Challenging the Theology of Spectrum

Policy Reformation Ahead

A Report from the Aspen Institute Roundtable on Spectrum Policy

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Foreword

For 19 years the Aspen Institute Communications and Society Program has convened an annual Conference on Telecommunications Policy. It has become a premier occasion for telecommunications, Internet and information industry executives, experts, and governmental leaders to explore current issues of telecommunications policy in an informed, multi-disciplinary, yet informal, atmosphere. Each year the group has met at the Aspen Institute campus in Aspen, Colorado in the summertime, and issued a report of the meeting that next winter.

For the past three years, in addition, we convened a second meeting of the participants in the springtime at the Institute's Aspen Wye River campus. The spring meeting focused on issues of spectrum policy as a subset of broader telecommunications policy questions. As spectrum issues became more and more important in policy-making circles, and as we believed we were making a contribution to the debate in sorting out the models of spectrum regulation and management, we determined in 2004 to expand the activity and establish the Aspen Institute Roundtable on Spectrum Policy (AIRS) as an independent project of the Communications and Society Program.

This is the report of the first AIRS Conference, held at the River House of the Aspen Wye River Conference Centers in the spring of 2004.

While reports of the Telecommunications Policy Conferences over the past three years have laid out models and options for spectrum policy, e.g., government (command and control) allocation, private property, unlicensed commons, and hybrid models, we began this new

enterprise by digging to the very core precepts of spectrum policy, what we called the theology of spectrum policy.

Essentially, the conference examined the old dogma—the conventional wisdom on spectrum policy for decades—with the fresh lens of new technologies affecting spectrum, such as software defined radio. That innovation allows for access to unused frequency space or unused specs of time on frequencies that are otherwise licensed to an exclusive user. Much like other aspects of telecommunications, this innovation demonstrates the changes and advantages possible through the use of digital technologies over the older analog models. With that, and other newer technological challenges to spectrum management, conferees found many of the traditional precepts no longer valid.

The basic assumptions challenged at the meeting and found wanting included, for starters: conceptualizing spectrum as "frequencies" whereas others now see it as a collection of codes; that spectrum is scarce, whereas if one looked at the resource differently, and if new technologies progress, that may be a relic of the past; that all interference is harmful, whereas it might be better to think in terms of interference temperatures, and see that some levels are tolerable; and that regulation of transmission is the way to address spectrum instead of placing emphasis, as new approaches do, on the receiving technology.

Robert Entman, communications professor at North Carolina State University and the perennial rapporteur for the Aspen Institute Telecommunications Policy Conferences, has refined the dialogue at the conference into a coherent, comprehensible report that explores these

"old assumptions" and "new perspectives" in spectrum theology. And he weaves them together at the end to suggest, quoting Columbia professor Eli Noam, a future where spectrum is plentiful, flexible and competitive, with concomitant changes in regulatory approaches. There are many exciting possibilities in this regulatory realm, but all require an open mind and fresh look at the underlying regulatory scheme, a process aided, we think, by this new Roundtable.

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Charles M. Firestone
Executive Director
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Washington, DC
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Challenging the Theology of Spectrum

Policy Reformation Ahead

Robert M. Entman

Challenging the Theology of Spectrum: Policy Reformation Ahead

The Aspen Institute Roundtable on Spectrum (AIRS) that met June 7–8, 2004, yielded an important and all-too-rare outcome: near-consensus on the need to move beyond the traditional assumptions or "theology" of spectrum policy. Moreover, the group came to rough consensus on the general direction that policy should take. New technologies, especially cognitive or software-defined radio (SDR), are likely to open the spectrum to vastly more intensive use—to make any given swath of open spectrum available for far more users and to make sharing of already-occupied spectrum without interference a reality.

In recognition of these changes, AIRS participants essentially agreed that public policy can and must change in ways that accomplish goals that are universally held. In brief, these changes should involve overcoming longstanding assumptions held by various players in the political environment and policy arena to make flexible policy that rationally matches today's technical realities. No single future model is likely to replace the "command and control" licensing of frequencies for specific uses and users that has dominated the policy regime since the 1920s. Instead, different policies will apply in different circumstances.

The central insight that moved conference deliberations was that the whole idea of "frequencies" as *the* defining units of spectrum must be changed. The notion of dividing radio-magnetic spectrum into units called frequencies (denominated originally by cycles and more recently by Hertz) is a product of technology that existed 100 years ago, when crystal oscillators produced radio emissions that could be measured in terms of cycles per second or wavelength. Because it is now possible to divide up and exploit radio spectrum emissions via code division, time,

and other mechanisms, it is no longer necessary or sensible to remain bound to thinking of spectrum only in terms of frequency. Once we let go of this mindset, a range of new policy possibilities opens up. This expansion of horizons dominated discussion at the roundtable. Participants did find it convenient, however, to talk in terms of frequencies because that concept is the current basis for organizing spectrum, and it remains true that different parts of the spectrum have different physical properties that make them more or less suited to varying uses.

Yochai Benkler, Professor of Law at Yale Law School, characterized the overall sense of the conference as a new openness to experimentation, a willingness to question, and even a suspension of old beliefs rooted in the frequency paradigm:

> What we have is a relative lack of certainty, a will to engage in experimentation, a search for places where experiment is politically feasible, a sense that where there are licensees you experiment with sharing and flexibility; where there is no licensee, you can experiment with unlicensed spectrum—though where there's a government incumbent, perhaps you stay in command and control mode. You try to tweak the system to conduct better experiments. This kind of thinking seems fairly universal in the [conference] room.

Even if the old "theology" of spectrum has lost its luster for policy experts, however, policy change may not come easily. Many of the technologies are unproven in the field, and wholesale abandonment of the current policy regime therefore is not in order; instead, the idea of letting a thousand flowers of experimentation bloom—or at least a bouquet or two—seemed to capture the group's mood. Moreover, in Benkler's words, "Once you've suspended belief in the old assumptions, the practicalities of [license-holder] incumbency and political con-

straints determine the realm of possibility" for policy change. This report describes changes in basic beliefs about spectrum and suggests new policy perspectives that advance desirable social goals and meet the test—at least potentially—of political feasibility.

Goals of Spectrum Policy

There was little controversy about the goals of spectrum policy:

• Promoting consumer welfare, including economic efficiency as well as public safety and national security

• Encouraging the highest and best use of the resource represented by spectrum

• Developing and rapidly deploying beneficial new technology, including wireless, broadband, and others

• Supporting economic growth, opportunity, and competition

• Avoiding unduly concentrated ownership of media outlets and promoting free expression and vigorous exchange of ideas.

These goals generated ready consensus. Disagreements focused largely—though not entirely—on how to translate good ideas for policy experiments and policy departures into politically feasible realities. Before discussing these ideas, however, a brief note on what the technological excitement is all about.

Technology Drives New Policy Approaches

Ed Thomas, Chief Engineer at the Federal Communication Commission (FCC), described cognitive radio as the driving innovation among several that, generally speaking, are pushing the intelligence of the telecom-

munications system out of the network and toward the individual user's equipment. Cognitive radios can sense their environments and change modulation, power levels, or frequencies instantaneously as needed. Because at any given moment the vast majority of spectrum is unoccupied by signals, SDR provides the opportunity to make far more intensive use of the same spectrum, as momentary vacancies are filled a higher percentage of time by dynamically shifting frequencies. A cellphone is a (relatively simple) form of SDR or cognitive radio because it senses its location and changes its behavior in real time, depending on its exact location in relation to and coordination with different cellular transmission towers.

More advanced SDRs can hop frequencies in microseconds, finding unoccupied spectrum and adjusting power levels to ensure noninterference with users of adjacent frequencies or even concurrent users of the same frequency. The latter employs the idea of "interference temperature," whereby a noise floor is set and the cognitive radio operates as an underlay, preventing harmful interference with incumbent users of the frequency. Cognitive radio senses the interference floor level instantaneously; if it predicts that it will cause interference, it might lower its power level or, if that approach is not sufficient, switch to a new frequency where it can operate at sufficient power without violating the noise floor.   "White spaces" in the broadcast television spectrum could be used by unlicensed (or licensed) cognitive radios, which can sense whether in a given location certain parts of spectrum are vacant, occupy that point, and move elsewhere if another signal with higher priority enters that space.

Moreover, according to Thomas, the technology is advancing rapidly, at a rate reminiscent of Moore's law for computer chips (doubling processing power every 18 months at declining cost). Other innovations involve putting more communication power in chips, creating "mesh networks" that harness individual users' systems into flexible ad hoc networks, and multiple antenna systems that enhance the effective reach of wireless signals,

especially in combination with SDRs. Further details on these new technologies are widely available to readers who require more information.[1] Our focus is on the policy implications of these technological innovations.

"Theology" and Spectrum Policy

The conference initially was framed as a challenge to "the theology of spectrum." In accordance with that theme, this section considers nine broadly stated "articles of faith" that are arguably challenged by new technological, market, and policy developments. Although these beliefs are not explicitly, universally, or even widely held, they have been important to the political environment shaping public policy. That is, important players in Congress, state regulators, and members of the executive branch have held some or most of these ideas, and influential interest groups have invoked them to great political effect. Yet many of these ideas have long been rejected by most policy analysts and technical experts of the sort who come to Aspen conferences.

Thus, perhaps these ideas should be considered not theological faiths as much as unthinking assumptions or, in some cases, rhetorical tropes used to gain political leverage.[2] Many or most of them under previous technological and market conditions were quite reasonable. Even today, although these assumptions require thorough examination and possible modification in light of new developments, they are not necessarily all wrong, nor are their proponents necessarily insincere or misinformed. Nevertheless, the task of the conference and thus of this report is to critically analyze these assumptions and suggest modifications or outright replacement by new ideas.

As Charles Firestone, Executive Director of the Aspen Institute Communications and Society Program and convener of the conference, observed, the core changes in a nutshell involve recognizing that frequencies

can be shared rather than being licensed to exclusive rightsholders and that ensuring against interference involves regulating the more advanced technological *devices* now (or soon to be) available rather than regulating *frequencies.* With that observation as prologue, let us analyze the nine assumptions and new perspectives on them.

    1. ***Old assumption:*** *Spectrum is measured strictly as "frequencies" that can only have one licensed occupant.* ***New perspective:*** *The essence of spectrum is not "frequencies."*
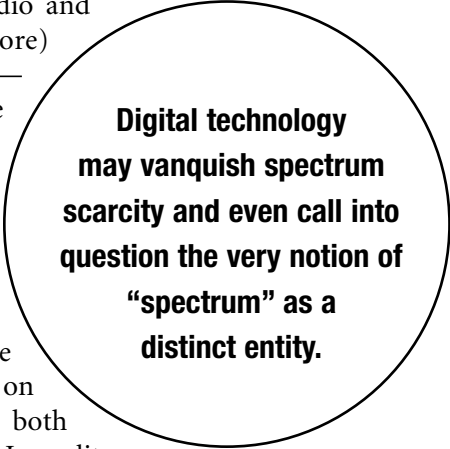
Kevin Kahn, Director of Intel's Communications Technology Lab, noted that if scientists had discovered code division multiplexing (CDMA) technology before frequency oscillators, people might conceive of spectrum in a wholly different way than as a frequency chart. If we had developed digital technology and known CDMA initially, "we might well have seen 'spectrum' as a collection of codes; we might not see 'frequencies' at all." Because we now have CDMA and other technologies for using spectrum in different ways, it is time—at a minimum—to conceive of spectrum as a resource that can be measured in a variety of ways. In particular, we should recognize that the new digital technologies render the frequency paradigm, rooted in old analog technology, as an analytical convenience more than as some sort of essential quality of spectrum. This insight, in turn, leads directly to new ways of thinking about public policy.

The essence of spectrum is not frequencies.
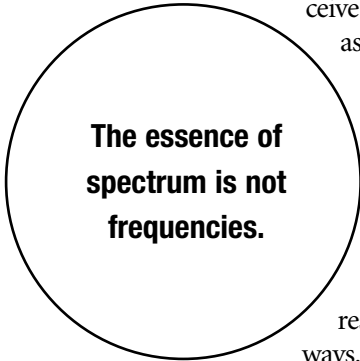
2. ***Old assumption:*** *Spectrum is a scarce thing.* ***New perspective:*** *Digital technology may vanquish spectrum scarcity and even call into question the very notion of "spectrum" as a distinct entity.*

As Ed Thomas of the FCC pointed out, in the normal physical world two things cannot exist in same space. In spectrum, with the new cognitive radio and other technologies, two (or more) things—in this case, radio signals—can functionally exist in the same place without necessarily displacing (or "interfering with") each other. Cognitive radios and other mechanisms can allow two users of radio signals—even two users in close geographic proximity to each other—to share the same frequency (say, to transmit on 3.017 GHz) in what appears to both users to be the exact same time. In reality, both users' SDRs will be interweaving signals in increments of milliseconds so that what appears to the users as two seamless conversations actually consists of their radios taking turns, with one transmitting in the brief pauses between the other's word or data stream. Of course, the users at the other ends of the first two users' transmissions will be doing the same. (In truth, if both originating users are talking at precisely the same time, one of their radios will briefly shift to another, unoccupied frequency for a few milliseconds and the receiver at the other end will follow along seamlessly.) In other words, technology may be rendering spectrum less a scarce "thing" that must be allocated than a unique enti-

Digital technology may vanquish spectrum scarcity and even call into question the very notion of "spectrum" as a distinct entity.

ty for which technology has unleashed new means of exploitation.

If we were to push the matter to the extreme, we might toss out our traditional notion of spectrum altogether and consider that new technology has revealed what is essentially a new, previously unknown, and potentially almost unlimited resource for wireless communication.

Kevin Werbach, Founder of Supernova Group LLC, suggested that the mistaken belief in an external physical entity called spectrum leads to battles over policy toward this entity—particularly over rights to occupy portions of it measured out in frequency bands. Technology has rendered these battles obsolete (although in the political arena and before policymaking bodies these battles are no less fierce).

Indeed, Yale Law School's Yochai Benkler went so far as to suggest that spectrum is the wrong object of analysis altogether. Spectrum, he argued, "is just a particular method of regulating rights"—in the traditional case, regulated in terms of rights to use "frequencies." What is now needed is a new paradigm for regulating rights to emit and receive radiomagnetic transmissions that does not focus exclusively on frequencies. John Muleta, Wireless Bureau Chief at the FCC, said that the proper policy debate should be over exactly what rights to grant to ensure the most efficient exploitation of this resource.

> 3. **Old assumption:** *All interference is harmful interference.* **New perspective:** *Frequencies can be shared without harmful interference; interference can be reduced to acceptable, nondisruptive levels.*

The notion that by definition all interference is harmful is rooted in the original spectrum-as-frequency paradigm. After all, the tradition has been to grant licenses for exclusive use of a particular frequency. If an emission strayed onto somebody else's licensed frequency, it was considered by definition harmful because it intruded without permis-

sion on what was regarded as a de facto property right—interference as a form of trespassing.

Yet just as in real estate, where easements sometimes are granted for uses by others that do not interfere with owners' rights to fully exploit their property, so it is for spectrum. In a strict sense, one might regard any presence of a nonowner as harmfully inter-fering with the owner's totally unfettered enjoyment of his or her property, but as with real estate, society has long accepted that any slight reduction in utility for the owner by some minimal encroachments is significantly outweighed by increases in overall social utility. Indeed, original owners themselves often significantly benefit from easements to neighbors' property, and vice versa; those easements make their own property more useable and valuable. Technology now makes analogous forms of easements to spectrum possible, and fulfillment of the goals listed at the beginning of this report suggests that policy move toward encouraging them. The presence of a signal on a frequency licensed to somebody else should no longer automatically be deemed harmful interference.
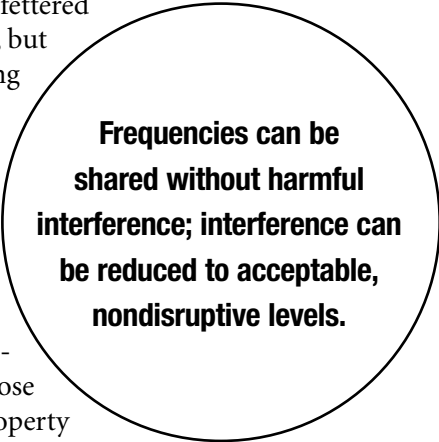
Frequencies can be shared without harmful interference; interference can be reduced to acceptable, nondisruptive levels.

Of course, it is possible that licensed incumbents sometimes can experience interference that is harmful to their ability to serve their own needs or those of their customers. This observation was a point of heated contention at the conference. Some participants contended that incumbent licensees often rationalize defense of their economic interests against com-

petition in terms of their right to protection against harmful interference that will cause viewers to receive degraded radio or television signals.

Broadcasters in particular were singled out for allegedly crying wolf over interference as a way of protecting themselves from competitors. This point appears particularly compelling to many observers in light of the fact that more than 85 percent of Americans now subscribe to cable or satellite services and therefore do not get their signals via transmissions in the licensed frequencies. When they are watching the television show broadcast on Channel 2, for example, their receivers actually are tuned to their cable or satellite boxes rather than to, say, 54–60 MHz, the spectrum licensed to television Channel 2.

Preston Padden, Executive Vice President for Government Relations of the Walt Disney Company, vigorously disputed these claims. He pointed not only to the 10–15 percent of Americans who still get television over the a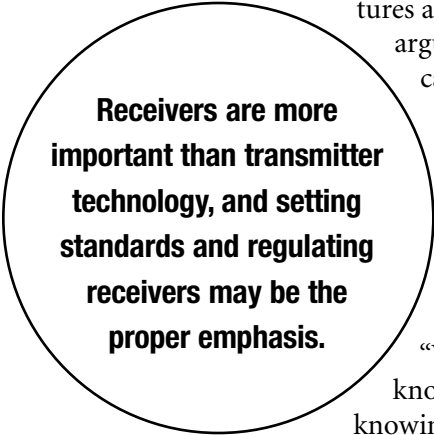ir and whose tolerance for snowy pictures and interrupted audio is slight; he further argued that the majority of households with cable or satellite television also have sets in bedrooms or elsewhere that rely on broadcast reception. This issue is considered further below with regard to proposals to alter frequency uses and assignments for current broadcast television channels. In the meantime, as John Muleta of the FCC pointed out, "You can't talk about alternatives without knowing what the other choice is. Only knowing the alternative use can we know how much interference is tolerable."

Receivers are more important than transmitter technology, and setting standards and regulating receivers may be the proper emphasis.

4. **Old assumption:** *Transmitter technology is more important—and more important to regulate—than receiver technology.* **New perspective:** *Receivers are more important, and setting standards and regulating receivers may be the proper emphasis.*

Michael Gallagher, Assistant Secretary of Commerce for Communications and Information and head of the National Telecommunications and Information Administration (NTIA), urged that receivers become a stronger focus for policymakers. He observed that technology creates not merely challenges to old assumptions but the means to help us answer future needs for more wireless communication. In terms of specific policy debates under way, he argued, sharing spectrum is preferable to changing frequency allocations, which involves clearing frequencies currently licensed to incumbents. "Clearing discussions are ugly," he said, and they raise all kinds of complexities—how to conduct auctions, how much to pay for relocation costs, and the like. Sharing is the new technological path now open to us, Gallagher argued, which means focusing more on receivers—on making the promise of SDR real.

In particular, Gallagher and many others argued—and most participants seemed to agree—that policymakers should focus at least as much on devices and on setting standards for them as on regulating the frequencies on which transmissions are emitted. This position holds in light of the fact that with SDR, frequencies will be constantly changing and in many cases will be shared. This idea for sharing particularly includes frequencies now assigned to television broadcasters. In that instance, the "interference temperature" paradigm will set noise floors and receiver standards that will allow other uses to share broadcast frequencies as underlays, without causing interference. Not all bands are fair game, however, for sharing in the face of technologies such as SDR.

Gallagher pointed out that certain government frequencies will need to remain protected, given critical government missions in areas such as aviation, defense, and space. Therefore, sharing will not apply across the board, and exclusivity will remain a necessity for some frequency assignments. On the other hand, for the private sector improved receivers and appropriate standards will allow frequency sharing. Therein lies an important rub, however, as codified in the following old assumption—rarely explicit but no less powerful.
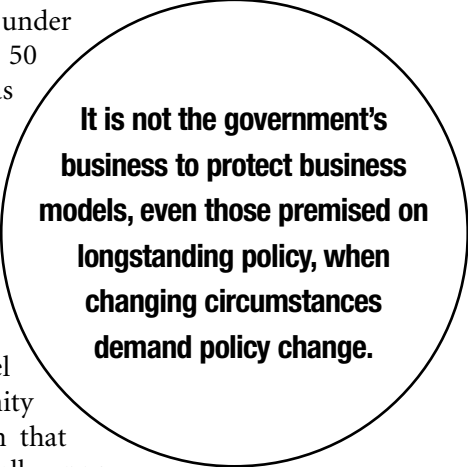
> 5. ***Old assumption:*** *Any business model premised on a government policy has a preemptive right to veto any policy change that interferes with its original business model.* ***New perspective:*** *It is not the government's business to protect business models, even those premised on longstanding policy, when changing circumstances demand policy change.*

This fifth assumption certainly was never enshrined formally in policy and rarely if ever was stated out loud. Yet conference participants generally agreed that, in part because incumbents' businesses enjoy political and legal clout, it has been an implicit assumption of great importance to understanding the aching slowness with which government often has reacted to rapidly changing market and technological conditions.

What most participants voicing an opinion appeared to believe is that government has no obligation to defend business models, even if those models are based on decades of policy that might have seemed immutable—akin to laws of nature—to many firms. Instead, government's duty is to pursue the goals listed at the outset of this report. Given continuing political realities, that approach is likely to mean granting reasonable protection to incumbents from sudden, cata-

clysmic, or uncompensated threats to their business models. However, it will not and should not mean preserving their current levels of competitive dominance for all time.

What does this new perspective mean in more specific terms? Much of the conference dialogue focused on television broadcasters—perhaps because they occupy such large swaths of the most valuable spectrum and do so under policies worked out more than 50 years ago, when technology was entirely analog and genuinely harmful interference was a serious problem. Because the tuners of analog TV sets were manufactured with little selectivity, government had to allow plenty of buffer space between channels in assigning frequencies. Channel assignments in any given community were made under the assumption that there had to be several MHz of totally unoccupied buffer between each occupied VHF and UHF channel.

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As a result, throughout the United States there is more unused "white space" than occupied channels, even though the white space could be used without creating harm to any user. For instance, Robert Pepper, Chief of Policy Development for the FCC, observed that even in Los Angeles, the city with the most broadcast television channels, only 196 MHz are occupied, leaving large amounts of valuable "white space." Furthermore, new technology allows lower-power cognitive radios to operate even on occupied broadcast channels as underlays that will not exceed a noise floor and cause harmful interference.

Assuming equipment standards are set correctly, newer digital technology can eliminate interference, and broadcasters themselves could benefit by using the unexploited spectrum adjacent to their assignments and beneath the interference temperature to offer new, lower-power services. At the same time, of course, this development would create opportunities for new entrants to offer other new services to consumers. Thus, two concrete proposals for broadcast frequencies flow from the new assumption: Move television off the air altogether, or, at least, begin underlay-sharing arrangements. Television broadcasters already are slated to give up 6 MHz of their allocations when the transition to all-digital broadcasting is completed.

Broadcasting interests generally seem reluctant to regard these scenarios as sanguinely as the rest of the policy community. In the words of the FCC's Ed Thomas, "Broadcasters want to exert rights over, say, Channel 6 in New York City even though [as a "white space" buffer] nobody has a right to it—on grounds it *might* interfere with 5 and 7. What really bothers me is, here's a group of incumbents trying to exercise rights even on spectrum they have no license for."

This situation is even more problematic because the vast majority of viewers are receiving television programs over cable and satellite services and thus do not use the assigned channels at all. In fact, according to Thomas Hazlett, Senior Fellow at the Manhattan Institute for Policy Research, some stations are turning off their analog broadcast signals altogether because they have virtually no viewers using traditional over-the-air antennas. Hazlett was even moved to issue this call: "Let broadcast television die a natural death"—in other words, allow the entire broadcast spectrum to be used for other (nontelevision) services.

Naturally some vigorous dissent arose around the notions that technology has rendered over-the-air television more or less obsolete, that current policy is tantamount to simple protectionism for the broadcast industry,

and that not merely part but all of broadcast television's spectrum should be reassigned or at least shared. Marsha MacBride, Executive Vice President for Legal and Regulatory Affairs at the National Association of Broadcasters, argued, "Broadcasting won't go away so soon. Broadcasters are local; they are connected to their communities in a way cable isn't, and communities won't let go of this so easily." Moreover, she asserted, claims about the efficacy of noise floors in preventing interference in the case of sharing frequencies are untested. These factors give impetus to political opposition that is likely to be mounted by the powerful broadcast industry.

This analysis led MacBride to urge that rather than trying to force mandates on broadcast owners, which could well arouse political opposition, policymakers should engage the industry cooperatively. According to various participants, this approach would mean providing sufficient financial incentives to ensure that broadcasters need not fear for their viability as businesses, as well as thorough testing to ensure that the underlay idea and utilization of currently vacant channels would work without causing harmful interference.

As Lara Warner, Director of Credit Suisse First Boston, pointed out, some financial incentives for the incumbent broadcast industry would help prevent damaging reactions in the investment community. Thus, there are political and economic reasons to consider incumbents' business interests, even under the new assumption 5. Indeed, paying attention to the financial aspects probably would head off political opposition. In the view of Robert Gensler, Portfolio Manager in Media and Telecommunications at T. Rowe Price, if broadcasters had well-defined spectrum rights and the flexibility to maximize their value, traditional economic theory would work to protect well-managed broadcast firms' businesses.

John Muleta argued, however, that in the real world current business models are sticky, and investing in new opportunities may seem too risky. Either tax credits for broadcasters investing in their own new

underlay services or ensuring heightened competition might be necessary, he suggested, in forcing broadcasters to take risk; flexible rights alone might not necessarily work.

Summarizing within the religious metaphor that sporadically infused the discussion, Eli Noam, Professor and Director of Columbia University's Institute for Tele-Information, said, "We've progressed beyond the religious wars; we've had an Enlightenment, and now we should have Tolerance—specifically, a 'Spectrum Policy Tolerance Regime.'" In this regime, experimentation would be vigorous. If broadcasters fear interference, for instance, small markets could be used as test sites to see what happens. "It's a big country, and we can do a lot of things," said Noam.

> 6. ***Old assumption:*** *The public's investment in consumer premises equipment (CPE) needs to be protected, and any attempt to reduce the value of CPE may create massive political backlash.* ***New perspective:*** *Public fears can be handled readily by using a small fraction of the efficiency gains from policy change for subsidies.*

Beyond the feared political roadblocks to policy change arising from broadcaster opposition is the implicit assumption that consumers inevitably will become politically fearsome forces if threatened with change. As Preston Padden of the Walt Disney Company observed, many people still watch their analog televisions and will give them up with the greatest reluctance. Even in many cable homes, people use televisions to watch over-the-air programming in their bedrooms, kitchens, and bathrooms. If policy renders these sets inoperable, in the view of Padden and others, there will be angry consumers and voters. As Padden put it, "The U.S. Congress knows there are no votes to be had in turning off people's television sets. Years ago, when just 200,000 rural satellite dish owners got upset with a policy change, they tied Congress into knots."

Yet if cable and satellite subscribers have extra televisions that would go dark and if nonsubscribers would lose their service entirely, some participants said, the new efficiency gains from totally clearing the broadcast spectrum would be large enough to easily fund free internal wiring to cover subscribers' extra televisions and to make free basic digital cable or satellite service available for nonsubscribers who desired those services. In the perhaps more likely scenario whereby television broadcasters were not cleared entirely off the spectrum but were required to go through with the planned transition to 100 percent digital transmission (assuming "white space" broadcast spectrum and underlay uses were authorized), the efficiency gains still could readily fund digital set-top boxes for over-the-air consumers.

Public fears can be handled readily by using a small fraction of the efficiency gains from policy change for subsidies.

William Webb, Head of Corporate Research and Development at Ofcom, the United Kingdom's regulatory agency for telecommunications, described one of the approaches Ofcom is considering. Spectrum is treated as a nationally owned asset. Broadcasters are charged per MHz for their use, and this charge provides a strong incentive for them to transition out of analog technology. Webb argued that the efficiency gains far exceed the price of subsidizing digital boxes for consumers—currently down to a market price of just $55 each. Assuming that typical digital economies applied, that price presumably should shrink further.

7. ***Old assumption:*** Grants to licensed incumbents are "windfalls," and windfalls are political poison and may be per se undesirable. ***New perspective:*** Fears of political backlash against windfalls to incumbents may be exaggerated, and what some observers label "windfalls" actually may be win-win situations that yield welfare gains for everyone.
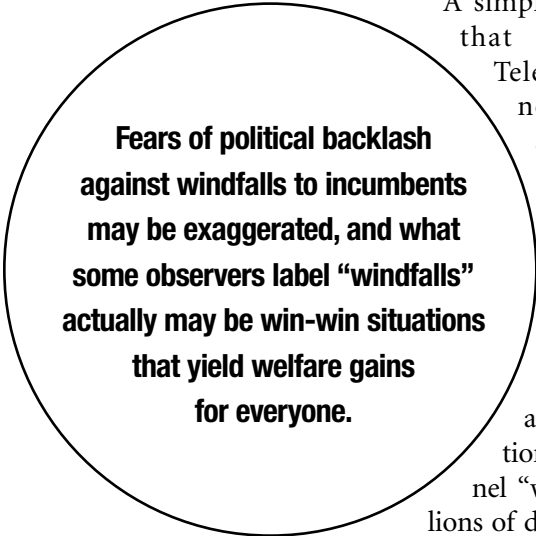
One final political barrier has been opposition to windfalls. The fear is that if policymakers grant incentives to incumbents to ease the way to what should be welfare gains for everybody, a dangerous political backlash against windfall gains will develop.

Fears of political backlash against windfalls to incumbents may be exaggerated, and what some observers label "windfalls" actually may be win-win situations that yield welfare gains for everyone.

A simple answer to this concern is that the fear is overblown. Telecommunications policy is not on most citizens' radar screens. In the mid-1990s Trent Lott and Newt Gingrich, the Republican leaders of the Senate and House, respectively, helped ensure that incumbent broadcasters would not be charged a fee for their valuable existing spectrum allocations or for the new digital channel "windfall"—worth tens of billions of dollars—they received through the 1996 Telecommunications Act.[3] Although both 1996 presidential candidates, Robert Dole and Bill Clinton, nominally opposed this provision as corporate welfare and a

burden on taxpayers, neither made it a priority. No doubt both assumed the issue was far too technical for the public and was unlikely to generate press interest. The matter never gained traction and received essentially no media attention in the 1996 campaign. There was no detectable political fallout. The same could hold true of the spectrum-related windfall issues discussed in this report, which would be even more obscure to ordinary citizens than broadcast channel allocations.

As for the more substantive arguments that windfalls are simply wrong, Thomas Hazlett of the Manhattan Institute argued that what might be considered windfalls are "positive *and* negative—and ubiquitous; it leads to policy paralysis if you worry about them." For instance, one might argue that Intel would receive a windfall if the FCC allocates more spectrum for unlicensed uses because that allocation would enable Intel to sell more of its chips for WiFi devices. Yet few would argue that stopping such a "windfall" would be a reasonable basis for preventing WiFi from expanding.

Hazlett argued that finding the right policy is the key objective. If the policy is set correctly, competition should minimize windfalls. A liberal spectrum policy would invite so much entry that license values would be a very small fraction of total social surplus.

Saying, "Get over it; we need to benefit the consumers even if there's a windfall," Robert Pepper of the FCC offered another analogy for the windfall issue: price caps. Some years ago, price caps replaced rate of return regulation of the regional Bell telephone companies. The latter form of regulation was cumbersome and introduced many inefficiencies. Price caps allowed the telephone company to charge anything for local service up to the agreed cap, regardless of what rate of return it might yield. By letting the company keep any efficiency gains (also known as "windfalls"), consumers benefited: Competition was enabled and real prices actually dropped.

> 8. ***Old assumption:*** *Government use of spectrum must be considered separately and handled differently from private uses of spectrum.* ***New perspective:*** *Government uses of spectrum should become more subject to market-like efficiency standards, and this goal can be accomplished while maintaining national security and other vital uses—perhaps even while contributing revenue streams to government agencies.*
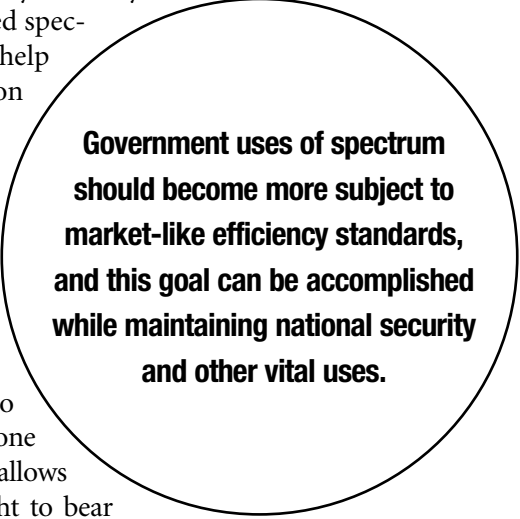
NTIA head Michael Gallagher noted that by some measures, the largest incumbent occupant of spectrum is the government, and although there is resistance to change or challenge to traditional licensed frequency rights among these incumbents just as among those in the private sector, "There is a beachhead inside government itself for the kinds of new principles we have discussed here." Gallagher said that it is possible to induce government agencies to recognize the opportunity cost for their uses of spectrum and to encourage them to engage in some market-like weighing of alternative uses and efficiency criteria.

Yale's Yochai Benkler pointed out that the core requirement of such government activities as emergency services or national defense is *communication,* not necessarily *spectrum.* Government agency officials should recognize that what must be fully protected is their ability to communicate with high reliability and quality, as opposed to their current frequency allocations. If technology makes it possible for agencies to communicate with equal or even greater reliability and quality while using far less spectrum, they should not oppose certain changes in frequency allocation.

Indeed, Columbia University's Eli Noam observed that at least one feature makes dealing with government incumbents easier than dealing with private-sector incumbents: There are no implications or fears among government incumbents about the impact on the investment

community of altering government licenses. Not only does technology enable government licensees to reduce their uses of spectrum and share their frequencies without threatening the objectives of reliable, high-quality communication, but payments by private users to use newly freed spectrum or shared spectrum can help fund agencies' communication and other activities.

Although this scenario seems to be a straightforward possibility for change, as with private spectrum licensees, political clouds mar the horizon. Intel's Kevin Kahn noted that the process is relatively transparent with regard to broadcast and cellular telephone services, among others, which allows effective pressure to be brought to bear for efficient changes in spectrum policy. In government the process is less transparent, and it is more difficult to tell how much urgency for change is felt among agencies or how well different ideas for change are being received. Other participants confirmed that efficient management of spectrum is not high on most agencies' priority lists and that many fear changes in spectrum policy because their budgets already are strained and they have no excess to fund, say, a migration to new equipment or frequency allocation. Furthermore, in the realm of national defense, resisting signal jamming and ensuring the security of sensitive or covert transmissions are highly spectrum-intensive activities.

> **Government uses of spectrum should become more subject to market-like efficiency standards, and this goal can be accomplished while maintaining national security and other vital uses.**

Several participants argued that paying government agencies for the opportunity to use or share their excess spectrum should be a feasible way to reduce their political opposition to change. It would be important, as the FCC's Ed Thomas pointed out, to change the law to ensure that any such payments go directly to the agency rather than to the general Treasury revenue pot, *and* that agency budgets not be cut when they receive such payments. Otherwise, of course, their incentives to economize on spectrum use would disappear. Blair Levin, Managing Director at Legg Mason, added that one alternative would be to provide a mechanism that readily permits entrepreneurs to seek newly directed spectrum from and pay fees to federal agencies. This strategy could prove better than the current practice, whereby obtaining spectrum often is a largely political process that involves lengthy, expensive—and often unsuccessful—fights with various incumbent organizations, such as educational and religious entities that hold Instructional Television Fixed Service (ITFS) licenses.
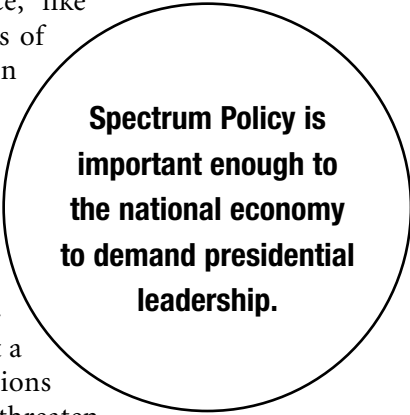
There are additional drawbacks, however, to monetizing government spectrum rights. For example, legislators dislike losing any control over funding, and members of Congress might well resist giving up their discretion over agency budgets and priorities, which could be entailed by these new mechanisms for raising funds. Furthermore, observed Brian Fontes, Vice President for Federal Relations at Cingular Wireless, shared use of spectrum between government and private entities does introduce new complexities with regard to relocating the private carrier incumbents. If critical government uses are shared with others, relocation becomes even more complicated and fraught with potential for even more opposition. In addition, Michael Gallagher noted, if a popular consumer application were to "take off" in a particular frequency segment, it could threaten to "eat the whole band"—and that possibility might threaten the government's use. Anticipating these problems

could be another source of government resistance to spectrum sharing. Nonetheless, conference participants appeared generally to believe that such conflicts would not be insurmountable.

> 9. ***Old assumption:*** *Individual senators or House members with key committee positions have the right to veto rational telecommunications policy changes.* [4] ***New perspective:*** *Powerful individual senators and House members should not be allowed to block change for idiosyncratic reasons merely because spectrum is a technical area that is off the media's and public's radar screens. The area is important enough to the national economy to demand presidential leadership.*

Participants at this conference, like those at many before it, heard tales of rational policy change—or even rational policy discussion—being stymied by stubborn and sometimes idiosyncratic opposition arising from individual members of Congress who happened to occupy committee or leadership positions. For instance, one important senator became convinced that a relatively simple telecommunications policy change would somehow threaten rural electricity supply in his state and effectively vetoed the change. Relegating this kind of power over telecommunications policy to individual congressional fiefdoms might once have been tolerable. Given the importance of the policy area both to the nation's economy and to its defense (and these two areas are intimately related), however, it

Spectrum Policy is important enough to the national economy to demand presidential leadership.

seems to be time for top decision makers to take more responsibility—even if it means expending political capital in an area that generates few electoral payoffs.

Charles Firestone of the Aspen Institute Communications and Society Program said it best: In spectrum policy, technology has afforded us a great opportunity to try a variety of "religions," or approaches—from traditional command and control, to unlicensed spectrum commons, to underlaying or overlaying spectrum shared with government and private users, to secondary markets in spectrum, and more.[5] Ultimately, Firestone said, bringing about needed policy changes of the sorts suggested by the new perspectives listed here "will take leadership—somebody with a vision to push them forward."

What steps might leaders take to make the political process more hospitable to the kinds of changes in perspective discussed here? Michael Gallagher of the NTIA, Robert Pepper of the FCC, and others discussed political impediments to moving policy in the direction of the new perspectives and away from the old assumptions. In the parlance of political scientists who study the policy process, they identified the need to pry open windows of opportunity for policy change and to keep them open as wide and as long as possible.[6]

In this case, there is substantial pressure from stakeholders who want to use new technologies and services, and that is an important start. However, incumbents who want to preserve the status quo have a large head start. They have the advantage of those old assumptions, and they have allies throughout the institutions and processes of government. A certain form of political Darwinism operates. Newer technologies threaten businesses built on older ones, and the latter naturally resist. Too often the former fail to organize sophisticated campaigns that maintain the pressure, educate decision makers, and keep the political situation fluid and open. This strategy is none too easy because most officials outside the expert agencies are

not technically sophisticated and thus are prone to believing pronouncements that are based on the old, quasi-theological assumptions.

One rhetorical tool Gallagher suggested would be emphasizing how modernizing spectrum policy would help in achieving the broad missions of government, such as maximizing economic growth, job creation, American technological leadership, consumer welfare, and national defense (very much including homeland security and the war on terrorism). These missions might well form the frame for speeches by top officials that could help push the process toward needed reform.

Improving the Policymaking Process

Beyond substantive changes in policy, conference participants also explored procedural changes to move policy in good directions. Participants heard the usual talk about enhancing cooperation between the FCC, the NTIA, and other government agencies and speeding up decision making. More important, in response to Charles Firestone's question about what the conference might do to move along what might be *the* central impediment to policy change, "the interference issue"—that is, the argument that new technologies may not yield reliable sharing of frequencies but harmful and costly interference— participants identified two process needs in particular.

The first need is for an independent entity to test technology, gather data, and conduct definitive (or at least highly credible) experiments on which government decision makers could rely. The second need— assuming SDR or other forms of spectrum sharing are about to mushroom—is to establish high-priority development of a mechanism or mechanisms for resolving interference complaints in real time, or at least in better time than the normal, excruciatingly slow route of agency proceedings and court cases.

Several government officials in attendance said they were tired of listening to policy arguments rooted in alarmist "arm-waving" and invocations of conventional wisdom. As the NTIA's Michael Gallagher said, what decision makers need is "technical excellence and rigor that exposes the real issues, the underlying assumptions." John Muleta proposed creation of an independent interference testing laboratory. This organization would operate independently from participants in the policy arguments. Muleta said it would allow for a "de-interleaving" of the technical and political disputes.

Kevin Kahn of Intel argued that these matters always contain a healthy dose of subjectivity. For instance, somebody has to decide if one pixel or ten pixels of snow in a television picture constitute harmful interference, and somebody has to ensure that lab tests realistically reflect likely real-world conditions. Nonetheless, Dale Hatfield, Adjunct Professor of Telecommunications at the University of Colorado, argued, "You can get to decision more quickly with more independent data." Eli Noam of Columbia University suggested that having more factual data would offer decision makers a more reliable "schedule of tradeoffs—one that exposes the underlying value judgments being made." In other words, mo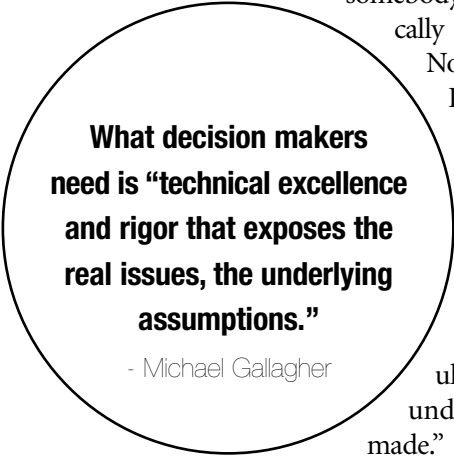re credible data would help ensure that the stakes in the political arguments and decisions would be better and more widely understood. In a federal budget well in excess of $2 trillion, funding such an independent testing facility should be feasible.

> What decision makers need is "technical excellence and rigor that exposes the real issues, the underlying assumptions."
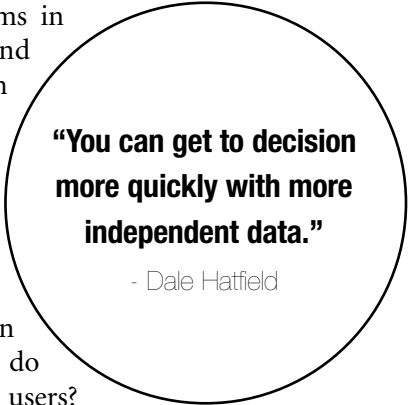>
> - Michael Gallagher

The second suggestion was somewhat more difficult to envision, and the participants did not delve into the matter in any detail. Briefly, as Kevin Werbach of Supernova Group LLC put it, current dispute resolution mechanisms in the spectrum area create bottlenecks and lead to damaging mistakes. Werbach mentioned the range of policy tools—from enforcing property rights, to setting and monitoring standards, to employing liability rules.

"You can get to decision more quickly with more independent data."

- Dale Hatfield

Brian Fontes of Cingular Wireless asked more specifically and pointedly, however, "What if there are problems in the real world, and cognitive radios do create interference with incumbent users? How will the FCC respond then? The more you pack the band, the more likely there will be interference—so how will FCC address this *in real time?*"

Ed Thomas of the FCC responded that the Commission always faces this issue of whether technologies will work properly: "You set up rules the best you can, you certify equipment, and deal with it when it doesn't work." After all, Thomas maintained, cellular telephones are essentially cognitive radios, and this area is regarded as a major technological success.

This response was not entirely satisfactory to Fontes and others in the room, many of whom may have experienced a healthy share of dropped calls and cross-talk on critical cellular phone calls. The answer may lie at least in part in the solution Muleta proposed: rigorous independent technical testing, combined with use of the resulting data for strictly applied certification of equipment. There also may be innovative real-time market solutions.[7]

Conclusion

Let us give the last words to Columbia professor Noam. He opined that in the past, the argument was over slicing up an existing pie. Although the spectrum system currently experiences pressure because of higher demand, new technology allows the pie to grow. For Noam the operative slogan is: "Open up the candy store!"

Specifically, that slogan means developing technology that allows use of new spectrum ranges, underlay, overlay, and the rest, while on the regulatory side establishing clear rules to dole out the candy. These rules must recognize legacy users, which in Noam's view means giving incumbents extra flexibility with their licenses—which is just another way of allowing the pie to expand. At the same time, however, new entrants must be allowed to enter.

Down the road, Noam predicts, this new approach may produce a problem that may be difficult to imagine right now: so much competitive entry in a business still characterized by high fixed costs and low marginal costs that ruinous competition and price-cutting ensues. "One way of keeping competition from being ruinous in the past has been spectrum scarcity. Once we eliminate that, we unleash a market structure that won't be stable. Then, eventually, there will have to be market consolidation, and ultimately we will need active antitrust or other regulation." Given current spectrum policies that arguably dampen competition and innovation, observers might well prefer ruinous price-cutting, consolidation, and antitrust problems over today's status quo.

Endnotes

1. See, e.g., Kevin Werbach, *Radio Revolution: The Coming Age of Unlicensed Wireless* (Washington, D.C.: New America Foundation, 2003). http://www.newamerica.net/index.cfm?pg=article&DocID=1427.

2. Conference participants actually came up with more than 25 "articles of faith." The ones explored here seem to be most significant to telecommunication politics and policymaking.

3. See Mark Landler, "Capitol Hill Fiat on HDTV Isn't the Last Word," *New York Times* (July 1, 1996): D-1.

4. This item was added by the author on the basis of numerous remarks by conference participants in other contexts, although it was never explicitly stated as an article of faith.

5. For more details on the variety of approaches, see the report of last year's Aspen spectrum conference: Robert M. Entman, *Spectrum and Network Policy for Next Generation Telecommunications* (Washington, D.C.: Aspen Institute, 2004). http://www.aspeninstitute.org/bookdetails.asp?i=56&d=221.

6. The classic reference on this issue is John W. Kingdon, *Agendas, Alternatives, and Public Policies,* 2nd ed. (New York: Longman, 2002).

7. See Ellen P. Goodman, "Spectrum Rights in the Telecosm to Come," *San Diego Law Review* 41 (April 2004): 270–404, for a detailed conceptual analysis of dispute resolution in this area.

APPENDIX

List of Conference Participants

Challenging the Theology of Spectrum:
Policy Choices Ahead

River House • Queenstown, Maryland • June 7–8, 2004

Bill Bailey
Majority Senior Counsel
Committee on
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  and Transportation
United States Senate

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Michael Calabrese
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Cisco Systems

Colin Crowell
Telecommunications Policy Analyst
Office of Representative
  Edward J. Markey
United States House of
  Representatives

Robert M. Entman
Professor
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Note: Titles and affiliations are as of the date of the conference.

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National Telecommunications and
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Portfolio Manager
Media and Telecommunications,
  Global Technology Fund
T. Rowe Price

Dale N. Hatfield
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  and Adjunct Professor
Interdisciplinary
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  Research

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Intel Senior Fellow
  and
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Communications Technology Lab
Intel Corporation

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Jennifer McCarthy
Vice President
Regulatory and Market
  Development
QUALCOMM, Inc.

Note: Titles and affiliations are as of the date of the conference.

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Professor of Economics and
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Columbia University

Preston Padden
Executive Vice President
Government Relations
The Walt Disney Company

Robert Pepper
Chief
Policy Development
Federal Communications
  Commission

Edmond J. Thomas
Chief Engineer
Federal Communications
  Commission

Bryan Tramont
Chief of Staff
Federal Communications
  Commission

Lara Warner
Director
Credit Suisse First Boston
  Corporation

William Webb
Head
Corporate Research &
  Development
Ofcom

Kevin Werbach
Founder
Supernova Group LLC

Staff:

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  Society Program
The Aspen Institute

Note: Titles and affiliations are as of the date of the conference.

About the Author

Robert M. Entman, Professor of Communication and Political Science at North Carolina State University, received a Ph.D. in political science from Yale University and an M.P.P. in policy analysis from the University of California at Berkeley. His research and teaching interests focus on political communication and communication policy. Among Professor Entman's books are *Democracy Without Citizens: Media and the Decay of American Politics* (Oxford University Press, 1989); *Mediated Politics: Communication in the Future of Democracy* (Cambridge University Press, 2001; edited with W.L. Bennett); and *The Black Image in the White Mind: Media and Race in America* (University of Chicago Press, 2000; with A. Rojecki). *Black Image* won the Mott/KTA prize for best book from the Association for Education in Journalism and Mass Communication; the Lane Award for best book in political psychology from the American Political Science Association; and the Goldsmith Book Prize from Harvard University. His most recent book, *Projections of Power: Framing News, Public Opinion, and U.S. Foreign Policy,* was published by the University of Chicago Press in 2004. He is working on a new book, *Media Bias and Scandals.*

A former National Science Foundation Graduate Fellow and National Institute for Mental Health Postdoctoral Fellow, Dr. Entman was the Lombard Visiting Professor at Harvard during the fall 1997 semester, and he taught previously at Duke and Northwestern. With Lance Bennett, he edits the book series *Communication, Society and Politics* for Cambridge University Press.

Selected Publications

Spectrum and Network Policy for Next Generation Telecommunications
    The report of the 18th Annual Aspen Institute Conference on Telecommunications Policy offers policy alternatives in both spectrum and network policy to achieve new gains for the telecommunications field. The first essay suggests new management approaches to encourage more efficient uses of the spectrum while preserving the commitment to reliability of service and public safety values. The second essay debates the competitive structure of the telecommunications industry and its implications for building Next Generation Networks (NGN) and identifies three areas to encourage optimal development of the NGN: (1) operate the NGN on a price deregulated basis and begin addressing access regulation issues, (2) secure intellectual property rights of content suppliers, and (3) adjust the system of subsidized pricing to bring about competitively neutral pricing.
2004, 53 pages, ISBN Paper: 0-89843-394-0, $12.00 per copy.

Balancing Policy Options in a Turbulent Telecommunications Market
    How does the country strike a balance between telecommunications deregulation and regulation in order to encourage appropriate levels of investment and competition? Should the U.S. adopt a more flexible, varied approach to spectrum policy that includes a mix of market solutions and government regulation? Are there new models of spectrum allocation and management that the government should consider? This report assesses the future of communications regulatory paradigms in light of desirable changes in spectrum policy, telecommunications market environments, and regulatory goals. It suggests four models of regulation,

including government allocation, private spectrum rights, unlicensed commons, and a hybrid system of dynamic spectrum access. It also addresses how changes in spectrum and other telecommunications policies, and new business realities, might affect current regulatory regimes for the telecommunications industries. The publication includes an excellent background paper on spectrum policy by Dale Hatfield.
2003, 69 pages, ISBN Paper: 0-89843-370-3, $12.00 per copy.

Telecommunications Competition in a Consolidating Marketplace
    In the telecommunications world, what would a fully competitive environment look like? What communications initiatives should policymakers develop—considering the ultimate welfare of the consumer—to implement change in the regulatory climate? This report explores ways to reshape the current regulatory environment into a new competitive space. It addresses competition not only within but across separate platforms of communications such as cable, wireline telephony, wireless, satellite, and broadcast. This publication also includes an essay on an innovative approach to wireless regulation, "Opening the Walled Airwave," by Eli M. Noam.
2002, 64 pages, ISBN Paper: 0-89843-330-4, $12.00 per copy.

The Aspen Institute
Communications and Society Program

www.aspeninstitute.org/c&s

The Communications and Society Program is a global forum for leveraging the power of leaders and experts from business, government, and the nonprofit sector in the communications and information fields for the benefit of society. Its roundtable forums and other projects aim to improve democratic societies and diverse organizations through innovative, multidisciplinary, values-based policymaking. They promote constructive inquiry and dialogue and the development and dissemination of new models and options for informed and wise policy decisions.

In particular, the Program provides an active venue for global leaders and experts from a variety of disciplines and backgrounds to exchange and gain new knowledge and insights on the societal impact of advances in digital technology and network communications. The Program also creates a multidisciplinary space in the communications policymaking world where veteran and emerging decision makers can explore new concepts, find personal growth and insight, and develop new networks for the betterment of the policymaking process and society.

The Program's projects fall into one or more of three categories: communications and media policy, communications technology and the democratic process, and information technology and social change. Ongoing activities of the Communications and Society Program include annual roundtables on journalism and society, international journalism, telecommunications policy, Internet policy, information technology, and diversity and the media. The Program also convenes the Aspen Institute Forum on Communications and Society, in which chief executive-level leaders in the business, government, and the nonprofit sector examine issues relating to the changing media and technology environment.

Conference reports and other materials are distributed to key policymakers and opinion leaders within the United States and around the world. They also are available to the public at large through the World Wide Web.