we'd like to pick up in the next 10 minutes or so.

MR. WOERNER: Yes, I think Ray's remarks really lead into that. There is certainly a huge variety of very sophisticated signal processing techniques out there and they do a very good job of coping with self-interference. They are capable of interfering with legacy systems. And I guess the final question we want to pose to our panel is how the FCC rules affect technology and development. Are there -- is there a sufficient push to improve the performance? Is there a sufficient pressure on legacy systems and we'll go down our panel and we'll start here with Jack.

MR. WENGRYNIUK: Well, again, from a satellite perspective since that's the only industry I've worked in for 25 years, the FCC's rules, certainly over time, have evolved such as, in my opinion, to push satellite systems. Take for example the KA band where you've got a requirement for 2 degree spacing, a requirement for use of adaptive power control, a requirement with the

FCC's rules to essentially tolerate an interference-limited environment. Certainly, with the desire to get as much, to squeeze as much capacity out of the geostationary orbit and to use the geostationary orbit as effectively as possible, the FCC's rules have, in fact, in my opinion, pushed satellite providers where they probably wouldn't otherwise have gone because of the costs and technical complexities involved. So in that sense I would say that the Commission's rules, have in fact, pushed the satellite industry.

MR. WOERNER: Historically, most of the regulation has primarily focused on the transmission end where -- what signals can be admitted and what bands, to what extent do you think it is appropriate to regulate the receiver side of the system?

MR. WENGRYNIUK: Well, certainly, this is speaking personally now, I believe there is a -- there should be a responsibility on the part of the receiver to take reasonable steps to protect themselves from interference, proper filtering,

that sort of thing, to suppress adjacent band signals. There's only so much you can do with interference that occurs within your band.

Dr. Pickholtz spoke of some of the things you can do if you had some a priori knowledge of where the interference is coming from. But when it's coming from a different service or a different system that you have no knowledge of, there's only so much that you can do to mitigate that.

In the satellite area again, because of the very nature of the service, we're receiving very weak signals from space. We tend to have fairly sensitive receivers and fairly high quality receivers. Even in the consumer market, there's a certain quality standard that has to be met in order to get any sort of a reasonable quality of signal out. So in that sense the satellite industry is almost self-policing, but certainly from a broader sense, I would think that there should be some consideration given to receiver standards.

MR. WOERNER: Great. Jack Rose, maybe you'll share some perspectives on the implications of this discussion for regulation.

MR. ROSA: Maybe I can address a couple of points that were made along the way and pick up on them. I think it's time, I think it's radically time to move from what I would call the myopic view to a holistic view. The FCC is predominantly focused on taking care of transmitters. In fact, the definition up there was sort of archaic. So it's time to move on to the -- what the environment is today.

And we need to look at both. We have -- if you want purified transmitters and making the receivers less susceptible and the technology again exists to do both of those. And there are optimum gains to be made. Now one of the two things that the FCC can do. The one point I tried to make before was this perception that high tech, next tech is going to cost more. The indications, in fact, are it's going to cost less. In fact, dramatically less. I don't mean just 10 percent

less, maybe half to one third, one fifth of what we pay today for systems. So the expectation, by the way, of the Defense Department, if you pile up all the radios they buy, you're talking big bucks. Anyone who wants to buy one for $50,000 that does all these tricks and it's a cheap one. So the art and the science exist to get there. They exist in the commercial world and exist in the Defense world. But are the incentives to go and do this? That's what the question is. Why would I want to move forward. I see this as two components. One is the FCC again taking the homogenizing this and becoming the driving force to accelerate the course, to cause it to happen sooner rather than later. Let's get proactive rather than reactive, my message there.

Second is just business sense. You must have incentives. And maybe some simple things like a -- how much you spread into other spectrums is a function of your licensing thing. I've got a simple picture that's at a level and if you get to this level, you pay X dollars a month and if you

get to this level, you get -- maybe at some point you get y dollars back, in fact.

(Laughter.)

Penalties and incentives, if you will. You can readily determine what those thresholds are, okay? It's not rocket science either, by the way. It's very simple. You make the penalties and incentives attractive enough that a reasonable business man will make a no brainer decision. In one year, if I can get my money back, then I'll go do it. See? You need to have something that makes sense from a business aspect.

I think in issues like that which I know are -- these are dramatic from the way we behaved in the past is what it's going to take. It's going to take some radical departure from conventional thinking, to accelerate -- to speed up the film, to accommodate what the world wants.

MR. REPASI: Dale, do you have a few brief comments?

MR. HATFIELD: Since I was on two panels, I'm going to yield my time to my

distinguished colleague to my right, except for making one -- I have to say that maybe we ought to look at sort of interference trading rights to just like you have pollution trading rights.

(Laughter.)

There may be some opportunity here, but to people at the edge to say gee, it's cheaper for you to fix it than it is for me and I'll pay you to fix it.

We may want to allow some economic type forces to get into that trading as well.

MR. LOCKIE: I have two comments here and before I ought to pass off some credit for them. Often, we come up from Silicon Valley to the FCC with some ideas, you know, and often we end up in Mike Marcus' office because, particular millimeter wave community and often he offers us another suggestion that is maybe one or two or three or 20 dB better than the idea we walked in with. So Mike, I'd like to thank you for all your help over the years in passing off ideas. Some of this stuff is yours.

Two things, one I recommend that we look -- there's a lot to be said for the old -- a lot to be said for software-defined radios and all this stuff that we can do in the processing world to make things better. There's still no substitute for antenna gain and side lobe control and frequency control to orderly fashion reuse spectrum and make things better. So not to downplay that, just build on top of it. But along those lines, I think there's one thing we really want to explore and we're pushing this in the NPRM 7181 and 92 gigahertz is electronic filing and electronic coordination. This is another example. When we got computers now that for 500 bucks, you can buy a computer that can keep track of all the spectrum and every transmitter received around the world, so I would suggest a couple of things. We take a page from the radioastronomy community and the way we're doing filings there that every geographical area is a website, heartbeat. And that every new license coming in has it's own URL and with V6, Version 6

of the internet with unlimited numbers of addresses, it's a heartbeat.

In the process of all that, and some of you want to take a look at some nice things going on, go look at Donald Draper's software. It's nascent. You need batteries, you need some assembly and don't do it just at home, but this is a beautiful example of very cost-effective mapping software and electromagnetic software that we should be able to build on top of that and not have to waste $3,000, $4,000 or $5,000 per filing doing this coordination. Phone calls back and forth, missed calls, a lot of expense tied up there. We ought to be able to minimize that down to a few hundred dollars per site license. I recommend we look at that some more.

The other thing is I recommend that the FCC start looking at what are the basic physics of each spectrum band and what it's good for and I'll make a suggestion here and I hope Jack Valenti doesn't put out contract on me here, but two of the most valuable chunks of spectrum according to

physics for mobility for 3G, for 4G, for 5G, is VHF and UHF television. Now it's also some of the most important spectrum in the country in terms of keeping the economic base going, because that's how you get a pair of jeans to cost $90, 50 percent of it goes to advertising, but at any rate, if we could figure out a way, if there was a way to get the VHF and UHF broadcasting community to say hey wait, I'd like to give back my spectrum and get some of this new stuff, and I have a suggestion for what that might be and probably other folks will be able to come up with better ideas, but if we went off and built a satellite with about a 300 or 400 foot antenna, can't do that today, because it's just too hard. A rocket is only 12 feet wide at the top and the antenna is limited to 12 feet if you want a cheap satellite. But we can build antennas today a couple hundred feet in diameter and we can probably expand that out to 400 or 500 feet and if you had an antenna that big, you could have a thousand simultaneous spot beams. Now if you had a thousand simultaneous spot beams and with

that kind of antenna gain, you only need a quarter watt drive in each one of them instead of 25 watts. Well, you could have power up for 10 watts or to 5 watts on each one of those and so you'd pick up 15 or 18 dB of link margin for when it's raining and it's only about 10 percent of the country has got rain going on at any one time so the satellite's average power would remain pretty constant and you could go to 62 QAM or 256 QAM and so you could have 100 channels for local broadcasting and every spot beam. You could have 100 channels of educational and you could have 800 channels of video that's just what we're watching today and you could probably upgrade it all to HDTV as we went from 256 QAM to 1024 QAM.

So I think there's a lot that we could do in terms of not sponsoring, suggesting or catalyzing ideas like this to take back some of the spectrum that's maybe being not wasted, but not optimally used in terms of what the physics would like you to do with it.

Before you laugh me off the stage, I

ran this by Tony Tether, the other night and I said Tony, what do you think of this and he said we've already done far more than that. I said oh, that's interesting. How do we get you to DARPA to get involved with this? We'll make it a software developed, defined radio and that would be all behind you. So now I'm going to modify my satellite to make it also software defined and then we get DARPA involved in it as well.

(Laughter.)

A couple of thoughts.

MR. REPASI: Well, maybe I can open it up. Does anybody have any closing thoughts?

DR. PICKHOLTZ: Well, I have another alternative to the VHF/UFH buy out. Buy them out and give them a fair charge to make it compatible with cable system. I have a Yagi on my roof I haven't used in 10 years, so cable is pretty good. Not as good as it should be, but it's pretty good.

I just want to say one closing comment. This comes from my favorite editorial, way before the FCC was formed. It's a lesson from the past.

It's form the Boston Post, 1865, probably some of you know it. "Well-informed people know it is impossible to transmit the voice over wires and that were it possible to do so, the thing would be of no practical value."

(Laughter.)

MR. WOERNER: I'd like to thank our panelists and hopefully the predictions made today are a little more accurate than that one.

(Laughter.)

I think it's going to be an interesting discussion after lunch, I think on the regulatory implications to some of this.

MR. REPASI: I'd like to make a couple closing remarks too. I think that the Boston Post article was on point because it mentioned wire line. It didn't say anything about wire less.

(Laughter.)

Wire less possibility --

MR. WOERNER: There's another saying from Marconi, but I won't go there.

(Laughter.)

MR. REPASI: I too want to thank the panelists for coming from all over the country basically to participate in this very nice effort to have you guys here. I also wanted to point out that we've got about an hour, or a little bit less than an hour before the next panel will start, if everybody could be here at 1:30 to reconvene for Panel 3. Dr. Tom Stanley will be co-moderating that with Chuck Jackson, so a lot of exciting things to continue on with in the afternoon session.

Thank you.

(Applause.)

(Whereupon, at 12:30 p.m., the workshop was recessed, to reconvene at 1:35 p.m.)

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

1:35 P.M.

MR. STANLEY: Welcome to Panel III of this look at interference protection. Earlier panels picked up the subject of interference challenges and also what advanced technologies can do. Here, we're trying to focus at something a little bit differently. It's a look at the regulatory process, what we do with interference. The FCC really doesn't design radio systems. We really design regulatory systems that people design radio systems within.

So what we'd like to do here is kind of look at our own regulatory process and how we manage the interference function.

The FCC actually touches -- using interference, touches a wide array of activities. For example, not just allocations and sharing, where which services can fit with which and what services can actually share the same bands where interference protection is fairly obvious. But in our definitions of service rules, how flexible we

can be, but also licensing and coordination, the actual site by site coordination of facilities to include even international ones and even an enforcement. And let's say the lives of people we touch, it's not just existing services that are trying to grow and existing services offering new features, but also new ideas coming to the marketplace, people trying to seek establishment in the telecommunications world.

All these basically come back to interference protection to some degree and the FCC's ability to define it and enforce it.

Let me introduce our panel of that broad array of people whose lives we touch. I think we have most of those dimensions with us today. But first let me introduce my co-moderator, Chuck Jackson. Chuck is a well-known telecommunications expert in the Washington area. It's probably not widely known, but actually Chuck's Ph.D thesis, as I recall, actually touches on spectrum management going way back --

DR. JACKSON: Don't tell them how far

back.

(Laughter.)

MR. STANLEY: All right. Let me introduce the panelists and I'll do it alphabetically, I guess, starting on my right. Phil Barsky is regulatory spectrum management and systems engineering consultant for XM Radio. XM Radio, as we've heard earlier, is one of two licensees that offer digital radio service in the United States.

Steve Baruch is a member of the law firm Leventhal, Senter & Lerman. Steve is also a very familiar face here at the FCC. Steve represents a variety of satellite entities. We see Steve a lot also in particular in some of the ITU preparation work. I mean, I think of V band and I think of Steve Baruch. He just kind of goes together.

Also Mark Crosby. Mark is the president of Access Spectrum. Access Spectrum is a very important and new development, relatively speaking, in the Commission's process of looking at

different ways of getting people access to the spectrum. In addition to that, and we'll get back to the guard band manager idea a little bit later, Mark actually was president of ITA before the name changed to then CERCA. So actually he has a long and deep history of involvement with the frequency of coordination process.

Dave Hageman. Dave comes to us, he's vice president of operations, wireless operations at a company called Poka Lambro Telecom. And that's actually a wireless cooperative in the middle of the country. And I'm going to ask him to tell us a little at the right time what that stands for. Dave brings some of what I call the rural perspectives of wireless operators to the table.

Nancy Jesuale brings the metropolitan orientation to the table here. Nancy is director of communication services for the City of Portland.

Richard Smith, spectrum radio management consultant. He's a consultant who, I guess, spends a great deal of time traveling recently. Most of us know Dick. He was the chief,

our top cop for enforcement in what used to be called the Field Operations Bureau and later ran the Office of Engineering and Technology.

And John Storch is executive director for engineering and technical operations for Western Wireless, a wireless carrier bringing us some wireless carrier perspectives coming from Washington State.

A variety of things that had come up earlier in our discussion, I'm not even sure we can even get to all of them, but we're going to try to sort of touch on several of these topics.

Let's start with the first notion as to what the FCC really does. We can argue over the definition of interference and whether or not we should get a new one or not. But let's lay that question aside just for the moment and look at it maybe from a slightly different perspective. Maybe it isn't the definition of interference, but it's really the FCC's decision process when we decide on an allegation or service rules or whatever particular action we take. Interference is usually

implicitly there. Sometimes it's so implicit that you can read the text and you won't find the word interference. You might find and therefore we think sharing is possible. And it will be in one sentence, and if you read fast you can go right past it. But it's there. And there they'll be height and power or field strength or some other technical specifications. Sometimes there won't even be a discussion of certain kinds of potential for interference, adjacent channel out-of band.

So at times it's said that we are ad hoc in our decisions. Too ad hoc. We address the issues before us. The lawyers tell us don't say anything more than you have to. And as such over the years, we have sort of let's say a fabric of decisions, rather than sort of maybe a body of that says interference is a very well defined thing.

So I wonder if the panelists would shed some light on what they think when the Commission basically makes allocation decisions, sharing decisions, and you've certainly been a part of this, or in the coordination area.

Are there things that we're not clear about or perhaps we could do a better job, and if so, how? And I'll take volunteers for this but maybe I'll start with Phil.

Phil, in our decisions, are there holes of commission, omission, sins rather?

MR. BARSKY: I've been involved with the FCC since 1959 as an amateur. And surely, I haven't agreed with all the decisions and have not been involved as deeply in the process as I have been with XM.

I think there's nothing wrong with the process. Perhaps because of the complexity of systems and what's going on, some of the methodologies might have to be augmented. For example, we were just talking about in-band sharing. Well, to XM we had to do some special things between us and Sirius. So we're right adjacent to one another. In addition, we had to do some things within our band. Our satellite receive band for our repeater is 2 megahertz away from the transmit frequency of the repeater. We had to come

up with some very, very fancy transmit filters.

So we had to do some things in-band, but most of the things that affect us have to do with

out-of-band emissions from other services. And it didn't become a real issue, or it doesn't become a real issue until you look at the relative deployments and architectures between two systems, or intended architectures between the two systems. For example, one of the architectures I look at is what's going on inside the automobile. Another architect is what's going on inside of a house or a building. What are architectural differences between certain wireless neighbors and doors? To look at the question of whether you're going to interfere or not, you have to understand what your neighbor system is, or what its deployment is, vice your deployment to understand just how much energy each one is going to put at each other's receiving antenna.

And if you boil it down to my very, very simple -- I'm from Brooklyn originally, the

very simple definition of interference is how much of my energy am I putting at that receiving antenna versus the signal that, very early in my case, I was on channel 1 or the old six meters and my neighbors were trying to receive channel 2. So as long as their reception of channel 2 was stronger than my signal on channel 1, or six meters, I was okay. In a lot of cases that wasn't the case and I had to help the neighbors out in filtering in their TV sets.

I believe with the ubiquitousness of 802.11, hot spots that have been coming in vogue -- bluetooth, piconets, and personal area networkz, and ad infinitum and it's just an explosion out there, I think that adjacent services that are close enough to interfere with each other must look at the deployments of each and the architectures of each to evaluate the interference potential. And I think that's probably what's different these days.

MR. STANLEY: Steve, from a legal perspective, somehow we could be saying a lot more about other aspects of interference, but frequently

the record isn't there. It's astonishing sometimes that only after a major decision is made to share is attention put out to power. And we get recons for love the decision, but hated the power. And so again, recon a few more dB, please.

Should we be doing more proactively?

MR. BARUCH: Well, Tom, when I stopped and thought about what it is that could be done or whether how this process works, I guess the first think I asked is is the process broken? And I had a hard time coming up with the answer to that, but the answer to me is not really. I think it works and I think it works right. And here's why. You start out with allocation level decisions as you're looking at gross compatibility of one service with another in a particular frequency band of range of bands. You have to take into account things like the existing services, evolution of the existing services, adjacent services and other sorts of compatibility. But you can do that on a gross level without getting into too much in the way of how actual systems that would operate in that band