little wiggle that we introduce and every little attempt to demodulate it -- to some extent it interacts with every other one and drawing strict boundaries doesn't necessarily work.

The problem with regulating receivers and I agree with you, is that in some sense what you really want as a regulation of receiver is a limitation on the right to complain. That's the form of regulation, not what kind of receivers can be built, but if you buy them and they don't work, what right does the manufacturer have to complain and so forth. We've seen that recently, for example, that the XM -- the satellite radio guys are saying gee, we really ought to -- we're complaining because the spectrum or the rules we got aren't good enough to protect us from say 802.11. This is a hypothetical argument. I don't know if it's true in practice. But in some sense, the FCC could just say and in a quite reasonable way well, tough, that's what you accepted and if stuff leaks into your band you've got to deal with it, but there is this sense that they're allowed to complain and that gets into the whole question of what is interference and interference is a much more complicated notion that is encoded in policy or worse yet and this is where I fear that we're going to get into trouble, in both the courts and in the Congress, we've sold this rather -- this idea that interference can be understood by any

human being by just thinking about things messing each other up and in fact, interference is only a phenomenon that happens in the receiver design. Other receiver designs won't experience the same difficulties and the interference happens in the system design as Bruce mentioned earlier. You can create transmitters that create wave forms that by the FCC rules would be interfering but which would interfere with absolutely no radios out there. So the lack of knowledge and understanding about these basic principles of what is interference and so forth, I despair that our legislative or judicial process can resolve them and that's one of the reasons why I think we need to leave it to the industry to resolve by cooperating and solving those problems among themselves, trying to create a rights regime to finalize that, to create a rights regime where you've got property rights. Well, where are property rights ultimately enforced? They're enforced in the courts.

I can't imagine trying to -- bringing a court case maybe you'd do it in small claims court for a fraction of a second, so and so interfere with so and so by some subtle definition of interference and escalate that to the Supreme Court

where the Supreme Court will try to decide what interference means and come up with some reference back to my childhood in Illinois when my friend threw a rock at me at my house and the window got broken and therefore that's the precedent, the legal precedent we're going to base this all on.

(Laughter.)

MR. PITSCH: I feel you're directing this to me, David.

DR. REED: Actually, it's not.

MR. PITSCH: Actually, the other David, I think this receiver question is a great question, a great issue because I think it implicates all these interference issues.

First off, you can't abstract away from the interference problem. We could be incredibly conservative about it, at great trade off in costs and efficiency and consumer welfare, right? In terms of the resolution of it, there are sometimes we use courts that are expert, we do that in certain legal areas. I have fundamentally no problem with the FCC being the body to determine these issues.

But the issue of receiver standards, I think, is worth drilling down on for a second

because it raises this issue of how we define the rights because in the PCS space, I would argue that you see receiver improvement, a lot of times I suspect the Commission doesn't see it for proprietary reasons. No one has to come to the FCC to get the imprimatur any more, so they don't hear about it, but it's going on.

But in the broadcast space, we have some problems and I think a lot of that is due to improperly defined interference rights. And one last wrinkle I'll put on it is the credibility of the FCC on interference. I mean you want the interference criteria to be output. You want them to be

objective-defined, so you have transactions. You want them to be enforceable which gets into the dispute resolution issues and I'll tweak the commons folks a little bit because that's where you get the tragedy of the anti-anti commons and -- but then you have credibility. Will the Commission follow through when someone builds receivers that foreclose uses and there are all these folks out there squatting and I think that's a real important issue. The Commission has to develop credibility and if it can't I think that's the best argument

for receiver standards, default receiver standards.

MS. RATH: Basically, we're running out of time and I think this is about the quietest I've ever had to be as a moderator and I appreciate everybody's participation. I don't know if there's anybody who has any sort of parting thoughts from the panel here as we close out or even -- I thought I saw somebody raise their hand in the audience. Yes, somebody is coming around.

MR. STEVENSON: Yes, I think the issue of receiver standards and how it affects the issue of who's to blame for lack of a better term for interference is something that's necessary for the Commission to address in order to promote spectral efficiency. Otherwise, you have the situation where legacy receivers with poor performance and high susceptibility to interference are permitted forever and other uses of the spectrum that could be possible, if there were receiver standards that would eliminate unnecessary interference were enforced, you end up precluding new uses and it's just sort of because they're there and I don't think we can afford that any more. I think this is something that contributes to this artificial scarcity of spectrum is that we're not exploiting

all of the possibilities for sharing and for frequency radios.

MS. RATH: Any comments? Bruce?

DR. FETTE: Yes. Earlier there was a comment about what happens after SDR that I wanted to come back to and just speak to briefly and I believe it was you.

I wanted to address it in the following way. As SDRs begin to be deployed into the -- both commercial and defense environment, amongst other things you'll see them implementing legacy receive functions first, so that they're interoperable with existing standards, but then they will begin to be upgraded by people who are willing to provide software for those SDRs to implement new functions and fact to the extent that the technology supports it, they will continue to evolve to new capabilities until it runs out of horsepower, somewhat like the Intel model, right?

So you'll see the new generation followed by the new generation followed by the new generation followed by the new generation. And so as long as the SDR is capable of having new functionality installed into it, you'll receiver performance improve, new transmit wave forms and so

forth that will give a continuing and interesting evolution of the functionality and I think what we're about here is making sure that we can accommodate that.

DR. KOLODZY: Well, thank you. Well, I see it's 12 o'clock. I would like to keep things prompt here with the task force as much as we can. So first of all, what I'd like to do is say thank you to all the panelists for taking out of their valuable time and to be able to bring some unique insight into this problem. I think we've had views from every perspective possible here and I think that's important in a sense to bring everything, bring all possible ideas out into the open.

I also want to thank the participants, the audience that actually came out today. This is actually one of the cooler days we've had for the Task Force. The last three have been in the upper 90s, but I appreciate your interaction and some of your viewpoints and comments I think were very useful and hopefully we can take those into consideration as we move forward with some of our recommendations.

So again, thank you and what I'd like to also let you know is that we're going to start

up again at 1 o'clock this afternoon. For those of you who are not familiar with the Commission, if you want to have lunch here you need to go up one floor to the courtyard and you can go out to the courtyard leaving your badge and then coming back and getting your badge and having lunch and then we'll reconvene here at 1 o'clock.

I want us again to say thank you to the panels and have a round of applause for all the hard work.

(Applause.)

(Whereupon, at 12 noon, the meeting was recessed, to reconvene at 1:00 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:08 p.m.)

MR. FURTH: Good afternoon and welcome to our second session of today's workshop. It's a beautiful August day out and less than 90 degrees and I'm impressed to see so many people who haven't chosen to hit the highway early and head to the beach. We will be talking this afternoon about modeling of licensed and unlicensed spectrum usage rights and I hope that we will have a discussion that builds on the very interesting discussion that we had this morning.

Let me introduce myself. I'm David Furth. I'm senior counsel with the Wireless Telecommunications Bureau and a member of the Spectrum Task Force. On my right is my co-

moderator, Michele Farquhar of Hogan & Hartson, and we will be leading this discussion today, but I think that most of the interests and excitement and heat and light will be generated by those folks to my right and left.

What I would like to do, first of all, is tell you that we're going to be focusing on a number of issues. We have a lot of ground to cover between now and approximately 3:15. Since we're starting a little late, we might run a little bit longer than that. We will be talking about defining, trying to really come up with definitions that can actually be employed, practical definitions that can be employed for defining spectrum rights and responsibilities and looking at different models, both the unlicensed commons model that we've heard about at some length this morning, and in prior sessions, as well as various licensed approaches to spectrum; variations on exclusive or property rights that many people have talked about.

We'll be trying to talk about how you actually come up with the basic building blocks of a rights model. We'll also be talking about transition mechanisms. How do you get from where we are to where we want to go. So we're doing

something better than what Yogi Berra talked about which is if you see a fork in the road just take it. We're going to actually try to have some sense of direction in where we go.

What I'd like to start with is to ask each of the panelists today to introduce themselves and I hope in no more than a minute describe both their background and their particular perspective on the spectrum rights issues that we'll be talking about today. I'm going to start on my right, at the extreme right, Michael, why don't you tee off?

MR. CALABRESE: Okay, thanks David. I am Michael Calabrese, director of the Public Assets Program at the New America Foundation here in Washington which is a nonpartisan public policy institute. The questions that have been framed for this panel are just right on the mark, particularly as a wrap up because as we look at the future for licensing and how it can coexist with unlicensed and a commons model, you know, it will be particularly important to talk about the bundle of license rights, the transition to these new licenses with service and market flexibility and then what ongoing role for the FCC.

And I just want to make a couple quick

points which is that the bundle of license rights, you know, we believe, and I should mention, I filed comments that were also on behalf of Consumer Federation of America, Consumers Union, and a number of -- Media Access Project -- and a number of other public interests groups. And what we wrote was that the bundle of license rights -- it's very critical that they not be permanent, exclusive, or fixed beyond the period of the license because even if Congress were to change the law to allow some sort of permanent rights in frequencies, it would be both bad policy and unnecessary.

Bad policy, because as we've heard on all the other panels, the Commission will periodically need to refashion license rights to accommodate technological change and changing social need. We don't want to freeze a zoning system that was made around analog technology. We don't want to freeze that in place forever and unnecessary because we can clearly define a bundle of rights with service and market flexibility that are also for limited periods and are changeable over time, particularly with respect to interference.

And the last point is just with respect to the transition, we would oppose any retroactive and cost free giveaway of valuable new licenses to incumbents for the same two reasons. It's bad policy, because as CTIA, I believe AT&T Wireless, Nokia, and other companies wrote in their comments, in addition to violating the Communications Act, a windfall to incumbents would be unfair to business competitors, to the public, and would fail to internalize opportunity costs efficiently.

And finally it's unnecessary again because a number of auction and leasing fee methods are available to accomplish the flexibility that we're looking for. For example, incumbents could be given an option to convert to these new licenses with complete flexibility in return for paying a market base spectrum user fee and so that would just be one of several options that I could mention later and which are in our comments.

MR. GATTUSO: My name is Joe Gattuso. I'm with the National Telecommunications and Information Administration at the Department of Commerce. One thing I always like to say for those who know or those who don't know is that NTIA has two functions when it comes to spectrum management.

And like Mike Marcus was saying just moments ago, those are simultaneous functions. Mike was saying that it's like the way of, nature of a radio wave or a light wave itself, both a photon and a wave but the same time. I don't think I ascribe to that. But, in fact, our two functions are separate, but exist at the same time; one function being one that is more high profile. That is, the Agency is the manager of the federal government's use of spectrum, and we host the Interdepartment Radio Advisory Committee which the group of federal agencies that determines how spectrum is to be used. We are also though the Executive Branch's, the President's principal advisor on all telecommunications matters. And through our Assistant Secretary, Nancy Victory, through the Secretary of Commerce -- we are located in the Commerce Department. We have an interest in developing good policy including spectrum policy that affects not just federal users but all the users.

And that is also my interest. I work for NTIA's Policy Office. I think we talked about this question before. You know, what's our interest here, what do we hope to add? I actually

hope we can think through on the panel today some of these questions about what it means to have a right, what rights are, and what that means. And even though NTIA and the Department of Commerce has its own efforts going on right now on spectrum policy, we had a spectrum summit a couple months ago. We have not drawn conclusions, and I say even though that's a prelude to saying that I'm here mostly talking about ideas that represent how I view things, not my Agency or the Administration, but I think this is what the workshop, what these workshops have come down to because already offering one of my own views, the spectrum I would propose doesn't even exist. The spectrum is a representation of something, and that's a range of frequencies.

In some ways, if you look at a spectrum chart, the spectrum itself is a representation of various rights that are held by different parties or operationally. And it comes down to a matter of what are the rights today. Are they defined? Can they be defined, and if you define them, how do you use that then to be more efficient in serving the public interest. So that's where I see the discussion here and that's where I am. Thank you.

MR. STROH: My name is Steve Stroh and I edit a small newsletter about the broadband wireless industry that I call Focus on Broadband Wireless Internet Access. I'll disclose that I'm not an engineer. I'm not a lawyer. I'm not even a former FCC staffer.

(Laughter.)

My view is that spectrum is entirely a creation of technology. The spectrum that we natively are equipped to use is a relatively narrow band of frequencies in the audio range and the visual range, somewhere between infrared and ultraviolet. Everything else we have to have tools to make use of that spectrum. And the better the radio, the more spectrum that there is. It's totally useless to us until we have better radios, and we are at the threshold now. We've crossed the threshold actually of being able to make radios do literally anything we can imagine that we can want them to do.

We've got ample digital signal processing. We can engage new modes that were just not possible when, that were not practical that we could only do with super computers and now we throw just as many cheap processors as we need to to

accomplish that. And I watch the license exempt bands pretty closely and I'm just in absolute awe of the innovation that's going on there. You want long range, fine, you can have it. If you want very high speeds, fine, you can have it. If you want very high densities, fine, you can have it. All living quite happily within the UNII Part 15 Rules. So I'm just watching what's happening there and it just seems like it's a shame not to apply those lessons more widely. That's what I would be advocating.

I think that the most brilliant thing that the FCC has ever done, I think it's a very under appreciated piece of phraseology as the Part 15 rule that says "this device must accept interference even when that such interference causes undesirable operation". That phrase assures, it absolutely casts in concrete that the spectrum that that particular device is operating in cannot stay static. It has to evolve. More and more things can use it and if you want to keep using it, you've got to adapt. You've got to buy better devices. It just cannot -- it's not allowed to stay static.

MR. WYE: My name is David Wye. I'm

with AT&T Wireless based here in Washington, D.C. I guess my list of disclaimers, I'm not an engineer. I'm not a lawyer. I'm not an economist. But I am an FCC ex-staffer. So I'm not sure how that matches up. And to complicate it another way, I started out working for a research agency of the U.S. Congress, as David Siddall did. I worked for OTA which was a longer term think tank, if you will, that was disbanded a few years ago, then moved to the FCC under the good graces of Michele Farquhar was her technical advisor for a couple years. And now I have transitioned in my life to the private sector, so I have this kind of very weird, lots of different things going on.

I thought that actually this morning's panel was quite instructive and perhaps one of my favorite ones that the FCC has put together so far. There were a lot of great ideas. One of the things that struck me, and this is kind of, you know, encapsulating what we've heard for the last couple weeks, is the idea that this really is kind of a mixed model. It's not a pure property rights model, it's not a pure commons model. You've got a little of both. It's not clear to me that you're going to go in one direction or the other. I see

in some sense a lot more of the same, and the question I know is what's the balance, what's the interplay between the two.

Obviously, I come from the license side of the world. That is what I know the most about and I would agree with Michael that the bundle of rights that licensees have is absolutely critical. My company holds licenses. In some cases, we paid a good deal of money for those licenses. And we thought we knew what we were getting. And as the world has kind of played out in the last couple years, it's becoming I think less clear perhaps what exactly those rights really are and obviously that concerns my senior management, I think, especially in terms of interference. We've talked about that all the way through these panels. It keeps coming up and certainly I think that's the preeminent issue that the task force is going to have to deal with going forward as given these conflicting models and many conflicting uses and conflicting services, how do you treat interference. How do you define rights associated with and responsibilities associated with interference. And so I'll be breathlessly awaiting Paul Kolodzy's report when it comes out in late

October.

And finally, and I was making this point earlier today with some folks. If we think about it, this goes to the last portion of our talk today, it's all about transition. We're not starting from scratch. There's no clean slate here that we're working from. And this goes back to the first point I made. So you know to talk about these things in isolation at a very theoretical level doesn't strike me being a somewhat practical person perhaps that that's necessarily all that useful all the time. I appreciated Peter Pitsch's comments that you have to be very practical about how you go about this, and I certainly would agree with that. And I'll stop there.

MR. FURTH: We'll work our way again from the outside coming in. Martin?

DR. CAVE: I'm here from Europe and I've been completely fascinated. Sometimes it feels almost like I'm from Mars or something --

(Laughter.)

As I witness the sophistication of the debate which I'm afraid we aren't tabled to match in Europe to date. The reason I'm here is that I'm the author of a report. I'll hold it up like the

Shopping Channel. It's 261 pages. Weighs about two kilograms. It's probably a lethal instrument in the physical sense, I suppose, rather that the more metaphorical sense and it's a report which I prepared for the British government, finishing up in March of this year, as an independent review of frequency management. And the British government is now considering its recommendations and I hope they will announce their decisions in the next two weeks or so. the communications bill, which is now going through our Parliament.

Just to relieve the suspense, I'll give you two paragraphs of what I recommend. Basically, I have proposed in the report a dual-track approach in which a distinction is made between on the one hand commercial spectrum, and on the other hand, spectrum which is reserved for public services. As far as commercial spectrum is concerned, the report recommends the abandonment of most use restrictions and the use of market mechanisms, auctions for initial allocation or assignment of spectrum and secondary trading.

This doesn't exclude the possibility of unlicensed spectrum. That's a matter that's discussed briefly in the report because it has not

yet assumed in Europe the same significance as it has in the United States, and I look forward to coming back to that later.

As far as public service spectrum is concerned, the report proposes maintaining for the next 5 or 10 years the system in which the government can reserve a spectrum for specific uses. However, in order to encourage economy of use on the part of public services, it proposes that administrative charge be levied for that spectrum. And economies that departments of government can make in use of spectrum will yield savings which will be available to them to spend in order to provide some sort of incentive for economy.

The two tracks that I've described and linked to the extent that I propose in the report that public service spectrum should actually be available for leasing across the boundary. So that if, for example, our Ministry of Defense has some spectrum which it will not require for five years or so, it should be entitled to lease it to a commercial organization and to keep the revenues from that. Now, this is I recognize an entry measure, this dual tracked approach.

It would be possible, of course, to extend it into a more fully market base system in which the public and the private sector compete for the use of spectrum. But I felt that at this stage, the European environment wasn't ready for such a radical step or as I think it is ready for the introduction of the market base reforms that I've recommended. Thank you.

MR. KURTIS: My name is Michael Kurtis. I'm the president of Kurtis and Associates PC. Since we're doing disclaimers, unfortunately, I am an attorney and I'm an engineer. So my perspective though is quite narrow. It's from that of the rural telecommunications carriers providing commercial mobile radio service in the nonurban areas such as a PCS and cellular. From our perspective, there's been a lot of talk about going with someone acquiring all the spectrum and then privately managing it. And I guess I'm hearkened back to paraphrase the words of Winston Churchill, in that the FCC is a very bad way to regulate spectrum usage, but I fear the others are much worse.

And the situation that we are primarily concerned about is going down a track of one size

fits all. That urban versus rural area is set with the same implementation of rules and not only from the standpoint of what meets the needs of the urban versus what meets the need of the rural, but also the consideration of the interplay between them. For example, just this week, the FCC announced a plan to sunset the analog standard for cellular, which you know there were a lot of comments filed. But we need to see what the order says because while there is a need for greater spectrum efficiency in the urban areas, what the rural carriers had filed concern about is we are a rural carrier and the urban market to the left of us deploys one technology such as CDMA.

The urban market to the right of us deploys the other technology, TDMA. The analog standard is what allows all of my subscribers to be able to receive service in both of the markets and the concern that we have is even if we decided to build both technologies in our market, we still don't have a radio we could sell to a customer who wants to travel to both of the urban markets.

So the concern that we have is in developing a new spectrum model. We keep in mind that there's been a lot of money paid for licenses

already in this particular service, that there was a situation that extreme amounts of money that have been spent to develop networks and that we are meeting the needs of customers nationwide that are spending a considerable amount of money to purchase hand sets and I think have an expectation of being able to continue to have the right to utilize those handsets and to get service on a going forward basis.

MS. WARREN: Hello, my name is Jennifer Warren and I'm senior director for Trade and Regulatory Affairs at Lockheed-Martin Corporation and I'm an ex-FCC staffer and I am a lawyer. But while I was at the FCC, I served in both the International Bureau and the Wireless Bureau, so bringing both the satellite and the wireless perspective. And coming from Lockheed-Martin, which has historically has been viewed as a satellite services, a company with satellite services by us. My portfolio has expanded considerably over the last few years to where it now incorporates interest as a business licensee, as an experimental licensee, as an aeronautical services provider, as a system integrator recently entering into the public safety arena.

So I have a very marked interest, and with the outcome of the special policy task forces, because it will basically affect every aspect of some of our businesses. And so that's why I'm here and I'd like to introduce into this discussion, while we've been focusing on spectrum rights, we really haven't focused on responsibilities. And when I raise responsibilities, I don't mean what are our responsibilities to protect either our neighbors or those with whom we share the band, but what are the responsibilities that are imposed on the licensees; licensees versus users' responsibilities in the spectrum.

MR. MILLER: Hi, I'm Larry Miller. My background started in civil defense, public safety communications about 23 years ago; from there into transportation, and for the last 12 years I've worked for one of the FCC certified frequency coordinators, and I can appreciate the reference to Winston Churchill. You know, frequency coordination is a process that receives a significant amount of criticism and it probably is a very, very bad system but it's better than anything else that anyone has ever come up with. And so my basic experience is with shared use, how

to limit technical and operational parameters to new licensees so that they can coexist with the existing incumbents in the band.

MR. HAZLETT: Hi, my name is Tom Hazlett and I am a former FCC Chief Economist where my primary function was to be research assistant to Evan Kwerel.

(Laughter.)

And I'm currently a Senior Fellow with the Manhattan Institute and my views on spectrum reform are laid out in a 4-page filing in this proceeding attached to which is a 20-page paper that was written last November and advocated that the FCC set up a spectrum policy task force and now that the Commission is following my instructions, I expect forward progress will be substantial. I also have a 200-page plus paper that is available on my website and published last year also on the website by the Harvard Journal of Law and Technology.

In less than 200 pages, let me summarize the top 10 points. One, current spectrum allocation policy is ultra-conservative, creating large social losses. The task force should pursue a better balancing of costs and benefits for

wireless entry and innovation.

Two, competitive markets will accomplish this if permitted to.

Three, the path to this market solution is via deregulation. Rules limiting flexible use of frequencies assigned to licenses should be removed. Laws and procedures blocking access to under utilized bands by new entrance should be eliminated.

Four, the primary function of the law is to allow spectrum users clear control of frequency space with liability for damages incurred. The regulatory function is not to (a) create markets; (b) settle all interference issues; (c) find the perfect path to liberalization.

Five, interference dispute resolution now a detailed ex ante Commission determination, inefficiently front loads the regulatory process paying incumbents to stretch out real arguments. Interference adjudication should move to a liability framework.

Six, deregulation is not a windfall. Nations that grant substantially more rights to wireless operators see lower license bids at auction. Liberalization will result in wipeouts

for many operators and licensees which should not be compensated.

Seven, do not take broadcast TV spectrum off the board on public interest grounds. On public interest grounds, the arguments are overwhelming that much greater social value would result where the airwave is redeployed. Markets can do that.

Eight, spectrum scarcity continues to be a problem in both licensed and unlicensed uses, and rules that reduce coordination problems are the goal of proconsumer public policy.

Nine, shared use does not have to be unlicensed. The most successful application of spread spectrum technology, for example, is codivision multiple access via licensed broadband PCS. Flexible rights promote investment, technology, and spectrum sharing.

Ten, a free and competitive market in wireless bandwidth will allow entrants to expeditiously gain spectrum access by paying the marginal cost of bandwidth. That is the public policy optimum. Thanks.

MR. FURTH: Well, I think the introductions have touched already on a number of

issues that we'll be coming back to and I expect that there will be some very interesting discussion of those issues. I wanted to start off with what I might call a clean sheet of paper question, and we actually asked the panelists to think about this question ahead of time and it's based on a hypothetical. In order to perhaps get some sense of where it is that the people on this panel would want to ultimately go with respect to defining spectrum rights and responsibilities, and the hypothetical is as follows. Assume that you have essentially two spectrum use models at your disposal. Assume that you are in the role of the regulator, you're in the role of the FCC, except perhaps with some plenary powers that even we do not have.

The two models, one is an exclusive rights licensing model that looks more or less like our PCS rules, just to take an example. The second model is an unlicensed model that looks surprisingly like our Part 15 rules to take another example. You have the choice to apply either model to any spectrum from 300 megahertz to 300 gigahertz. If you would like you can also reserve spectrum for specialized uses that you don't want

to license or assign or allocate under either model. Assume that you're dealing with today's technology and assume, at least for the sake of the initial hypothetical, that you don't have any incumbents. This is the last time you're going to be able to make that later assumption by the way.

And the question I'd like the start with is which model would you use or would you use both and why? How would you decide which model to use in any particular band of spectrum? What types of spectrum uses, if any, would you reserve spectrum for and not apply either model to them?

Anybody want to take a crack at that?

MS. WARREN: Sure.

MR. FURTH: Jennifer, go.

MS. WARREN: I'll be the target for everyone else's comments. I guess I would first say that I wouldn't pick a band. I'm going to talk more generically than that, but I'm going to take about models and I would have both models. I would have an unlicensed model. I do think there's obviously great merit in the unlicensed. It is innovative and all the things we've heard over the last three days from all the unlicensed speakers that have been here. But I do think there are

responsibilities that the licensed uses offer.

There's certain customer responsibilities, consumer responsibilities if you like, that go with being a licensed user, particularly if you're CMRS or some of the other categories. And I think there's, unless we're assuming away public interest obligations of the FCC which you did not address, I'm assuming there are responsibilities beyond just a market approach. And I don't equate public interest with market based spectrum management.

So I would have both, recognizing as I said that there are interests in both. I would not reserve -- I'm not really sure what you mean by reserve, but if you mean allocate and just don't put out for assignment purposes. Yes, I probably think it's helpful to allocate spectrum for services to give product developers an indication of where they might build to and explore, know what they're sharing if any sharing environment, or what their exclusive rights might be. But I would allocate and then when there's a petition or license request upon then proceed with assigning. I wouldn't artificially withhold and I wouldn't artificially throw out there with no proponents for

use. And we've seen both situations and neither one has produced great results.

MR. GATTUSO: What kind of system would let a guy like me make a decision that's so important which is, of course, I'm being facetious, but not entirely because I think one of the essential things I'm talking about is how the system works, how the rights work, and how the system makes decisions like this. And does it come down to putting a decision like that in the hands of somebody who works for the government? And a lot of people argue that government is the only place that can make the decision or is the government's role slightly different?

And I think that's part of our debate here because if there are certain rights, if there are certain things in place that lead to an efficient outcome, there may be more of a framework that the government establishes rather than decisions. Now, if I did have to make the decision, the first thing I'd say is it's too easy to say I'd use them both because I like to balance things, I'd use them both. But I think one of the things I'd want to look at is what decision would be most likely to accommodate the best result over

the long term, and I would ask if you went to one or the other of these, are there exclusive rights or the shared one? Is that something that could evolve into a different system?

Sometimes I think if we maintain the concept of spectrum with a consistent idea of rights starting with the type of titling rights and then going to a type of spectrum use rights, you could almost think of the commons approach as something where the title is held with the government, and in fact, there's an exclusive title with the government and the government has chosen to open this up for a commons uses. So you could actually argue, I'm stretching this, but I could argue you could actually have an exclusive rights model that could accommodate either one at least in terms of the ultimate title.

MR. CALABRESE: I would -- I think especially given the assumption that given today's technology, that we would certainly need to have a version of each of these. But what I'd want to make sure, I think above all, is that the former does not constrain the later. In other words, that exclusive, for as long as we have licensing, that the exclusive rights and flexibility do not

constrain the development of the unlicensed technology that can dynamically share.

And to understand that I think it's important to make a distinction that has been somewhat lost in some of these conversations, and that is when we talk about unlicensed Part 15 type, I think most people think about today's technology based on, you know, WiFi technologies, 802.11 and so on which really are our means to share wire line connections using a hub and spoke architecture. It operates on a channelized basis. But what David Reed and some others have been talking about, for example, in the last panel, called open spectrum is something very different. I mean that is really three to five years off, but it is more of an ultra-wide band technology that creates a potential for ad hoc mashed user controlled networking that dynamically shares spectrums and serves as repeaters for traffic between those. So it's way beyond WiFi.

Okay, so when we look at the word unlicensed we can't just think about today's technology. We have to make sure that the bundle of rights and the type of flexibility allows room for the evolution of interference standards and so

on in order to unleash the potential technologies that are still on the drawing board.

MR. KURTIS: Starting out with the clean sheet of paper, I had all kinds of great ideas, but I kept settling back to the concept that there is a need for a bifurcated regime. We do need to have spectrum that has property rights and I would go so far as to say a standard of usage. And what I keep boiling down to is if I'm using my cell phone, I want to be able to use it as I travel. If I move from Indiana to Virginia, I want to make sure that someone broadcasts television signals that will work on the TV set that I bought in Chicago for the technology that that particular TV station chose to put out.

Market place is fine and there are always applications where a market-driven spectrum usage is going to have its needs and I think we've seen that in the Part 15 where you can have very different flavors of noncompatible wireless handsets that are talking to the bay station that's plugged in in the family room. But I think once you get to other items that are intended to allow common usage over the airwaves, I think you have to back down from that market place model, and there

are certain items that we need to have a body such as the FCC to make sure that the industry grows, that the market place that fosters the development of the high quality television set that's available for purchase because the people manufacturing it know that there will be a market for a period of time for that technology. So I very much favor keeping the split approach.

MR. STROH: I don't favor keeping the split approach, but I recognize that the licensed allocations are a necessary evil for the time being because they're not going to get blown away. And we're constrained to some extent. For example, we're not going to rebuild the highway system in some better model to support trucks and cars and bicycles, ideally. We have to live with what is there. What I do think is that it's the new digital technology, the software-defined radio, spread spectrum, very low power operation signal processors have made it possible for us, for licensed exempt users, to piggyback on licensed spectrum that's not being used. And I use the example of the television broadcasting spectrum that's pitifully under utilized in rural areas at this point.

Why not a radio that could take advantage of that fallow spectrum in rural areas to provide broad band services without the necessity of completely rebuilding copper infrastructure or putting up with the irritating delays of satellite broadband? The industry that I watch most closely, the wireless ISP industry is doing this now. They're making it work with 2.4 gig spectrum but there are places they can't go. There are cost points they can't meet, people they cannot service because of the limitations of the technology. But if they were permitted to buy equipment that could make use of that spectrum now, and the MMDS spectrum is even worse in how pitifully underutilized it is. They could provide much greater services including voice.

MR. HAZLETT: The goal of the Commission, I believe, should be a cheap spectrum policy. This has been lost, it's certainly with license auctions on the table the last decade or so. People talk as if you're trying to maximize those rents you can extract through high prices for licenses. It's, of course, the wrong approach and the way to get to a cheap spectrum policy is not to do it through artificially suppressing the price

signals that people face. It's to actually allow lots of competing exclusive use licenses, whether it comes through what you want to call band managers or exclusive use licensees, or even to some extent unlicensed users who could have, and in fact, do exercise property rights effectively even under current unlicensed rules.

But the thing that has to be remembered is that coordination amongst these various users is still important. You just read through this record, the filings here, or any of the other proceedings that are similar on spectrum policy, licensed or unlicensed. And you have all kinds of demands on the Commission to impose a standard. We've heard about seven of them so far. To impose rules, to impose use restrictions on various alternatives. Seems rather late date to have to argue that this is why God created competitive markets, not the portals, okay?

The portals should be used for something useful, and it's not to micromanage these markets. Now the useful function is to get lots of competing and flexible spectrum assignments out in the market place so all kinds of uses, shared, unshared, it's hard for me to think of an unshared

use, but if you want to call it that. Then to get out there, but do it in a way that the transaction's costs of putting coordination together, amongst all the shared use can be handled reasonably.

And again, there's no contradiction between these sort of open entry environments and exclusive use licensing by the FCC. In fact, if you have a number of competing band managers or band owners in the marketplace, they will, in fact, invest to bring the traffic in, to bring the shared use in, and to manage and coordinate new infrastructure amongst those multiple users to limit these conflicts. And all these examples, like the TV spectrum that can't be used, that's a tragedy of the commons, not of exclusive use licensing.

The commons is, in essence, the socialization of the spectrum through the regulatory process. If, in fact, there was ownership in the market for those unused rights, of course you can have these kinds of contracts.

It's important also to understand that the great thing about unlicensed is the "un." And the places where it's most effective is where the

real cost of spectrum is low; not artificially low, but where it is low and it will probably stay low for some time, particularly in environments where there will not be as much competition or scarcity. For example, in rural environments some of these wireless ISPs are doing very well there and there's a lot of aggressiveness there.

Local area networks, where property owners assert de facto control in the coffee shop or the airport waiting area or what not. These sorts of areas can be, in essence, licensed exclusively through the unlicensed process. In fact, they are being used that way today so coordination can take place. This is what the FCC should look to, how you can get these decentralized decisions and all the flexibility that that entails. It was said that one size fits all is wrong. That's absolutely correct. One size fits all is what you get when you regulate and micromanage from Washington the diversity and variety that comes through decentralized decision making in allowing the market to come up with various uses and to maximize traffic because you as the rights owner of the bandwidth can do that. That's where you get the variation that will

maximize consumer welfare.

MR. CALABRESE: I thought I'd interject in order to really confuse everybody since Tom, who I agree with completely redeploying broadcast spectrum, but when he says that the broadcasters or the broadcast spectrum is a commons, you know, I would think that quite the opposite is true which is that actually the broadcast spectrum would be the perfect home for a commons and that, in fact, the commons, when we talk about unlicensed devices, dynamically sharing, that that's the ultimate market solution because what that does is it takes the bureaucrat, whether government or corporate out of the middle.

What it does is it allows the equipment manufacturers and the software manufacturers to put more sophisticated devices directly into the hands of individual citizens, and then they can decide, you know, how and when they want to communicate. An open spectrum imagines that on a peer to peer basis. So I think the most important point in all this is to not

-- we obviously have to continue these two models, you know, the licensing and the commons together for quite some time.

But we should be sure that the former is not impinging on the development of the later, because we're really in a major historic evolution, I mean from analog to digital, from dumb devices to cognitive radio, from narrow, from screaming over narrow bands to whispering ultra-wide band, from exclusive to sharing, from scarcity ultimately to abundance. And so we also have to change from this sort of zoning exclusive rights zoning model to more and more and more of a commons model.

MR. FURTH: Let me ask a question here because I'm hearing a number of people talking about wanting to use both models, either because they think it's correct as an ultimate policy goal or because they see it as a practical necessity that we're not going to get rid of one model at the expense of the other ultimately. But I think I want to go back to a point that Joe made which is, is this really a decision that he or I or us at the FCC should be making? Is it inevitable that the FCC has to make this decision or is there some way, in other words, through writing rules, or is there some way in which we can set up a structure of spectrum policy that allows this decision to be made in the market place and by the market place?

And if so. how would that happen? What would be the rules that we would write in order to make that happen?

MS. WARREN: Could I just say one thing? First of all, you would rewrite the Communications Act to get rid of public interest.

MR. FURTH: Why is that?

MS. WARREN: Because I think Part 15 when we talk about unlicensed devices, for example, the gentleman down there pointed out the caveat in Part 15 on licensed uses which is no expectation that this device will not operate or what was the exact language that you used?

MR. STROH: Must accept interference even when it causes undesirable operation.

MS. WARREN: Whatsoever. Do we want the customer, consumer, to have no rights and to give that much control, in some ways, to a greater upper hand to the manufacturers? I don't know. It's a question I put because Michael said something about putting the customers in control, the consumers in control because they'll just keep purchasing different devices as things improve. But I mean we have competing manufacturers and unlicensed devices, some rules, but Darwinian rules

is what I've understood -- everybody has said over the last three session. So where does the consumer come out in this?

MR. STROH: He has greater choice. He ultimately achieves greater choice.

MS. WARREN: He has greater choice or he's forced to constantly change?

MR. STROH: If you go into Target, you can walk up and down the aisle and there's 20, 30, 40 different cordless phones. You take your copy of Consumer Reports which has done the test and buy on the basis of which one Consumer Reports says operates the best.

MR. KURTIS: But the key is no matter which one of those you select, you can plug it into the jack and it's going to work. I submit to you that if you say, you know, let's throw it all open you're in a situation where you're walking down the aisle. There are 12 different models to pick from and there's only one that works with your particular landline telephone network.

To stretch the analogy, suppose you bought the WorldCom compatible toll phone and then something happens and WorldCom is not there and you can't move that phone to another competitor or you

have an AT&T TDMA phone that AT&T is phasing out and you're stuck with -- you're perfectly happy with it, but AT&T says sorry, can't use that anymore. But without defending AT&T which is a position I'm particularly uncomfortable with --

(Laughter.)

I am not aware, and David is probably in a better position to say this, that AT&T said turn off all your phones today because we're no longer supporting it because that gives the consumer the incentive to go out and shop around, I think there's going to be some type of a transition that recognizes the fact that that has been an adopted standard, that that unit is out there and they'll make it in their customers' best interest to migrate as they want them to migrate.

The customer always has the choice, but they have an underlying compatibility that they can rely on. Right now, for example, that phone would work analog. So they could use it in an analog mode.

MR. WYE: And at the risk of actually representing AT&T wireless --

(Laughter.)

Thank you to Michael for doing that for

me actually, it was very well done. Certainly we're in the middle of managing a transition now. I mean, my company at this point runs analog, TDMA, GSM, CDPD, GPRS. We've got a bunch of stuff going on and it doesn't make sense for me to go out and strand my customers. When we migrate them, they have the opportunity to migrate.

Now I will immediately point out the difference perhaps between Michael and AT&T Wireless. We actually were a little disappointed that the Commission took five years to sunset the analog rule.

We are trying to manage a transition now to greater speeds, higher use of digital technology, and you know, we believe that that is going to hinder our ability. I fully understand Michael's position. He certainly kind of lives in a slightly different world than we do. But you know, to go back to maybe the original question a little bit, clearly I think there's somewhat of a consensus, I think, on this group that you're going to have to have both even in a kind of clean sheet environment. I think you can see the benefits of having both types of models working together.

How do you decide how much of one and

how much of the other? Off the top of my head, I frankly am not smart enough to know that you can just throw that open to the market and that somehow the market would say you know, 50 percent needs to be licensed and 50 percent needs to be unlicensed or commons or what have you, which is why I actually do think that the government has a role to play there in helping to make that decision.

So going forward, is it both? Yeah, I mean we're not in -- as I've said I tend to be too practical sometimes, but I think the answer is certainly both and the government has a role to figure you know how much is right.

MR. FURTH: I'd like to ask if Martin has any perspective to lend on this from his experience in the U.K. and then I'd like to throw it open for a few minutes to the audience if they have questions on this topic as well.

DR. CAVE: Well, essentially we've had to address this question with even fewer facts than you have since it's only the past three weeks that the U.K. government has changed the rule in relation to unlicensed spectrum to permit the provision of services to the public rather than just

self-provision. As a consequence of that, the demand on unlicensed spectrum has been curtailed.

We have, however, been very worried about the prospect of congestion in the light particularly of possibly misleading horror stories that we've heard from this side of the Atlantic.

And that has predisposed me personally to favor the hybrid solution in many cases which you've identified, which is the use of band managers, will be able to bid on a competitive basis for spectrum and then try and pile in as many possibly low value users as can actually be accommodated within the band. This is just simply driven largely by the difficulty of doing the risk analysis. Clearly, it would be a disaster if whole swathes of spectrum became effectively sterilized as a result of congestion and their availability disappeared.

However, there may be certain areas in which unlicensed spectrum can survive and for that reason I'd be reluctant to see it abandoned completely. But my own preference would be to sort of stick roughly to the line that Tom has identified and acknowledged that unlicensed spectrum has a zero price but a competitive

spectrum market can actually produce prices which are probably pretty close to zero in certain contexts.

MR. FURTH: Questions from the audience? We've got mikes in the back. Stand up and identify yourself and direct your question to us, thank you.

MR. REED: Yes. David Reed. Well, actually more of a comment than a question on the particular question you raised earlier about how we might practically decide how to balance between "unlicensed" or commons, both of which are bad terms or the inclusive license market approach. And what I think probably best thought about in this space is two things, one responding to Martin Cave's point which is that in fact we have no congestion. We are so far from congestion in the spectrum other than by regulatory limits that the likelihood that we'd have congestion in the next 5 to 10 years, if we freed it all up, is very low even if they allowed people to use it for terrible reasons.

The practical fact of the matter is that the old regime, which is neither of these two, has been the most inefficient of all. As far as

the new types of ideas, these spectrum auctions, secondary markets, versus the other, I think we should have a horse race. And I put all my money, and I think I would recommend to all my investor friends, to put all my money on the unlicensed side. But it's fine, a perfectly reasonable strategy would be to basically have either a regulatory proceeding or a congressional. I'm not sure who gets to do it.

But it basically says for every new allocation of spectrum to a new use, half of it goes to auction and half of it goes to unlicensed, both primary users. If all the economic value migrates into one thing or the other, we'll know our answer.

If we hobble one of those approaches by unreasonable rules that basically then we won't find our answer and I think now is the time to get the answer.

MR. FURTH: Do you want to comment, David?

MR. WYE: Yes. Throughout all these workshops, one thing that I've noticed is there seems to be a tendency to kind of if you will tar one model or the other with kind of the sins of the past if you will. I am the first to admit that

some of the, we won't say broadcasting -- some of the broadcasting spectrum probably isn't as efficiently used as it could be. That doesn't mean that all licensed spectrum is being used inefficiently. I actually happen to think that AT&T Wireless uses its spectrum pretty darn efficiently.

On the other hand, we all recognize that there are, at least I thought, one of the things I thought I knew as a truth, and anybody can correct me if I'm wrong, is that the reason we keep going kind of from 900 to 2.4 to 5 is because at least the reports that I've heard or seen in the press is that it's because the bands keep getting congested. Now, that's not to say that that can't be solved through better use of technology. I think that's maybe what David Reed was just saying.

But I just would perhaps offer a cautionary note that just because we did it wrong in the past doesn't mean we're going to continue to do it wrong in the future. And I think that's the whole point of what this task force is all about is not to throw the baby out with the bathwater, but how do we make things better? How do we make the

licensed regime better? How do we make the unlicensed regime better? How do we make them better together, and so maybe we could carry that forward.

MR. STEVENSON: Carl Stevenson. Jennifer asked what I thought was actually a very good question and that was what happens to the customer of the unlicensed device where the current rules say you must accept any interference you receive from anything else. Period. End of story. And then Mr. Wye's comment also about the apparent congestion and things that started out in 900 and went to 2.4 and now are going to 5. I'd like to make a couple observations on that.

First of all, when Part 15 Spread Spectrum Use first started and IEEE 802 started developing standards for computer networking, the environment was very different. The use of these things has grown to such an extent that we do find ourselves needing more spectrum. Part of it is a problem that Mr. Wye seemed to at least allude to or point to a little bit is that there are no standards. It's basically a free for all. You have a mixture of things like cordless phones and baby monitors and so on and so forth that don't

look out for each other, don't use the spectrum cooperatively. And this causes a lot of the interference that does exist in the Part 15 bands.

And I would submit that, as I mentioned the other day, that if the Commission were to take a look at the National Technology Transfer Act, at least a very strong encouragement that federal regulatory agencies take open industry consensus standards into account. I think we're at the stage where the 802 standards have become so ubiquitous and have become so important to society that they actually have enough public interest value that they really should have their status in some sense upgraded so that the users do have a little more of an expectation of better performance.

In terms of technology transfer, all the way along the line we've retained backward compatibility. We haven't stranded users. I think the standards organizations have done a pretty good job. Some of the problems that we face in the Part 15 bands are due to other systems that aren't cooperative, that don't work together well. So some way of dealing with that issue is something the task force should consider.

MR. FURTH: Comments.

MS. WARREN: Yes. I just wanted to respond to something Carl said which was about unlicensed perhaps having the need to be able to afford greater protection to the consumer. I may be paraphrasing what he said. But I think that then argues for unlicensed uses to perhaps have their own unencumbered spectrum rather than sharing because it's very difficult because while the manufacturer understands that it is under Part 15, the consumer doesn't read the last line of the instruction manual too closely as the gentleman on session one panel a week or so ago acknowledged.

So unless there is some way to fully notify so that the consumer can't miss it like on the device that you have no expectations or your expectations have to be limited with the way this device operates, it's very difficult for shared use and there's obviously a proceeding in play right now that raises that issue directly.

MR. FURTH: Ed?

MR. EDGAR: I just want to ask the same question I asked at the unlicensed workshop we had almost two weeks ago. I'm hearing two conflicting views here. Cut it open, let it be Darwinian. And the other one is we need some rules. And I'm

talking about the unlicensed spectrum.

My question is, is it broke and we have to fix it today or are we anticipating problems in the future?

I'd appreciate anybody who wants to comment on that.

And I also have a second question. Most of the day today has been on unlicensed, which I've found interesting. And that's fine because if that's what you want to talk about, by all means talk about it. But I do have a question about shared use of spectrum in terms of rights and responsibilities.

What about things that those of you are familiar with -- the north points of the future. Or what the responsibilities of incumbents to keep their technology? Let me put it this way. What are the obligations, or what should the obligations of incumbents be to keep their technology current, either in the unlicensed spectrum or in the licensed spectrum?

MR. FURTH: Comments on that because I think that's a good segue on where we want to go on the next sort of section of our discussion, defining the rights better as David talked about

and under both models.

Does anybody want to comment on Ed's questions?

MR. HAZLETT: Yes. I think the assumption is there is an unlicensed model and we should get the rules right and make sure that people cooperate. The assumption implicit is there is a need for coordination. There is a scarcity problem. You can't interfere. It's costly not to interfere. There's a need for some coordination, some protocols and some etiquette and that needs to be coordinated. That's right, but again the regulatory model is wrong.

That is to say this is a competitive market function and just suppose, just get crazy and suppose that the 1996 proposal by Senator Pressler to issue overlay rights covering the entire broadcast TV spectrum, 402 megahertz, and that that proposal had gone through and we had given out several licenses, 580 megahertz licenses or some larger number of smaller allocation or whatever. But you had gotten those licenses with complete flexibility into the market place, and they had to respect the incumbent broadcaster rights, you know, to protect the three or four

American households that don't subscribe to cable or satellite.

The use of all unused, somebody said in rural areas TV spectrum is slightly underutilized. That's going down as the understatement of the new century. So these flexible rights competing against one band manager competing against another, you could have all kinds of economic activity. It could see mobile services, very close to what we have today. You could see fixed wireless broadband, close to what we see today. You could see all sorts of stuff is cutting edge. You could see all sorts of stuff we haven't seen yet.

Different rules, different coordination mechanisms, different architectures certainly could be proposed. And that's the trial and error you want. You want these competitors in the market place to be able to offer their various solutions. In general, those will be shared solutions if you want to speak in those terms, but just as cellular and PCS systems are shared systems. But you will have an opportunity to actually have competitive rivalry between these solutions and the consumer interests are clearly on the side of that rivalry.

If you're at the target and you're

walking down the aisle with a telephone and you think that the FCC is giving you this compatibility of everything at 900 megahertz, you're in the wrong aisle. Go over to the software aisle. There's no FCC to protect you on software and there's lots of compatibilities and by the way there's lots of incompatibilities. But that's a better market. It's much more progressive, lots more innovation, and lots more great, new stuff and lots more welfare created for society because of the dynamics of that process, despite the fact there is a cost associated with being stranded on an eight-track stereo tape or a Commodore computer.

MR. CALABRESE: I think to some degree the answer to both of Ed's questions can be informed by remembering, and I just want to reiterate what I said earlier the distinction between the two types of unlicensed technology that we're talking about. You know, today's 802.11 type technology which is channelized and the future of unlicensed, which is going to stretch out all across the spectrum across both licensed and unlicensed bands on an underlay basis.

And so the Commission's unlicensed policy making needs to proceed on two very

different, but parallel tracks, with respect to that. And I think that in both cases we will need rules. There is an ongoing role for the Commission, but the rules are of a very different type than the licensing. So for example, when Martin talks about licensing a band manager for unlicensed devices, that is probably totally unnecessary. Imagine if we did that on the internet, if we had a bandwidth manager for the internet. I mean why not instead you know have open protocols and etiquettes and so you have compliance-like, compliance licensing for devices that can share that space.

And you know, the same thing would probably be true with respect to the underlays. And then on the second question concerning interference standards, Dale Hatfield, I know, has been blue in the face talking about the need to regulate receiver standards because interference, if we allow these fragile old dumb devices to lock up the spectrum, it's really standing in the way of innovation and efficiency.

And so what we need to do, and that's one of the main reasons against any permanent, vested interest in frequencies because the

Commission will need to continue a role in evolving the interference standard. And I think we're going to go to talk about that.

But it's very important, if we're going to redefine license rights, as a bundle that on one hand has complete service flexibility, but on the other hand limits interference both in terms of what you can impose and what you must receive, then that standard, that interference standard has to evolve with technology. You can't just say these are your fee simple property rights forever and leave it at that.

MS. FARQUHAR: I think we've already segued into the second part of our panel and so let me pick up there with respect to defining basic spectrum usage rights and where Ed started and where Michael just picked up in particular.

Our frequent criticism is that noted of spectrum usage rights is that they're not clearly defined by the FCC's rules right now. So one part of the question is in what sense are they imprecise or not clear at how or why does that need to be fixed? And also, should there be time limits or term limits if government, for instance, does address these issues and set some limitations?

Should we recognize that technology evolves? Should there be an indefinite period of time for which say 5 or 10 years for which these rules are effective and then you automatically revisit it? Do term limitations or something else? Or should there be some other mechanism to revisit this over time?

Let me start with Martin to give him a chance to think about this and then we'll take comments from others at the table.

DR. CAVE: Naturally, these are the questions we had to address as well in writing the report and let me focus particularly on the duration question because I think that's really quite difficult. In essence, the conclusion we came to was that you could either adopt a band specific policy which would, in essence, mean that you would have to look at each band and decide how the technology was going to change and adjust the duration on the basis of that.

But as we know, that's a pretty fragile basis upon which to base decision making because we don't know how the technologies are actually going to develop. So in conclusion I think we came to the view that it was probably best to have infinite

duration and licenses but with some kind of reserve power for the government's compulsorily to purchase the licenses at some kind of market evaluation where that was necessary, if the system which I've described appeared to generate particularly severe market failures and strategic behavior. But we were still a bit unhappy with that because nobody wants to give governments or regulators the powers to remove other people's property compulsorily.

So I think this is a very open question and really is one for the purposes of my report we sort of handed on to the next line of people who are going to have to frame the legislation.

MS. FARQUHAR: Joe?

MR. GATTUSO: I'd like to comment on this. It seems to me in listening to the other workshop sessions and also in knowing about spectrum management generally, sometimes I wonder if we have advanced to a point over the last 70 or 80 years of having radio where we think we know the rights to a certain point and we make decisions in spectrum management thinking we know a certain amount about rights and responsibilities, but we have a lot of uncertainty back a step that we would not tolerate in other areas.

The analogies in spectrum management come fast and furious. You've always got the property rights analogy, the real property. But you can have intangible rights analogies. You have the highway analogies. In every one of those cases, I think of okay, I believe in analogies so I'll throw out some. You think about are there certain principles that have developed in terms of real property you've had six, seven hundred years of development where it's already established in law, certain things are established. In real property you've got title. I've mentioned that before.

You've got a certain sense that as a general principle a purchaser of a right would have a certain rights for -- they fall into certain classifications and there are certain things under those classifications you can do. There's a developed body of law with respect to newcomers versus existing users of the rights and you have both time and you have nuisance law. And I think of the equivalent in spectrum and it's like not knowing if you're getting an oil and gas lease how long it's going to last or what does it mean when you have an oil and gas right. Well, we know that

in oil and gas. And it means like if you want to use the highway example, we know that as a general principle everywhere in the United States that a car entering in the highway, its wheels are already on the highway. We know that.

But it seems that we are constantly debating and through the analogies very simple things like who owns the spectrum? One person says there's no ownership. True. The other person says well the analogy goes a certain way. We haven't established that. We're asking a basic question -- how long does the right last? Well, you can argue that some ways given practice since the Federal Radio Commission and given court decisions and broadcasting elsewhere, the right does continue indefinitely in certain areas.

Real question is should it or not and that's why I think Martin Cave had the difficult analysis of saying well, which is better? Do you want something -- do you want the ability to go back and revisit that and do you institutionalize that or do you have a system where that's there? So I think that these fundamental questions should be addressed and there are especially with usage certain things with respect to what the party

holds, what incumbents hold, and what they're allowed to do with those secondarily.

MS. FARQUHAR: Comments from the people in the panel?

Mike?

MR. KURTIS: I think the current model that you have in CMRS is an indication of how this can work properly. There is an expectation of a license renewal that is subject to being taken away if you haven't met certain standards. You know, you don't want to be in a situation where the person who holds the license in a particular technology especially like CMRS that requires a lot of time and a lot of money to deploy, that that license does not have an ongoing expectation of being able to renew. That's an absolute way to cut off all capital available for building a costly, complicated expensive network.

But you do maintain at the Commission a safeguard from that spectrum lying fallow or not being properly used in methods that have construction requirements at the end of that period. Other people can come in and take over and apply for licenses that have not been properly used if the carrier is not acting appropriately,

although there was an expectation of renewal, it's not an absolute right. But to the extent that the carriers are doing the right thing, there has to be the expectation that their license is going to be continued, if you want to be able to get full use of that spectrum.

MS. FARQUHAR: That's a good point with respect to -- and please, chime in and raise this issue too. Jennifer mentioned earlier consumers expectations with respect to devices, products. Michael just noted that expectations of the capital market and investors. Are there other expectations out there that fall into this realm when you think about it as well?

David?

MR. WYE: Yes. Obviously, I would tend to agree with Michael on that. My company spends billions of dollars building out its licenses. This year alone we'll spend over five billion dollars trying to improve our coverage and our capacity and everything else. If I think that in three years that's going to go away, why would I ever spend that money? And although I agree theoretically that you know the licenses have a renewal expectancy, I certainly believe that they

should. I think one thing that has not perhaps been one of the Commission's shining moments in the past is that when licensees have not lived up to their obligations, they have not taken the licenses back.

And I think if we're going to make this system work, and I think it works well now, the Commission has got to stand up and say you're not using it, I'm taking it back. I know that AT&T Wireless has turned licenses back in because we're not able to meet the requirements of the terms of the license. And that should be an absolute mantra at the Commission is enforcement. We're back to enforcement again. It's not that the system is necessarily broken and we have to change the terms of the licenses, we simply need to enforce the system that we have in place now.

MS. FARQUHAR: Jennifer?

MS. WARREN: I just want to add one even though I said I wouldn't come at this from a satellite perspective. You have to apply again the principle of practicality to go back to what Peter Pitsch said earlier. Even if you were looking at limiting time frames for licenses, if throwing out a five year time period, you don't even have the

satellite launched then. So I mean there are very different expectations by industry as well as to the terms and the means to satisfy the terms of the licenses and I think that has to be taken into account.

And I would also say the enforcement issue is an important one from the satellite perspective and we started to see that from our arena and it's healthy, painful but healthy, and we would encourage the Commission to keep doing that.

MS. FARQUHAR: To what extent -- I'm sorry.

MR. CALABRESE: I just want to make point in this discussion is I hope we're not leaving the impression though that there's a kind of, I guess, I would call a false dichotomy between some of these. Because, for example, renewal expectancy is not, I don't believe is contradictory to limited term licensing because you can have what we do today, right? You're saying in PCS a limited term license with renewal expectancy, the question is kind of on what terms, how we do that. Similarly, with interference you can renewal expectancy, limited term licenses and still have

the Commission migrate the interference standard along with technology over decades. So none of those things are in terms of assembling a bundle of rights, I don't think any of those three things are in contradiction, although they may be in some tension. And that's one reason too in response to David's point about internalizing the opportunity cost of spectrum.

Again, rather than relying on the Commission to have to yank spectrum back, if we move to a more flexible market oriented allocation policy using a price mechanism, then those sort of market base incentives for efficiency should be built right in. The problem is though we have commercial users who are not on a level playing field. Many like AT&T Wireless and so on who pay for their spectrum and others who haven't. That's why earlier at the very outset I was mentioning that if we are going to create this new type of license with this valuable service and market flexibility, when we assign these new licenses that we ought to perhaps take advantage of moving to a kind of annual user fee for spectrum use because that can serve several important objectives that are in the statute. It can recover to the public

an ongoing and market based return on the public resource, internalize these opportunity costs for efficiency. It can reduce, and I think it's an important flaw with the current auction system is these are sort of viewed, the companies are forced to view these and it's even worse in Europe. But they're forced to view these as one off auctions, where you're sort of bidding to have control of this resource for all time. I say worse in Europe because they were actually licensing, it's like a business license. Even if you owned first or second generation license you couldn't do 3G unless you went into this auction and paid more money.

So it would reduce barriers to entry to whether we use competitive assignment in entry or not, do it just for the first term. And then after upon renewal give the incumbent either now or these incumbents who get the spectrum through auction, give them the option if they want these valuable flexibility rights, then they can just convert to an annual rental fee system. And that can be based, imputed, based on a modest percentage of the value that's evidenced by the secondary market transactions.

MR. MILLER: I'd like to quickly

comment. I like hearing your user fee proposal because the LMCC discussed this and even I think proposed it many years ago. And the reason is with auctions one thing I think a lot of people don't look at is even economically they're not really that good because the government gets the money today and then as the winner builds out his system, he deducts the auction price and his operating cost so five years down the road when government expenses are much higher, government revenues suffer because they got all the money today instead of being spread over the years by your user fee. So I like that concept.

I'd like to address the question that didn't get answered about what incentive is there for incumbents to use more spectral efficient equipment. For commercial users, this whole conversation seems to be dominated by commercial and what we call private radio users and there is an economic incentive for governmental users, there really isn't an economic incent. There's an economic disincentive since they have existing infrastructure they pay millions of dollars for tax revenues that are down.

The FCC tried to address the congestion

of spectrum users in the bands below 512 beginning in 1991 with the refarming issue. They started out with very aggressive deadlines at which all new systems had to achieve certain spectral efficiency standards and then after a certain amount of time existing system. They gave up on that and went to this market based approach that I hear expounded so freely here today. And it doesn't work.

With respect to governmental entities, when you go into your budget director, if you say I need to buy more spectral efficient equipment to improve operations, he'll say what are you using now? Keep using it.

If you say the FCC passed a rule and by 2012 I have to have this, then you get the money allocated in the budget. So I'd just like to throw that out.

MS. FARQUHAR: Let me go back to my original question with respect to the lack of clarity or definition in the rules themselves, if that's the issue or is the lack of enforcement perhaps by the FCC with respect to enforcing such rules that exist right now? Which is it, I guess, is part of the question. And let me ask a side or secondary question with respect to can the spectrum

users or licensees themselves even in an unlicensed environment do more to enforce these rules or administer these rules and are there models out there right now where that's going on.

Let me ask Steve Stroh that question in particular. How are the etiquettes working in the unlicensed community and what lack of definition might there be right now? Or is there, do you believe a lack of definition?

MR. STROH: The etiquettes, such as they are, work very well. It's basically does it function or not?

I'd like to touch on one point. The gentleman from Ager said that everything would be great if everybody would adopt the 802.11 standard. And that guts out the most innovative part of the license exempt spectrum that different technologies can compete on an equal basis, and whichever one is more applicable to the use is better.

802.11(b) is a wonderful standard for internal local area networks. It's a lousy standard for wide area networks. There are many other systems for example, the frequency hopping spread spectrum that's used by a number of vendors. OFDM is another one. All of those uses are

evolving in 2.4 already. They're being used. They are in daily use. The market is sorting out or is performing the function of an etiquette that if it works, they use it. If it doesn't work, they stop using it and go buy a different set of technologies or a different set from a different vender, change their operations. So it is working.

MS. FARQUHAR: Larry, can you answer that question from the perspective of the public safety community and others -- the product licensing realm in particular the private wireless realm. They have to do a lot of self policing. Does that work as a model or not as much when you have shared environments?

MR. MILLER: Well, self-policing works well. Unfortunately, it's a lot more personality dominated than technology. We have cases all over the country where if you have counties where the sheriffs like each other, they can sheriff. They don't, seriously, they don't.

MR. HAZLETT: Can you give us a map of which county is which?

(Laughter.)

Which ones to stay out of?

MR. MILLER: Actually, it isn't quite

that easy. So essentially, we try to look at it as we assign, as we recommend frequencies for licensees we try to do them on a technical basis. And that works pretty good, 85, 90 percent of the time. But there are times when things we think we won't work do and things we think will work won't, simply based on the incompabilities of the personalities involved.

MS. FARQUHAR: Let me see if there are questions from the audience.

David Reed?

MR. REED: Just a quick comment because it was mentioned before by Martin and sort of is implicit in the question you asked Steve. I've been personally tracking down and researching every story I've seen about 802.11 congestion. These so-called pileups and I'm convinced, based on that research, that most of those stories are of the hypothetical nature that various people who have no experience in the field are positing that this will happen.

In very, very high density areas it's possible to have a problem briefly. You discover that two radios next to each other are tuned to the same channel. But the nature of that particular

technology, which is not the same as a wide area network technology is that you can resolve that very quickly because it's not very far away whatever interferer there is, whether it's a microwave oven or whatever. And certainly we don't need the FCC or even a micro market to solve that problem -- a market infrequency. We just need people to either spend a little bit more money or spend some time, which is a lot more effective way to do that.

I would be very interested and I'm really honest about this, I'd collect anything that would demonstrate that so-called meltdown that's talked about in the press. But I'm afraid actually that that's another example in the way public policy debates are carried out which is that people can claim they're something without somebody proving the negative. That doesn't happen. So I wouldn't make any policy based on the stories we heard in the press about meltdowns in unlicensed spectrum.

MR. LONGMAN: Wayne Longman, spectrum user of unlicensed devices. Well, if there's not a problem in the meltdown, why not issue licenses to the manufacturers? On the rare events there are

problems, we have someone to take responsibility for them. Thank you.

MR. WYE: That actually reminds me of something that came up a while back when we were talking about part of the problem in the unlicensed maybe is that they're kind of different competing uses. You know, not just 802.11 but there's cordless phones, there's baby monitors, and there's this, that and the other thing. It kind of generated a question in my mind which is well, does that mean that we need to have separate unlicensed band for different kinds of services? And I thought, okay we're starting to move back towards a license system. And I think this maybe goes back to Wayne's point and my memory is a little foggy on this since I left the Bureau. But we also I think had this thing in part 90 called license by rule where there is a rule part that governs some of the stuff. But each individual, you know, device is not necessary licensed and there is not a central controlling party.

Like in my case, my company kind of controls that spectrum through our bay stations, if you will. So this is a question maybe for the rest of the panel. You know, it says Part 90 and

license by rule get to what Wayne was just saying. Is that another element of the models that we need to be considering?

MR. HAZLETT: Yes. The suggestion is an excellent one and the question. This is exactly what would, of course, spontaneously emerge if a cheap spectrum policy were pursued and something like overlay rights, the Pressler plan or some other rendition were to be instituted, you would have, in fact, the Microsofts, the Intels, the Ciscos, your manufacturers, smaller, larger, all sizes. Actually, looking at this you would also have consortia develop in addition to manufacturer groups.

You could well, and again in a cheap spectrum environment, because lots of rights, lots of flexibility, lots of competition, you would, in fact, get that kind of entry, that kind of coordination, that kind of competition and experimentation between rival approaches to optimizing any particular band.

MR. CALABRESE: If there is a meltdown with unlicensed, it will only be because of failure of policy and I think that's true for a couple of different reasons. One is, you know, the whole

idea of the tragedy of the commons is a misnomer. It's what you -- there's many successful commons including the internet, but what there is sometimes is a tragedy of unregulated access. In other words, where there are not some rules promulgated such as the open internet protocols that David Reed helped develop for the internet that will kind of help self-regulate within the commons. So we may need those kinds of rules Jennifer mentioned, for example.

Many of the commenters suggested that for this channelized WiFi technology, we may need a new park that's dedicated for wireless broadband networking and that's fine. But the second is, you know, fallacy about it, you know, I think is also have this other technology that's coming on with cognitive radio and dynamic sharing, which means that if there really is, you know even if we open up a new park for today's technology and then that gets "congested", even despite protocols and etiquettes, then eventually what we should do is put out many more underlay rights for the new cognitive radio and ultra-wide band sort of technologies that can dynamically share.

And the first place we ought to look to

do that is the broadcast bands, you know, is to open that up to these new technologies as they come along to fill that white space.

As David made a point earlier that even though you might see congestion on the AD 3.5 megahertz and the ISM band, if you opened up these other huge parts of the spectrum that are just lying fallow to smart radio devices that can find the openings, that can fill the white space, there's almost no chance that there would be congestion.

MR. FURTH: Let me ask a question though going back to Michele's original question, I guess, about interference rights. But specifically focusing on the licensed model, because presumably when you're dealing with unlicensed spectrum you don't need to define interference because everybody has to accept it, whatever it is. But in the licensed model, there's been a lot of talk in prior panels about this concept that you were talking about that, first of all, interference rights aren't well defined and that one of the things this leads kind of fuzzy is the ability of these opportunistic technologies to hop in and out of licensed spectrum.

I guess I want to put that question out. Is it really a question of the rights not being well defined so that it is simply a question of writing a clearer rule? Or is it that they are well defined but they put the rights in the wrong place so that those technologies are blocked? And if you want to allow or encourage that type of opportunistic technology to flourish in licensed bands, what's the rule that you write in order to make that happen?

MR. KURTIS: Again, from my myopic point of view, I think the Commission got it right on cellular when they said users of adjacent spectrum and the same frequency band coordinate the usage and do it in a way and expand their systems so that they don't block the growth of the neighbor. I think one of the unfortunate oversights in PCS is that they did not keep the requirement that you coordinate in the same frequency band with your adjacent neighbor. And as a result I know from the rural carrier, we're having a lot more problems of interference cropping up unknown, unexpected overnight having to go down and hunt it down as opposed to a cellular model where there's an advance coordination process

that's supposed to take place. The carriers that honor that to my knowledge, the FCC has had very few interference cases come to them from adjacent CMRS operators.

MR. HAZLETT: Well, I'm not a lawyer but I play one on TV, so let me say that the rights as far as the market place are concerned, the rights are not well defined at all. If you want to take it from the legal standpoint, the rights are very well defined. The FCC regulates all the rights. Nobody owns the spectrum, and you have to come to the FCC for permission for any reallocation. So that's what fuzzes this all up. I mean to refer to exclusive use spectrum under today's regulatory model, there are examples where there's more flexibility than in others, PCS, for example, versus cellular or broadcasting.

But the current model, of course, does not have full flexibility, and so when you introduce a new technology on top of the, and I almost said obsolete technologies, let's call them existing technologies, like software-defined radio and you want to hop from one band to another, well obviously you're going to run in, frontally, run into the block allocation system because you can't

allocate around that without stopping at the FCC for 10 or 20 years each hop. Now that's probably too costly and prohibitive, and that's why don't see it in the marketplace.

Now to say then that the FCC solution is to override, decentralize decision making amongst all the different bands and then to impose that kind of shared usage is to make exactly the same mistake with a new technology. What you want to do is decentralize all that decision making, hand the rights to existing or new players that can, in fact, then in a flexible environment invite in on a negotiated basis all that kind of new traffic and then make those delicate trade-offs between some new system of software-defined radio, in some perhaps ultra-wide band tradition or whatever the trade-offs are in addition to you know standard commercial technologies being used today on a decentralized and competitive basis to hit the optimum, not to try to centrally plan this outcome.

MR. GATTUSO: I'd like to try to disagree with Tom, although really I'm going to make a different point but it was fun to say that I was going to disagree.

(Laughter.)

But something that Tom say triggered that which is I think Tom you said that at some point the rights are established, the FCC holds the right. But I think in another sense there's something very fundamental that at least when I was listening to the interference panel seemed very unsettled. And that is what exactly does an FCC license grant the licensee? And it seems like there's two possibilities and both have been in effect. One is the right to transmit in a certain area of certain power. We have possible parameters. Is it the right to transmit or is it the right to provide a service or a right to be free from interference?

And, of course, the second question raises all those issues about well how do you measure interference and how much does interference have to do with the receiver and it's been proposed even that you could define a right as the right to transmit with a cheap receiver and then take it from there. But it seems to me that that essential dichotomy exists in all sorts of situations and it's the basis for a lot of the spectrum questions that are pending.

I think the 800 megahertz issues that

we've heard discussed and those say well, one person said I have the right to do this. I have the right to send out the power. The other person might say not only can I send out the power, but you can't interfere with me. And then there's no clear direction, there's no clear answer and I think the Commission is left having to sort these out time after time.

MR. FURTH: I think one clarification in that is, you know, at least in the statute it's harmful interference. So what the license gives you is the right to provide, license to provide a service and to be free from harmful interference. And so if in moving toward flexibility we eliminate the service portion, I'm wondering in some ways to throw this up because I'm the lawyer, not the engineer, so I really don't know the answer. But I'm wondering if we can't just define this bundle of license rights primarily with respect you know, you obviously have things like know what frequency what you're talking about in the geographic scope, but if we can't define the license primarily with respect to the interference that you're protected from and then that's the license which means that all other users who can share that band without

harmfully interfering with you are -- as Tom was suggesting are invited in because there seems to be no reason given when you go back to the sort of the legal and constitutional values that underpin the Communications Act, there's no reason to squelch communication, particularly among citizens who are using these smart radios on a peer-to-peer basis if there's no harmful interference. And I think that definition of harmful not only has to be found,but then has to evolve over time with technology.

We need to actually move on here because we're running short on time and we've got a lot of ground to cover. I think we could inevitably discuss this for the rest of the day and a long time to come. But I would like to move on a little bit to talk about a couple things in prior discussion and in the comments the sort of uses of spectrum that people have tended to talk about as perhaps being exceptions to whatever general model or models we might want to apply, for example, to commercial uses of spectrum.

One of these is obviously public safety uses. And I'd also like to have an opportunity for the panel to come back to the question that I know Dave Siddal raised this morning and Michael has talked

about here which is the issue of whether we should have different regimes for rural spectrum versus urban spectrum or perhaps more accurately spectrum that is more congested and less congested since in rural areas clearly you do not have a congestion problem.

So I'd like to talk first about public safety and maybe come back to what Martin talked about initially which is a distinction that was made in your report between commercial uses of spectrum and sort of public uses of spectrum that would have to be approached under a different model and ask you to talk about that a little. And then ask the panel to perhaps address whether we'd need to sort of single out public safety and those types of uses and apply different model and if so what would it be.

DR. CAVE: It is certainly true as I indicated in the outset that the report which I wrote identified in essence two regimes with some kind of linking condition created by the opportunity of public service spectrum uses leasing over the boundary. I guess the reason as I've indicated that was incorporated was that I just didn't feel that we were ready yet to move to a

regime in which there was wholesale competition. But that's certainly the regime that I hope we will move to over a period of 5 or 10 or 15 years.

I was discussing this yesterday with another bunch of people here in the FCC and somebody suggested that in proposing this that I was rather like Gorbachev in trying to reform the Soviet economy. This halfway house was a measure that would inevitably fail and that some radical person like Tommy here for example will come in and elbow the proposal out of the way with a more radical approach. But as far as I'm concerned, as far as Europe is concerned, my estimation of the possibilities there, it's just not practical to move to a system where there isn't some kind of reservation of spectrum for public purposes.

But that, as I've indicated, should be accompanied by some kind of incentive for economy and its use so you don't get the problem which we have in our Ministry of Defense, for example, were inquiries reveal that they don't even know whether they're using the spectrum that they've got or indeed probably don't even know what they've been allocated. And that kind of situation is very serious.

MR. HAZLETT: Yes. Just on that point, was there any consideration of an approach within the set aside approach, so you have some allocations for public safety, but you go from there not to sort of the current top down regime but you have, in essence, requests for proposals and competitive bidding by private or public organizations to, in fact, provide those services and you know make bids for use of the spectrum at the same time. This would get to finding the spectrum that's not being used, getting much better public safety communications system and introducing competition. You know, it's government contracting is what it's is. Was there any consideration of that?

DR. CAVE: We already have some of that and it might be useful just to describe the arrangements we have in the U.K. for the provision of communications services for the emergency services. The U.K. government has let a contract to an operator and assigned the spectrum that it considers is necessary to provide that service. And that service is then provided uniformally to our fire, police, and ambulance services. So we have to some extent taken on board the notion of

outsourcing communication services. But it's been done in a way that has involved really vertical integration between the service provider and the band manager of the spectrum. And clearly those two functions could actually be separated. You could have an emergency services spectrum band manager which would then treat with various emergency services in order to provide whatever their needs were. I think that might be quite a useful halfway house, as Tom has suggested.

MR. FURTH: Then maybe I should put the question more generally to the panel is this halfway house approach or some kind of halfway house approach for public safety something that's appropriate for us to consider?

Larry, do you want to talk about it?

MR. MILLER: I think it is and I'd like to point out something. The Nevada Department of Transportation, about eight years ago, decided they want to be able aid statewide trunk 800 megahertz system, but they didn't have the financial resources to do it. So the manager there very innovatively contacted some county agencies, the Federal Energy Commission and several other governmental entities. They formed a partnership

with -- utilities also, the telephone company and the electric company there in Nevada.

They had to go through the waiver process with the FCC and a lot of other administrative applications and requests. But they were able to get away where they build a system that they use that's shared by utilities, it's shared by federal agencies, by the UNLV. I think there's about a dozen diverse governmental entities using this shared system and what it did it resulted in an economy of scale where they can share the cost of the hill tops by their subscriber units. So it worked out real well.

I think that's an approach that a lot of states are looking toward now. Homeland security is a big item now and I'm working on that application right now for the State of South Dakota where they're doing the same. They're building a state-wide combined shipment which requires waivers, it requires industrial radio service frequencies and land transportation, etcetera, just to get enough spectrum to meet the technical requirements to make the trunking system work.

So I think there is some options. Block allocations are good for certain things, but

when you get to a large, wide geographic area, usually you have to go outside the block to get the sufficient amount of spectrum. So I think that is something we should look at, is innovative approaches towards licensing these public safety systems.

MR. FURTH: Other comments?

MR. WYE: I never want to make the public safety community mad at me, so without getting to whether or not there needs to be set aside spectrum or whatever you want to call it, I think there is at least two issues I would mention. One is that there's a perception problem here. Having talked about this with some folks over the last couple days, not just in my company but other places, people keep saying you know, they have to buy police cars. They have to buy fire trucks. They have to buy the gas that powers those vehicles.

I don't understand, my wife said that, I don't understand why they don't have to buy the fuel that powers the radios. And so whether or not you agree or disagree is something that must be set aside. There's at least a perception problem that there is some kind of a disparity here that I don't

think anybody disagrees that public safety is a vitally important part of this nation. Certainly the services that we all want -- I want the police to show up at my house if I have a burglar or if there's a fire, I want the fire engine to show up. But there's an issue there were some people just kind of scratch their head and I just don't get it.

Secondly, just to return to I think the point Professor Cave made which is probably the most important one and we've seen this in the 800 megahertz proceeding that's going on now, is that regardless kind of what else is going on, there have to be some mechanisms in place to improve the efficiency of the radios and the equipment that the public safety community is using. We've run into problems time and time again, and now I'm kind of speaking in my past life when I worked for Michele and the Bureau where I kind of did some public safety stuff for awhile.

We run into this problem time and time again where the equipment is old. It's antiquated. It's extremely inefficient and the problem largely has been funding. I think we all recognize that and certainly the budget cycles are weird and I

appreciate Larry's comment which we heard before which is I can't just run into my city manager every five minutes and say I need to buy new radios. But when the FCC tells me I have to, then I have a reason to come up with. So two things. Perception problem and how do we improve the efficiencies of the public safety radios.

MR. FURTH: Joe?

MR. GATTUSO: I think it's important to recognize that public safety spectrum users really are a public service or non-profit. Obviously, I'm thinking about the federal government incumbents. The operation, the incentives, everything about a nonprofit or noncommercial service affects the incentives, effects their operation and one cannot blindly apply a solution that works in the commercial context to the noncommercial context, because if you do that you will very quickly see the disparities. Certainly, we see this a lot when evaluating the relative value of a federal government or public safety user spectrum versus another and it wouldn't be fair to say, for example, well, you haven't brought in $300 million this year. Obviously, you're not important.

There are other measures that may or

may not be measurable. They might not be quantifiable. And yet, fundamentally we do have to look at efficiency. We do have to look at incentives. And certainly, in a discussion such as this with respects to rights, remember that rights can work both ways. That one type of right that doesn't seem to be clearly defined is what rights do incumbent noncommercial operators have today and, in fact, how could you use the existing rights to encourage those operators to be more efficient?

I think it's important that we break out of the us versus them dichotomy and just a matter of breaking down which spectrum blocks we're going after to how can you change, how can you use the different incentives that these operators have to end up with more efficiency.

MR. FURTH: How would you change those rules? If you could make that decision, how would you do it?

MR. GATTUSO: One thing would be to at least explore, and I think the answers are not clear, explore how you can define the rights that are held by the noncommercial operator and then see how you might give the incentives for that operator to use those rights or to give away those rights or

to know that if the party needed spectrum in the future, that those rights could be acquired through a mechanism other than having to go through a long politicized process.

MR. FURTH: Jennifer.

MS. WARREN: Just a slight variant. I guess public safety clearly, at least in my mind, should not have to -- should be viewed as a public service and not be treated as other licensed services for purposes of access and spectrum. I think even among what I would call nonpublic safety licensed services that they can't be expected to compete with each other either for access to spectrum, whether it's the BLIT licensees and the CMRS. There's no ability

-- it's apples and oranges. It's not apples and apples.

So when you're looking at licensing regimes, you've got to distinguish between the types of users because otherwise you're going to have a very distorted outcome with perhaps those who can pay the most but not necessarily those who will put it a use that's a very valid use.

And then obviously, there's the satellite spectrum which is separate and apart,

aside from legal reasons and Orbit Act, I think Congress understood that there are significant transactional costs that would be placed on international satellite systems that they were subject to auctions, either sequential or global. So there obviously have to be distinctions even among or within license blocks spectrum.

MR. STROH: As strongly as I am an advocate of the smart radios and flexible spectrum, I can't find it in myself, at least immediately, try to share public safety spectrum. But I would support would be a grace period where say a period of 10 years where the public safety agencies would say that for 10 years the smart radios won't try and test your spectrum to see if it's in use, but after 10 years it will try listening. They'll have plenty of notice for that.

What I suspect is going to happen though is that those public safety agencies that feel like they have a 10-year grace period are going to find out that the services that are going to evolve in the nonprotected spectrum, the license exempt spectrum, are going to become so desirable that they're going to want to migrate out of their license spectrum to take advantage of all of what

is happening. An example of this is the San Diego Country Sheriff's Department which is doing a mobile intranet, running at one megabit per second into each of their 650 vehicles using the 2.4 gigahertz band to be able to do computer updates and dump data right down to their hard drives which are in the trunk of the car to be carrying the database around instead of trying to query it in real time for 650 vehicles.

The other thing I think is if you build a network of smart radios, it's also possible to build a preemption mechanism where basically the public safety guys start transmitting a beacon when they need more spectrum in a wide scale emergency and all of a sudden the smart radios vacate. They shut down. If you're not a priority use, you're not out of here. You just don't operate. The smart radios can do that.

MR. KURTIS: I just don't think that we need to open up 100 percent of the spectrum for the unlicensed use. I think that you have certainly the ability to use spectrum where it is fallow. You make a strong argument for being able to do that, but to say you've got 10 years, public safety, and then we're going to allow the

unlicensed people who have spread throughout all the other spectrum to spread into yours as well. I don't think we need to get to that point.

MR. FURTH: But if it's fallow?

MR. KURTIS: I'm sorry?

MR. FURTH: If it's not in use.

MR. KURTIS: Well, if it's not in use at the moment that that device goes to turn on is a different question than if it's not in use because there's nobody licensed in that area.

And while that unit can sniff before it starts using a particular frequency, the public service radio may not have anywhere else to go to when it needs to communicate or may not have the same sniffing capability.

I'm also concerned that you have the same dichotomy here that you have in the CMRS. There's a very large difference between the ability of a city to come up with resources for spectrum management costs versus a county. There's a big difference between a rural county and an urban county and there's a big difference between a county and a state. And I think that we have to be careful that if we're going to go to some type of a regime, to remember number one that any fees that

we impose on the public safety is really coming from the taxpayer. So we're essentially levying a federal tax to require the local jurisdiction to raise tax revenues to pay the federal tax and I think that the discussions that we have in terms of spectrum and the ability of licensed and unlicensed, I think that we do have to carve out a piece of spectrum for public safety that has the ability within it to be able to meet the needs of the city policy, the county, the state, right across the board.

MR. FURTH: I see your hands. I want to actually just ask a couple more questions before we get to the audience again.

I guess I would I would like, following up on Michael's comments, also broaden the discussion to talk about the rural issue because that is another example where it seems in the comments and in some of the discussion we've had here, there is this notion that somehow the models that we're looking at, the way they are currently configured don't necessarily fit, at least some would argue, when you're talking about rural issues.

My observation is that as far as I

know, other than sometimes in the way in which we license spectrum that we carve out licensing areas that are -- RSAs, that are defined through census data as encompassing rural areas. In general, our rules both on the unlicensed side and the licensed side, don't distinguish between different geographic areas in the country based on density of population and I guess my question would be is that something when you say one size doesn't fit all, is that something that you would advocate that there should be, in fact, be different rules, different standards and I'd like to throw that open to the panel as well.

MR. KURTIS: Yes.

MR. FURTH: But what? I mean you need to give us details. What rules should be different.

MR. KURTIS: Well, if we're looking at interference issues, again, you have to realize that one size does not fit all. If you have a maximum power that you are going to allow from a broadcast station, it's one thing to limit the power in an urban environment when a certain power level is going to give me access to hundreds of thousands of potential viewers in a broadcast

application versus in a rural area where I may have to have 30 times the power or 20 times the height to get anywhere near a footprint that is nowhere large in comparison to that population base. You just have a very different model. You have -- you've heard talk, I don't know if it's precisely exact, but like 90 percent of the population live in 10 percent of the geography and you have very different needs and very different cost bases. Classic example is the universal service. You would not have rural telephone service. You would not have rural electrification if it were not the ability to get the high cost areas subsidized by some of the areas where it is significantly lower cost and does that fit the marketplace? No. The marketplace would say don't let the rural people get telephones. Let's just have everybody go to the urban area to get it and I don't think that there are -- there is a situation where we want to come up with a business case that works in only a large urban application.

MR. FURTH: One thing, thankfully, that is beyond the scope of the spectrum task force is universal service, but I guess I would like to ask others on the panel if they feel that in terms of

our spectrum based rules there should be distinctions made between urban and rural areas as Michael suggests.

MR. STROH: Yes. Yes, there should be, but those rules whether the operation, how the operation varies from urban to rural ought to be imbedded in the radio and let the radio decide when it applies that rate, when it applies which rule. If it, for example, if it senses, the radio is able to hear a very dense RF environment, it is programmed to back down in its power and spread out, go to more of a spread spectrum or ultra-wide band model.

If it's in a rural area, and it doesn't hear a lot of other traffic, it can take a guess that it is okay to transmit higher power, narrower bandwidth and then to punch through for much greater distances.

We have the ability for the radios to make those decisions now without trying to micromanage what will work in Iowa or Nome, Alaska from Washington, D.C.

MR. FURTH: I guess my question is whether you need an FCC rule to make that happen or whether that's again a matter of protocols that can

be worked out by industry and in the marketplace.

MR. STROH: Yes, because it's not -- right now it's not legal for those radios to even have the option of other higher power.

MR. MILLER: I suspect you're speaking of your internet type devices and things. I'm more familiar with traditional land mobile. And the FCC realizing that spectrum is finite, many years ago imposed what they called the safe harbor limitations and so what happens with that is -- and since I do frequency coordination there are counties in Utah that are 20 miles wide and maybe 90 miles long and so -- and the mountains are 10,000 feet high with an AAT of a couple thousand meters or whatever. So according to the safe harbor rule, you can have a couple of picowatts from that transmitter site, but the Commission does allow you to ask for a waiver of that rule. So I think the Commission's rules, quite frankly, recognize that there is a difference and sometimes you have to do a little bit of work to show them that hey this is a rule site and this is why we need this justification.

I don't recall any instances of getting a rejection whenever I furnish the proper

documentation.

DR. HAZLETT: Yes, I'll take the other side of this one. No, the rules should be generic. If your rules are generic and they're screwing up allocations in rural versus urban markets, for example, then your rules are too rigid. Have flexibility in the regime so that yeah, the markets are going to provide, if there's any rationality or efficiency of this, they're going to provide a lot different mix of products with a lot different technologies and maybe analog cellular is fine in Butte, Montana and digital cellular is fine in Chicago, Illinois, but the rules to impose analog and then to keep analog and then to allow digital and then to allow digital all, those rules, that's the rigidity that has messed up the market, not the one size fits all per se in terms of the regime, but the FCC should not try to micro manage. If it does that, of course, every market is different and blah, blah, blah. That's why you want to make sure your rules allow that flexibility, the diversity to spring up spontaneously from the heterogeneity of the markets.

MR. WYE: I'll take a whack, too. It seems to me one of this is one of those theoretical

practical issues. Theoretically, I can see why you might need different scenarios, rules, whatever in urban versus rural. That makes sense to me. My practical side says okay, well, how do you implement that? And we heard one example of that although I must say it sent a shiver down my spine when Mr. Stroh said that the radio can take a guess as to how much power it could be using and that made me a little nervous.

And so when I think about well, how would you implement this or how would you define differences, I mean I guess you're going to run into a wrong word spectrum problem. As you move along the spectrum from urban to rural, where do you set the gradations? Where do you set the different limits? And okay, if I figure I can't do that and I envision here for folks who are familiar, driving up 270, you go from downtown Washington, obviously very urban, dense environment to Bethesda, probably not quite as dense, out to Germantown, again, probably not as dense again, but where do I set the limits? How am I drawing the lines on the map that says here I can do this and here I can do that? I think that would be an extremely difficult task for the Commission to

undertake.

And I recognize that we have the RSAs versus the other and maybe that's the only way you can do it is a very gross level of truly rural versus truly urban, but then of course, you get into the problem of okay, what happens when the rural areas start building out. At that point, the FCC is going to start changing their rules and you have to start drawing the lines again. So again, the proctocolitis here scare me a little bit.

MR. FURTH: I'd like to ask if anybody in the audience wants to ask questions or make comments on this issue?

David?

DR. REED: David Reed, again. Sorry for taking so much of your time. It seems to me I actually more wanted to focus on public safety issues, but also this one which relates to it. We're acting as if the public safety systems are locked into a technological backwater and therefore, which to some extent from budgets is true, but not as true as you might think because costs of technology have been plummeting, especially digital technology so buying the next system is a lot cheaper than the system they

already bought. That's one thing.

But I think the main thing to think about is that I've spoken to a lot of people that are operating public safety networks and they say the two biggest problems they have are one, interoperability and two, the inability to get any significant commercial investment because of the tiny size of their market in upgrading the capabilities of their equipment. So what's actually happened, alluded to in San Diego and a lot of other places is public safety activity has migrated on to the commercial services, you know, policemen use cell phones. People use 802.11 and so forth. And the market is moving that way anyway. It's just a lot better technology.

So if we pulled the plug and said over some period, I don't know whether over 5 years, 10 years or 25 years is the right thing, we go away from dedicated services to letting the public safety use the same techniques, therefore have access to all the spectrum which would be much more efficiently managed and more dense, they'd have more capability, not less and we'd again develop a rich commercial marketplace that could satisfy their needs, public piggybacking on that. And I

think we make a serious error to assume that just because people are rural, they're poor, just because they're public safety, they're poor and that sort of thing. Because in fact, it is the case that ambulances get down highways, right? We didn't have to build an ambulance lane and put jersey barriers on it to guarantee that public safety works.

MR. FURTH: Yes.

AUDIENCE MEMBER: I've got a couple of comments that I wanted to make through analogy. We heard a lot of analogies here over the last few days and if sheep are bringing their own grass and the horse is out of the barn and the dog is eating my bundle of rights, and it strikes me that in the end the issue of public safety as with much of these other issues comes down to money. And the analogy I would start with is if I have some land who is better situated to lease that land for another user, if I'm not using it all. Would it better to have me have the ability to lease part of it to someone else and then coordinate directly with them through contract to say you can lease this land under the understanding that you don't have any parties at night or if you do, I get to

come and if there are -- you can't have vehicles up on blocks, etcetera, and perhaps under that situation if I originally got land from the government, I would be obligated to share some of the revenue from the sublease with the government.

Or alternatively, would it make sense to have the government tell me that it has subleased part of my land and I now have to fight tooth and nail in front of the sublease regulatory agency to protect my rights and the claim that they're trying to do too many things and they say he's just afraid of the competition.

Extending this analogy to the public safety area, the public safety community has certain amount of spectrum allocated to it now. And one way to avoid the financial problems associated with simply mandating the stick of having them upgrade is telling them that this is their spectrum for the foreseeable future and they have two choices. They can either continue to use it inefficiently like they are. They could improve the technology that they apply in the spectrum, either to increase the robustness of it or they could increase the efficiency of their use of the technology such that they're only using half as

much of the bandwidth and then allow them to go ahead and lease out the other half of it to AT&T who wants to have more bandwidth in the area.

This kind of approach strikes me as very sensible in concert with the larger theme of having good incentives and just one other example which I'd like to give is for how we would handle this in the area of developing technologies. Imagine that there's a new phone network, say probably invented by David that has no infrastructure. Instead, each phone uses wireless IP style network where each phone agrees to pass along the traffic from neighboring phones. So if you've got 500 people with these phones who go out to the middle of the countryside, all of a sudden there's a phone network there. To start off with, it is unlicensed and it is experimental. It is -- it's growing and it's developing and after a while an industry builds and develops and consumers start to adopt it and they want protection. Well, at this point, it would seem like it would make sense to give these types of devices an area of protection, some place where they can be insulated from those types of devices that don't play smart, that aren't intelligent or adaptive and that could

either be in a separate part of the unlicensed band or perhaps it develops sufficiently that it's time for it to have its own band. And then once again it's within the public safety area, once it has its own band if we adopt the regime of allowing it to choose how to use the spectrum that it has earned, it can either stagnate and choose to forego all for the subleasing it could do or it could improve its throughput and reduce the amount of spectrum that it needed and then sublease it to somebody else.

MR. FURTH: Thank you. I think we need to move on. We started late, so we're going to run a little bit late as well. We'll try to finish at maybe 3:30, 3:35 or so, but I did want to move on to the next and last set of discussion issues.

MS. FARQUHAR: Which is transition mechanisms. One important element that the government needs to consider because spectrum is already so incumbered is that if it wants to make way for new technologies and also adopt new spectrum models for rights and responsibilities, it needs to adopt transition mechanisms to be able to do that effectively.

In particular, the types of issues the FCC has had to contend with recently where it's had

to adopt these mechanisms have been making way for new technologies, dealing with market failures and also taking into account the international realm and the global telecommunications market that the carriers, in particular, live in.

In that vein, some of the mechanisms that the FCC has adopted already has been to greater expanded rights to incumbents, to reclaim or relocate spectrum and licensees already either through mandatory or voluntary means, overlay approaches and underlay approaches. What I'd like to get from the panel is a reaction to these techniques and models and also consider an approach that was raised this morning, both by Chairman Powell, as well as by Tom Krattenmaker in their remarks and that was should the FCC take more time in its initial allocations and assignment of spectrum to adopt self-correcting mechanisms in case of market failures, to think through what could happen, anticipate problems and adjust for those on the front end, rather than having to deal with them on the back end. So let me throw it open to some of the panelists on that question.

In particular, Jennifer, if you could address some of the international issues that I

know you in particular have had to deal with and David also.

MS. WARREN: You want me to start? I haven't had an opportunity to think about that. Obviously, in terms of an international perspective, but I want to come back to a domestic one, in terms of transitioning incumbents to other spectrum, I mean at least from the satellite perspective, there's been a great deal of effort to try to harmonize the use of bands globally, and to the extent that you relocate satellite incumbents in spectrum, domestically, that has ramifications, obviously, globally, to their ability to continue to provide service, assuming it's not to a band that falls within a certain range.

And if they haven't yet deployed, this has happened several times in the context of PCS and MSS, the U.S. does lose its credibility after it goes and achieves an international allocation, for example, let's say an MSS allocation. And goes and achieves it after a great deal of effort, comes back to the United States and instead of pursuing that, then decides to reallocate that allocation to PCS which clearly proved right, given the services here, but made the next time we went back for an

international allocation, both for MSS and other services that we said needed to be harmonized and we needed the world to go with us, made it that much harder.

So there are those who think that domestic, the domestic allocation process is completely divorced from the international process or the international allocation process and it's not because it's important to manufacturers, whether satellite or wireless. It's important at least to satellite service providers because businesses are dependent upon a global business plan, not a national business plan as it more often the case for the domestic wireless carriers.

So there are distinct ramifications that need to be taken into account and I was very pleased to see that the task force actually had a section recognizing that there were issues there.

With respect to underlay, overlay, etcetera, domestically, I think licensed underlay approaches, as opposed to unlicensed is a very useful mechanism is parties are assured that it is noninterfering, as I think is a stipulation. But licensed, unlike unlicensed, at least allows you to go back to somebody who holds the license and is

accountable. So that if there is interference despite demonstrations that perhaps there wouldn't be, there is a party to go to.

That's the fear with the unlicensed underlays and overlays and whatever category you want to call, is that in the case, where there are disputes about whether or not the parties can co-exist, there's no one to go back to. Recalls are very hard. OET managed to do a very important one lately, sort of analogous. But recalls are impossible, really. So what do you do if the Commission gets it wrong? That's why licensed, at least, allows you a party to go back to.

MR. WYE: Just to follow up on one thing that Jennifer said and I completely agree on one point. I will say that the underlay concept still makes me a little nervous, even if it's licensed because if we're still talking about ubiquitous devices that are mobile, unless those devices are uniquely identifiable somehow, in other words if -- I have to have a way to trace them back to the licensee. Just having it licensed in and of itself may not get me enough, so as long as I can trace that device back to the licensee, that may work.

MS. FARQUHAR: Let me ask, Tom, if you could also address whether the FCC can adequately anticipate market failure and whether it should address that on the front end?

DR. HAZLETT: No.

(Laughter.)

DR. HAZLETT: But it can certainly anticipate nonmarket failure and it should eliminate it. So just listing them off, yes, the overlay approach, I've already advocated that and it's very good. And the PCS experience is a very, very good boilerplate. Two, the underlay approach, very, very nice, said well by Jennifer. Licensed underlay rights do give you somebody to look to. The question just brought up about the device and the licensee connecting the two, yeah, that's something that maybe if you put liability on the new underlay licensee to actually come up with a mechanism, you could do that, but what you should do in all of these -- well, I'll get to dispute resolution in a second.

Three, windfalls. You certainly do not want to tax them, auction these new rights. As said before, the way to get the licensee is not to discourage the new innovative use that brings

service to the public and raising the tax rate on that activity which is the most progressive of all, the way to get it at the incumbents is to introduce competition all around them and force them to go after innovative uses and as just was said in this very long and interesting comment from the audience, you want, you think and that's an excellent format, think about this underutilized spectrum out there. Whether it be a public service license band or any other band and how do you get entry in there? How do you get efficient use of that spectrum? And what you want is you want that licensee who is sitting there with some sort of fuzzy control over it because there's no explicit property rights, certainly, but you want that licensee to be part of the solution. You want that licensee to be investing in research and development to come up with ways to better use that to negotiate with alternative users and technologies and so forth and so on, so you throw the new rights to auction or you tax it away through fee structures, you just kill that incentive. And by the way, the Northpoint, broad wave example that somebody brought up, a perfect example of killing the incentives for innovation by

going to a licensed auction system and then lastly on -- what I don't see right here, I know you've talked about it elsewhere, I'm just saying -- the real action here on public failure and if you want to call it market failure, that's fine too is dispute resolution. These interference -- you can't just say all we're going -- we're going to deregulate, we're just going to worry about interference and expect that there's going to be any big action. That's all incumbents need is an interference dispute. And we can take 25 years on that and that's great. That's as good as anything the public interest standard ever offered for incumbent protectionism.

So what you really want to think about is efficient ways to get the liability on the -- both the incumbents and the new users in a way that can be resolved fairly quickly. That doesn't mean a perfect solution, okay? The ideal is the enemy of the good. You don't want to get these rules too good because that will take forever. You want a reasonable starting point and then you want to move away from the current system certainly where ex ante, before any entry is there, the new rival to all the incumbents has to prove that there will be,

you know, never will be anything that goes wrong and just remember what happened with PCS. Evan remembers this. The PCS incumbent said if you have new use in the 1.8, 1.9 gigahertz band, people will die. If the incumbents have any new uses around them, people will die and you know, maybe there's been a report we haven't heard about, but the fact is it seems to have gone a little smoother than that and all these excuses about how the interference is going to kill people will fall by the wayside if you go to a system where the entrants have an ability to get in the market quickly. They have to -- there may be some regulatory function here. There probably is, in making sure that the entrants have liability, that they don't spread a lot of interference around and say oh, that wasn't my machine. And then walk away from it. So you do want to have liability and get a market going in terms of consulting firms and institutions that will actually monitor spectrum, band managers, frequency coordinators, equipment manufacturers, insurance companies, that will actually certify what the actual damage is by new use. But you want new damage, okay? The entire system is rooted against new damage. You want new

damage. You don't want a lot of it, but you want some of it and you want it certainly to be limited and much smaller than the gains. Now the market will sort that out if you allow this quick low transaction cost adjudication to work in an environment where the incumbents have an incentive to actually talk about real interference and not just hold the process up by talking about what they say is interference, but really is fear of competition.

MR. CALABRESE: Yes, I think three of the four options that Michele outlined could be combined in a way that's very consistent with both the Communications Act and trends in the technology. First would be, I would say, underlay everywhere, so that we require incumbents to accept noninterfering uses, subject to the caveats that David just mentioned.

Secondly, when we should relicense under these new spectrum usage rules in other words, this sort of market and service flexibility probably reshaping the license around primarily around interference, okay, but in doing that it's this tough transition issue. So as Michele mentioned, you could have voluntary reclamation or

mandatory and again, I think we need to use probably a version of both.

We can have voluntary recognition, reclamation by giving incumbents and incentive to relicense under these new flexible rules in return for paying a market-based spectrum user fee to the public and we see that's exactly where Congress went, for example, with DTV when what they said was for this new digital channel that they gave in 1996 and it was a bad policy in many other respects, but one they said is that if it's used, they gave flexibility to use it for things other than transmitting a primary signal for quote free TV, but in return the broadcasters have to pay 5 percent of their revenue on those ancillary services. But there will be incumbents who we find because, in part, because they're not efficient in using their spectrum, don't want to start paying a rental fee and so that's where it can be mandatory and we can auction overlay rights. In other words, they can continue doing what they've been doing with interference protection, but their interference protection for that old service should wear away and if the auction winner wants to compensate them to leave early we can do again what

NTIA suggested recently with respect to the military and have some sort of compensation for either reasonable relocation costs because they can move to cheaper spectrum or for the depreciated value of their capital equipment through some sort of relocation trust that pools the auction proceeds.

But those would be, that would be a way I think to combine the elements and do this in a balanced fashion.

MS. FARQUHAR: We'll let other panelists address this issue who want to and then we'll go to the audience.

MR. KURTIS: The only thing that I would point out since Mr. Hatfield is not here to do it for his -- on his own behalf, if you're going to allow licensing on a noninterference basis, then you need to find what interference is. For example, if someone purchases a $3 radio with a wide open front end on it, it's going to be subject to interference in situations where the $50 radio with the well-defined front end filter would not receive interference.

So I think if we're going to go down the route of an underlay that is given on an

non-interfering basis, we need to make sure that we have some standard for the equipment on both ends of the radio link that the incumbent has on what is and is not entitled to protection so we don't, through the back door, reward the incumbent that puts the least efficient equipment out there because that has the greatest susceptibility to interference.

MS. WARREN: Just two points. I guess in my earlier comments about the licensed underlay and the way I view the underlay scenario that was laid out earlier, it's almost like licensing a secondary service. So that in effect the incumbent, if we want to call it that, would be still primary have the flexibility to evolve its technology. It wouldn't be frozen. It would be stifled. But at the same time if some other service can on a non-interfering or a secondary basis use that spectrum and be licensed so again we have the accountability, that would seem to be a good marriage.

With respect to a point Michael made in terms of old technology, I think we need to talk about what's old. Because I've been very confused by FCC decisions where there's been promotion of

what they called new technologies, but it's been I will say that in promoting new technologies often times it ignores another technology that's only recently been licensed, not even been deployed. But somehow it doesn't count any longer as a new technology.

I'm not quite sure when we talk about old versus new where we want to strike that defining line and that's kind of risky. So I prefer incumbent use if you like, but old and the promotion of new technology is something I think the Commission needs to define a little better when it looks to the statutory admonitions that it has to promote new technology to be a little clearer about what constitutes it and when you stop being it.

MR. WYE: I'd just like to pick up on a point each from Michael and Jennifer. To the point of the underlays, I agree that you absolutely need to determine ahead of time what the interference is going to look like. And this goes back to the conversation we've had before on this panel and back to the interference workshop as well, is what is harmful interference. Got to start there.

Okay, once I understand that then we

start to talk about you know underlays in a very specific manner, then we have to figure out okay, what level of harmful interference from this underlay or these underlays is kind of the right amount? And as you consider that, Jennifer picked up the point which is absolutely crucial is that you somehow can't do anything that then locks in the incumbent, if you will, still primary license service, because if I have an underlay come underneath me and non-interfering, terrific. But then the next year my vendors and I get together and work up a much more efficient technology that's going to allow me to double my capacity, triple my throughput speeds, and all of a sudden I find I can't do that because of the underlay. I've got a big problem. That's not a good problem for me to have.

MS. FARQUHAR: Audience? Questions, comments?

(Pause.)

Anything else from the panel before we close?

MR. FURTH: This is what happens with Friday afternoon panels.

MS. FARQUHAR: Joe, I think you get the

last word here.

MR. GATTUSO: Dangerously, I've not been joining in here, and since I'm the only person who hasn't spoken from the panel on this, I keep thinking this, and maybe I'm just on this one note today, but it seems like the challenges with respect to these types of transition mechanisms still have to do with knowing what rights are out there and then having to work out how the incumbents feel about those rights. And it's something like David was just saying with respect and also Michael about the interference right.

What the interference rights are, who has them, and what do you do when change happens? And we think about that with respect to federal government users who even in shared spectrum may be changing systems in the future or may be envisioning new systems, and if you plan an underlay and overlay type of situation, you don't know how necessarily that's -- you don't know what's there now in terms of rights and you don't know what's evolving in the future.

I do tend to think of these, as Jennifer was saying, as secondary, primary, really co-primary situations. We do have the experience

from the past with shared spectrum and it's important to I think the whole theme of this discussion is define the rights, because you're never going to be able to solve these problems without knowing what you're starting with.

MR. FURTH: Okay, well, I would like to thank all the panelists for staying extra long on a Friday afternoon to talk about these issues. I think you've given us a lot of food for thought as all of the panels have and now for those of us on the task force, the real work in a sense begins with trying to take all of these good insights back and try to come up with a report that will translate those into good recommendations for the Commission and for future policy.

DR. HAZLETT: That's why they call it a task force.

MR. FURTH: Yes, indeed. It's quite a task.

Paul, I see Paul Kolodzy over there raring to go and we all are. So again, thank you. Thank you very much.

(Applause.)

(Whereupon, at 3:39 p.m., the meeting was concluded.)