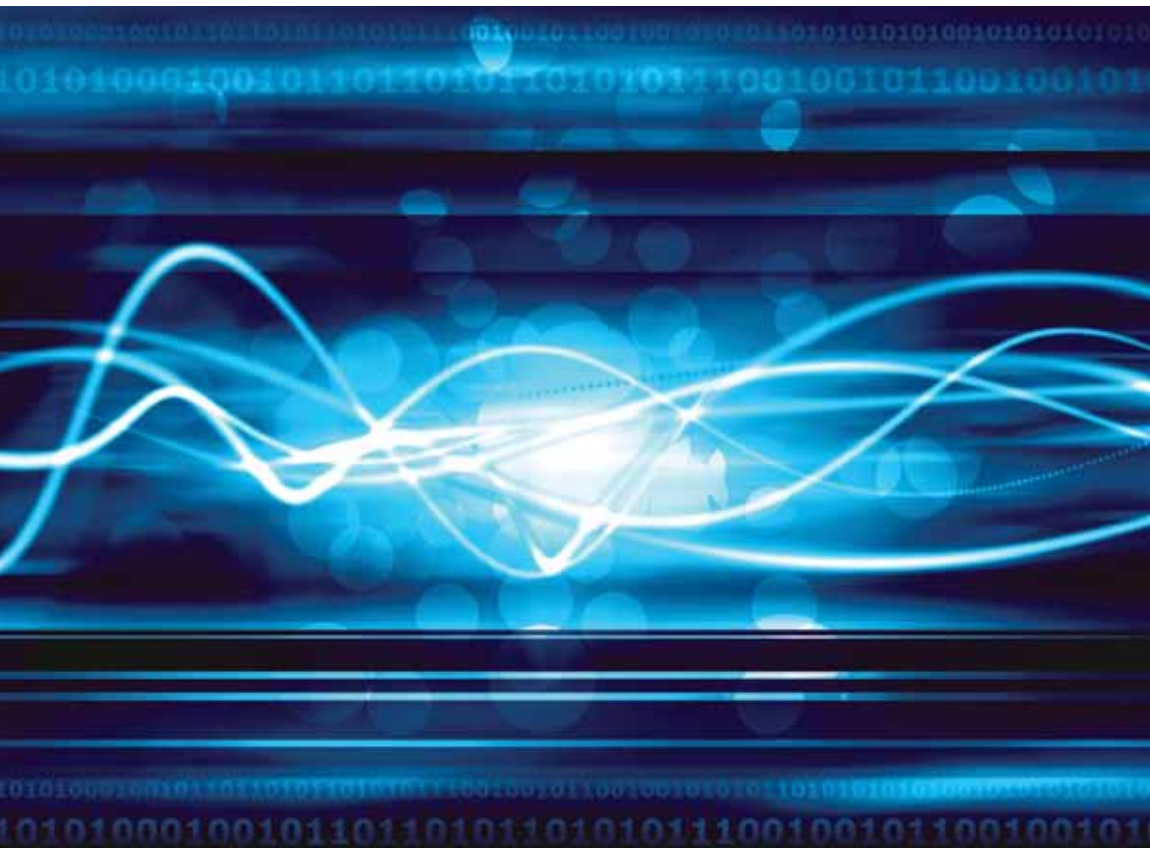


Spectrum for the Next Generation of Wireless

By Mark MacCarthy



Spectrum for the Next Generation of Wireless

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Rapporteur



THE ASPEN INSTITUTE

Communications and Society Program

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This report is written from the perspective of an informed observer at the Aspen Institute Roundtable on Spectrum Policy. Unless attributed to a particular person, none of the comments or ideas contained in this report should be taken as embodying the views or carrying the endorsement of any specific participant at the Roundtable.

Foreword

It is clear that demand for spectrum will only increase in the coming years. Wireless devices are flooding the market, with greater demands for text, audio and video use of the spectrum. Indeed, estimates range up to 500 MHz of spectrum that the wireless industry could use to make the dream of wireless broadband a reality in the United States. The 2010 Aspen Institute Roundtable on Spectrum Policy (AIRS), “The Search for 500 MHz: Spectrum for the Next Generation of Wireless” met in the fall of 2010 to address where and how that spectrum can be repurposed for wireless uses.

After exploring the apparent hockey-stick demand for more spectrum in the years ahead, participants addressed how users would find new sources of (or more efficient ways of using) this valuable resource. But rather than just look at the usual places one-by-one, the group took a broader, more strategic approach. It encouraged longer range plans to create mechanisms and processes for allocating both commercial and government spectrum. This would involve allocating budget to longer range planning and leadership from the Administration, perhaps at the Office of Science and Technology Policy in the White House, as well as the Federal Communications Commission and the National Telecommunications and Information Administration. Participants also liked the idea of an innovation fund within the government to encourage inter-governmental sharing and increased efficiency.

With respect to commercial spectrum, the group (though not unanimously) favored the concept of two-sided incentive auctions to encourage existing licensees who may not need all of their spectrum to sell the unneeded portions in auctions that would return some proceeds to the current licensee and some to the government. Broadcasters remain skeptical of the plan at this writing, but the proposal is for voluntary, not forced, entry into the auction. Participants also tended to favor more flexible use of spectrum already held for one purpose to be used for more efficient or higher yielding purposes. Like most areas of spectrum management, however, there are limitations and caveats such as the need for national and international coordination of the spectrum for certain uses, and the constraints of equipment.

The FCC and NTIA have considerable powers in this area, but most of these concepts, and many other proposals and solutions discussed—such as creating “overlay” licenses where parties could secure rights, essentially, to bargain with others to clear or use their spectrum—will need Congressional authorization. While that is always difficult due to the complexity of the subject matter and the relatively low place spectrum resides on the legislative priority list, the coming months and years may be different. Spectrum auctions bring money to the Treasury, and as legislators look to reduce deficits, the auctioning of spectrum may be a tempting target.

The Roundtable, then, offered a number of solutions to the spectrum crunch ahead, and even considerable hope that government officials will act to meet this challenge for the next generation of wireless.

Acknowledgments

I want to take this opportunity to thank our sponsors for making this Roundtable possible: AT&T Services Inc., Cisco Systems, Comcast Corporation, Credit Suisse, Ford Foundation, Google, Intel Corporation, John S. and James L. Knight Foundation, Liberty Global Inc., Lockheed Martin, Microsoft Corporation USA, National Association of Broadcasters, Qualcomm Incorporated, Regulatory Source Associates LLC, Stifel Nicolaus, T-Mobile, Verizon Communications, and the Wireless Innovation Forum. A special thank you goes to Mark MacCarthy, our rapporteur, for his informative account of the conference discussions.

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May 2011

**SPECTRUM FOR THE
NEXT GENERATION OF WIRELESS**

Mark MacCarthy



Spectrum for the Next Generation of Wireless

Mark MacCarthy

Introduction

In November 2010, the Aspen Institute Communications and Society Program held the latest in its continuing series of roundtable discussions on spectrum policy, “The Search for 500 MHz: Spectrum for the Next Generation of Wireless.” The Roundtable brought together technical experts, industry representatives, congressional staff, officials from the Executive Office of the President and the National Telecommunications and Information Administration, industry analysts, officials from foundations and public interest groups, and academics.

The conference found its inspiration in the proposal of the Federal Communications Commission (in its 2010 National Broadband Plan) and the executive branch to find 500 MHz of spectrum to satisfy the increasing demand for wireless broadband services. Participants largely focused on longer term strategic plans to more efficiently allocate spectrum for both commercial and governmental use. There was general consensus that the current political situation presents an unusual strategic opportunity to move institutions that allocate and use spectrum toward more flexible and nimble mechanisms.

The group generally concluded that granting the Federal Communications Commission the authority to hold incentive auctions satisfying certain conditions would represent a major step forward. It would allow marketplace participants to determine the uses of spectrum in ways that regulators, technicians and economists would simply be unable to foresee and plan for. In its National Broadband Plan, released in March 2010, the Federal Communications Commission recommended it be given express authority to hold auctions in which the incumbent licensees relinquish rights to other parties in return for a share of the auction proceeds. The U.S. Treasury would be the beneficiary of the remaining portion of the proceeds. The current political situation puts a premium on measures to reduce the national budget

deficit, creating an opportunity for Congress to move ahead with incentive auction authority in a way that allows all parties to benefit.

The group also looked favorably on further use of the FCC's authority to allow more flexible use of spectrum for a larger range of purposes than those for which the spectrum was originally allocated. This flexible-use policy could create the opportunity for incumbents to use the spectrum for innovative purposes or to sell it to others interested in these new uses. The group was concerned that the unlimited use of this authority, however, might create difficulties in managing interference and coordinating spectrum use internationally.

The group considered combining this flexible-use policy with the FCC's overlay auction authority. In an overlay auction, the FCC auctions spectrum in and adjacent to the assigned spectrum and allows the auction winner to negotiate with the incumbent to clear the spectrum. This provides incumbents with an incentive to allow or engage in repurposing of the assigned spectrum, and allows other marketplace participants to assess whether there are newer, more valuable uses of the spectrum. Although the revenue from the overlay auctions goes to the Treasury, bidders are presumably willing to pay less for the encumbered spectrum than they would for the cleared spectrum in an incentive auction.

There was substantial discussion of the need for auctions to meet equity and efficiency goals by including the full participation of small businesses and other designated entities and also by ensuring that auction results preserved workable competition. Some parties were concerned, however, that such arrangements would be unnecessary or counterproductive or might reduce auction revenue.

On the governmental side, the group endorsed the idea of long-range strategic planning for major systems that would involve both those who acquire the systems and those involved in spectrum management. Current reviews are short-term, take existing rules as a given and focus on compliance, and are limited to single agencies or departments. The strategic review called for here would require additional budget for long-term planning. The group discussed who should conduct strategic inventories and measurements of existing uses, considering both outside independent audits and reviews conducted by the National Telecommunications and Information Administration (NTIA). The

group agreed that strategic direction would have to come from the White House through an agency such as the Office of Science and Technology Policy (OSTP), with NTIA as the longer-term enabler of a collaborative process.

The group also embraced improvements in the Commercial Spectrum Enhancement Act (CSEA). This act currently allows revenue from previous auctions of government spectrum to be used for a variety of purposes, including conversion and relocation expenses for incumbent federal spectrum users. The recommended improvements would provide funds for planning and demonstration, liberalize the standard under which funds could be used for new equipment, provide a research and development budget for interference tolerance or mitigation, and include incentives for government to obtain services from commercial suppliers where appropriate.

Finally, the group advocated the development of an innovation fund to catalyze thinking on improvements in spectrum efficiency. This fund would provide for pilot programs for spectrum sharing with other government agencies or with commercial parties and identify obstacles to adoption.

Participants considered the role of Congress in approving new legislation that would embody these suggested reforms. While the window for successful action might be narrow, the group was confident that a comprehensive bill that would embody incentive auctions and funding for long-term strategic spectrum planning in government, improvements in CSEA and an innovation fund was a realistic possibility. Funding for improved management of the federal spectrum use should be derived from set-asides from spectrum auctions, device certification fees, and any spectrum use fees. The group also discussed the possible role of the FCC in moving separately and directly to increased flexible-use and overlay auctions.

Context for Evaluating and Allocating Spectrum

Every society that uses the electromagnetic spectrum for the transmission of information has to have a process for allocating it for particular uses and assigning it to people to use it. Once the technological capacity to use the spectrum for communications purposes was developed, the spectrum transformed from a natural phenomenon to

a common economic resource. Like individuals in John Locke's state of nature, societies face the problem of how to pull elements of this resource out of the commons. How could it be appropriated for productive use?

Almost all societies solved this problem in the same way. Various processes of government divided up the spectrum into usable portions, determined the appropriate use of each portion and designated particular parties as those entitled to the exclusive use of it for those purposes. In some cases, those entitled to use the spectrum were private parties; in other cases, government agencies. In the case of private spectrum users, transfers were permitted, but only to others who would use it for the same purposes.

All users were given the legal right to protection against physical interference with their assigned use of the spectrum. Early attempts to leave government out of the spectrum management process in the United States resulted in such chaos from interference that the nascent broadcasting industry eagerly sought protection from this interference through pervasive government regulation. In fact, the technical characteristic that the spectrum was a rivalrous but non-excludable good persuaded almost everyone that government had to manage this resource closely if it were ever to become a usable economic resource. Failure to allocate uses and restrict access would only result in a tragedy of the electromagnetic commons.

This was the situation observed by Ronald Coase, who, in his famous 1959 article, made the case for treating the electromagnetic spectrum less like a commons to be managed centrally and more like a typical economic resource.¹ Government, according to this perspective, should assign property rights in spectrum to commercial entities who would be able to use them for a wide variety of economic purposes. It should focus on resolving disputes that might arise between spectrum users.

The discussion at the conference was heavily influenced by this perspective and its emphasis on the practical reality that government spectrum management must provide a process for taking into account unpredictable developments in technology, business strategies and the relative strength of demand for competing services. The dialogue also drew upon an awareness of developments in technology, including the prospect of "smart" radios that may bring more nimble approaches to spectrum

management than the nearly 100-year-old allocation approaches.

Beyond this deep background, a number of other developments provide a context for the deliberations of the conference participants.

2002 Report of Spectrum Policy Task Force

In 2002, the Federal Communications Commission Spectrum Policy Task Force Report recommended that flexible use of the electromagnetic spectrum should be the regulatory norm, subject to several constraints including provision for public safety, protection from interference and compliance with treaty obligations.² The discussion at the conference built upon the framework developed in this visionary report and attempted to apply this perspective to the current spectrum management challenges.

2010 National Broadband Plan

The Federal Communications Commission released its congressionally mandated National Broadband Plan in March 2010. Chapter 5 of the report focused on spectrum issues and made several specific recommendations³ including that the FCC make available 500 MHz of spectrum suitable for wireless broadband use within 10 years and 300 MHz for mobile use within 5 years.

The conference made specific recommendations for achieving the 300 MHz goal:

- 20 MHz from the Wireless Communications Service band
- 10 MHz from the Upper 700 MHz D block
- 60 MHz from the Advanced Wireless Services band
- 90 MHz from terrestrial deployment of Mobile Satellite Spectrum
- 120 MHz from the broadcast television bands

To achieve this goal, participants also called on Congress to expand “the FCC’s authority to enable it to conduct incentive auctions.” In an incentive auction, the spectrum assigned to a licensee is auctioned and the incumbent licensee receives a portion of the proceeds of the auction. The report also proposed as a fall back mechanism, if Congress did not provide incentive auction authority or if incentive auctions did

not succeed, the use of overlay auctions. In such cases, the FCC would use its existing authority to auction spectrum in and around assigned spectrum and allow the incumbent licensee to negotiate with the auction winners to determine the use of the spectrum.

These goals and the use of incentive auctions or overlay auctions to achieve them were a major focus of the conference discussions.

2010 Presidential Directive

In June 2010, the White House released a presidential memorandum⁴ directing executive departments, agencies and offices to work with the Department of Commerce and the FCC to make available a total of 500 MHz of spectrum over the next 10 years suitable for wireless broadband use. The Commerce Department was required to complete a plan and timetable by October 1, 2010 for making available this spectrum.

In a speech the same day, Lawrence Summers, head of the National Economic Council, emphasized that this drive for additional spectrum was made urgent by the threat of a “spectrum crunch” that might fail to keep up with the demand for mobile data usage, which he estimated at between 20 and 45 times 2009 levels.⁵ He described the President’s spectrum plan as consisting of four parts:

- Identify and plan for the release of 500 MHz of spectrum—from both private and government hands
- Provide new tools and incentives to free up spectrum—including incentive auctions
- Redeploy spectrum to high-value uses—which he identified as for wireless broadband
- Use auction proceeds to promote public safety and job-creating infrastructure

2010 FCC Spectrum Summit

On October 21, 2010, the FCC held a spectrum summit focusing on mobile broadband and addressing ways to ensure that there was enough spectrum to accommodate the increased demand for mobile data usage. In a speech at the summit, FCC Chairman Julius Genachowski,

noted the existence of a “looming spectrum crunch” being driven by a likely “35X increase in mobile broadband traffic over the next 5 years” and the resultant need for an additional 300 MHz of spectrum by 2014 to meet this demand. He announced that the FCC had already recovered 25 MHz from the Wireless Communications Service band and had proposed rules to recover 90 MHz from Mobile Satellite Services band. He urged “swift action” by Congress to authorize incentive auctions, and he announced several items on the FCC’s November 2010 agenda to respond to the spectrum crunch:

- A notice of proposed rulemaking that would lay essential groundwork for incentive auctions quickly should Congress act, looking at lifting technical restrictions so broadcast spectrum could be used for broadband
- A notice to expand the FCC’s experimental licensing program including easing testing restrictions on institutions that are developing new services and devices that utilize spectrum
- A notice of inquiry to accelerate opportunistic uses of spectrum, including technological advances that enable greater use of secondary markets

Department of Commerce Reports

On November 15, 2010, the Department of Commerce released two reports.

The first was a Fast Track Evaluation. This report “examined four spectrum bands for potential reallocation within 5 years: (1) 1675–1710 MHz, (2) 1755–1780 MHz, (3) 3500–3650 MHz, and (4) 4200–4220 MHz and 4380–4400 MHz.” It recommended that “various portions of these bands totaling 115 megahertz be made available for wireless broadband use within 5 years, contingent upon the allocation of resources for necessary reallocation activities.”⁶

The second report was a 10-year plan and timetable that responded to President Obama’s presidential directive calling for 500 MHz of spectrum to be made available for wireless broadband. It identified 2,200 MHz of federal and non-federal spectrum suitable for evaluation

and possible release for wireless broadband over the next 10 years. Of this 2,200 MHz of candidate spectrum, “28 percent is allocated exclusively for federal use at present, 35 percent is allocated exclusively for commercial use, and 37 percent is shared by federal and commercial users.” This amount includes “280 MHz of commercial spectrum that the FCC recommended in its National Broadband Plan be made available for mobile broadband use within 5 years.”⁷

The report reiterated the administration’s call for incentive auctions and recommended changes to the Commercial Spectrum Enhancement Act, the use of prizes and awards to improve spectrum efficiency, and an increased role for the Commerce Spectrum Management Advisory Committee.

Industry and FCC Analyses

Participants at the conference also had before them a number of reports and industry developments that influenced their discussions. The first was the Bazelon Report, released in October 2009.⁸ This report concluded that \$62 billion worth of broadcast spectrum could be made available for mobile broadband at a fully compensatory cost of \$12 billion. This estimate suggested that the gains from allowing trades in broadcaster spectrum would probably be substantial.

The FCC released a report on mobile broadband in October 2010.⁹ It examined industry projections of the demand for wireless broadband usage and adopted the average projection of 35 times 2009 levels by 2014. The vast majority of the increases in projected wireless broadband usage would be for mobile video.¹⁰ Even if the industry continues to increase network density by increasing the number of cell sites at the current growth rate of seven percent per year and even taking into account increases in spectral efficiency from the new generation of wireless mobile, the report projects a spectrum deficit for wireless broadband of 275 MHz by 2014. If the industry attempted to meet projected demand by investing in additional cell sites over and above its current growth rate of seven percent, it would cost an additional \$120 billion. This figure gives an estimate of the economic advantages in terms of cost savings that would accrue if additional spectrum were made available to fill the wireless broadband spectrum deficit.

Tiered Pricing

In 2010 the wireless broadband industry moved in the direction of tiered pricing. For instance, in June, one carrier announced a tiered pricing model for wireless data services that charges users \$15 for 200 MB of data and \$25 for 2 GB.¹¹ The need to provide appropriate economic incentives for heavy users of video programming appears to be driving these tiered pricing arrangements.¹² Other carriers are poised to follow suit, and the FCC is unlikely to stand in the way of these plans.¹³ The FCC's Mobile Broadband report noted that these new pricing strategies have "the potential to impact data traffic projections if widely adopted in the market."¹⁴ The National Broadband Plan warned, however, that "it would not be wise for America to bet its mobile future on a strategy of 'demand reduction.'"¹⁵

2010 GAO report

The Government Accountability Office issued a report on competition in the wireless industry. It concluded that four large national wireless phone service carriers—AT&T, Sprint, T-Mobile and Verizon—currently operate alongside small and regional carriers of various sizes. The four large national carriers serve more than 90 percent of wireless subscribers, though no single competitor has more than one-third of the national market.¹⁶ In March 2011, AT&T and T-Mobile announced a proposed merger of their wireless operations.

Political Developments

In the 2010 mid-term elections, Republicans won control of the U.S. House of Representatives and narrowed the Democratic majority in the U.S. Senate. According to many analysts, concern about government spending and deficits fueled this electoral victory. Shortly thereafter, an initial recommendation from the co-chairs of the National Commission on Fiscal Responsibility and Reform contained specific plans for deficit reduction. Renewing the FCC's auction authority was one of these recommendations, although no estimate of revenue was provided.¹⁷ These political developments created an unusually strong focus on deficit reduction. Participants in the conference were aware that revenue from spectrum auctions would be a politically attractive strategy to reach this goal.

Spectrum Policy for Commercial Use of the Spectrum

In 2002, the Federal Communications Commission Spectrum Policy Task Force Report recommended that flexible use of the electromagnetic spectrum should be the regulatory norm, subject to several constraints including provision for public safety, protection from interference and compliance with treaty obligations.¹⁸

Meeting unanticipated surges in demand will require something more nimble than the current slow spectrum reallocation process.

In many ways, the discussion at the conference mirrored these conclusions.

The search for 500 MHz of spectrum was the framing question for the conference, but the discussion seemed to go back to the more basic question of the right regulatory framework for allocating spectrum to take account of the fact that new and attractive uses of spectrum are essentially unpredictable. For example, the huge success of smartphones, such as Blackberries and iPhones, was unanticipated. Meeting these unanticipated surges in demand will require something more nimble than the

current slow spectrum reallocation process. The conference was not seeking a solution to the immediate problem of wireless broadband spectrum—otherwise policymakers will be back in the same predicament in 10 years. Instead, the discussion focused on whether this goal of greater availability of spectrum suitable for wireless broadband could best be accomplished through incentive auctions, overlay auctions or flexible use. These more nimble mechanisms could then be used to avoid spectrum shortages in the future. The looming broadband wireless spectrum crisis provided the occasion for deeper reflection on more fundamental reform.

Demand for Wireless Broadband

The participants reviewed the October 2010 FCC mobile broadband report and raised some pointed questions about the evidence. While the industry estimates of the growth curve in mobile traffic all show dramatic increases in demand, varying from 23 times 2009 levels to 47 times 2009 levels by 2014, to some participants the FCC's choice of

the average seemed to be no more than arbitrary and imprecise guesswork that could under or overestimate the economic consequences by billions of dollars. It is possible that increasing system capacity to meet demand for wireless broadband could be met by creating smaller cell sizes through increased investment in fiber.¹⁹ The FCC report discussed this fiber-intensive, smaller-cell-size alternative and estimated that it would be more expensive than providing additional spectrum. However, there is debate about the reliability of these alternative cost estimates. In addition, the FCC report did not undertake an analysis of the net social benefits of making more spectrum available for wireless broadband. As a result, there was no assessment of whether other uses of the spectrum might provide greater advantages in terms of jobs, equity, reduction in the digital divide and trade benefits. Some participants questioned whether the drive for making more spectrum available for wireless broadband could be justified in the absence of this larger analysis.

Participants spent some time discussing a change in the network architecture to shrink cell size. One way to do that would be through the use of femto cells, which are low-power, short-range base stations that users connect to a wireline broadband connection to expand coverage within a home or office. Participants discussed the idea of shrinking cell sizes by bringing fiber to the “lamppost” and picking up and delivering the signal through inexpensive antennas. This architecture is similar to the architecture of municipal Wi-Fi without relying on unlicensed spectrum. Shrinking cell size might increase capacity 50 to 100 times and might be a good strategy if the only goal were to get signals to existing handsets.

In all likelihood however, this would not be enough to respond to demand for wireless broadband. Femto cells are good only for fixed, stationary broadband, and they are not as good for wireless mobile communications to fast moving vehicles. Moreover, femto cells are not effective if they are used for broadcasting as opposed to unicasting. So while the use of femto cells will increase in the future, they will likely not provide for all the uses of wireless broadband.

A network architecture based on significantly smaller cell sizes would not appear overnight. It would be a massive undertaking and there would be a need to install the cells everywhere to get spectrum

efficiencies. It would cost tens of billions of dollars to obtain a substantial increase in capacity. In addition an architecture based on smaller cell sizes would not work as effectively if the goal is to encourage innovative uses of the spectrum. Innovations create unpredictable, non-linear growth in demand, and additional spectrum would have to be made

Spectrum availability, or the lack thereof, is often a matter of geographic market.

available to meet this demand. For a variety of reasons, then, it would be a mistake to rely on an architecture focused on smaller cells alone to address the demand for wireless broadband.

Participants discussed the use of tiered pricing to dampen demand as a way to reduce the need for additional spectrum. Wireless companies have started to implement these pricing policies as a way to manage demand, and there is some indication that they would be effective

at the margin in reducing excessive demand from very heavy users. However, this strategy is not a sufficient long-term solution because it would reduce the availability of innovative broadband services. Furthermore, if wireless were used as a way to extend broadband services it is not an acceptable solution to raise prices so high that people would not want to use the services.

Participants offered insights into the nature of demand for wireless broadband. The spectrum crunch problem is not geographically universal and it does not exist in rural areas. Indeed, in rural areas spectrum is often not being used enough. The problem of an inadequate supply of spectrum for wireless broadband exists in “the NFL cities.” Spectrum availability or the lack thereof is often a matter of geographic market.

Other participants pointed out industry analyses were based on human-to-human interactions. Once machine communications are factored in, the demand for wireless broadband is even greater. Energy companies are beginning to install wireless devices to transmit energy use information from the home to the central office. Wireless systems are being used for crash notification, traveler information and traffic management. Device-to-device wireless transmission in the areas of the smart grid and intelligent transportation will dramatically increase in the coming decades, putting pressure on spectrum resources that have not been included in current estimates of demand for wireless broadband.

Most participants acknowledged the need for additional spectrum for wireless broadband. They accepted the uncertainties involved in estimates of demand but emphasized that spectrum policies have to be designed to accommodate unpredictable surges in demand for new services, such as the iPhone. Cost estimates for alternative ways to meet demand are also uncertain, and a net social benefit analysis would be desirable, but based on the evidence, at some point the spectrum currently used for wireless broadband will run out.

Despite the substantial discussions regarding the actual need for additional spectrum for wireless broadband, participants focused on the proper process for allocating the spectrum. The true consensus in the group seemed to be that the traditional process of reallocation by administrative procedure would not work in the case of wireless broadband or for future spectrum needs. The group considered other alternatives described below.

Incentive Auctions

Incentive auctions would allow a licensee to return all or some of its licensed spectrum to the FCC for reassignment, subject to new service rules. The FCC would hold an auction to determine the new licensee and provide the old licensee an opportunity to share a portion of the auction revenue. The incumbent licensee is provided with this portion of the auction proceeds as an incentive to return the spectrum to the FCC without the commission having to engage in an extended process to determine that a different use of the spectrum was more valuable and hence reallocate the spectrum for that new use. Incentive auctions are therefore an expedient tool to move spectrum out of less desirable and into more desirable uses.

The concept of an incentive auction is perfectly general, but the specific example considered in the conference applied to broadcasters. Broadcasters have extremely attractive spectrum that is suitable for use for wireless broadband. In an incentive auction for broadcasters, all broadcasters would be invited to make their licensed spectrum available for auction, but would not be required to do so. The FCC would “repack” the spectrum in ways that would allow for nationwide continuous blocks of spectrum, attractive to the large national wireless carri-

ers. The broadcasters who provided spectrum for auction would receive a portion of the auction revenue in return. Those who did not would be compensated for any relocation expenses associated with their move to different spectrum as part of the FCC's repacking.

The FCC called for incentive auctions in its National Broadband Plan. It has asked Congress for legislation that would authorize it to engage in incentive auctions.²⁰ It has also proposed incentive auctions in its Mobile Satellite Service (MSS) Notice of Inquiry (NOI).²¹ A bill introduced by Senator Jay Rockefeller (D-WV) would, among other things, provide general incentive auction authority that would allow the FCC to offer incentive auctions to the broadcasters and to other licensees in the future.²² One variety of this incentive auction idea, described by a conference participant as "land for peace," would be to remove some of the requirements on a service band such as MSS or ATC as a reward for a return of some of the spectrum for auction. The FCC proposed this in its MSS Notice of Proposed Rule Making (NPRM).²³

The participants in the conference supported granting the FCC the authority to hold incentive auctions in general. They also supported the specific proposal to allow the FCC to hold an incentive auction for the broadcast spectrum structured in a way to make available a national contiguous band suitable for wireless broadband service. The general authority would put in place a long-term mechanism to allow the FCC to respond quickly in the case of unpredicted surges in demand for new services. The specific use of this authority to auction broadcast spectrum for wireless broadband is a partial response to the current need to find additional spectrum for wireless mobile.

Incentive auctions of the broadcast spectrum for wireless broadband have several advantages. It would raise revenue for the Treasury. It would quickly move repacked national contiguous spectrum to wireless broadband purposes. Since it would be a voluntary measure, it is politically feasible and could be moved through Congress. Participants supported general authority to the FCC to conduct incentive auctions in other cases as well, since this seemed to be a clear improvement in the spectrum reallocation process. Indeed, the wireless broadband spectrum crisis provides a strategic opportunity to put in place this long-term improvement in spectrum management.

A broadcaster representative at the conference indicated that broadcasters are not in principle opposed to the idea of being able to sell their spectrum to another entity that would use it for a purpose other than broadcasting. Nor would they be opposed to a change in their license that would allow them to use their spectrum for a purpose other than broadcasting. Even if they do not want to sell it, they can only gain by having the opportunity to sell.

Broadcasters are concerned about a number of other possible developments. They are concerned that the FCC or Congress might reclaim the spectrum and auction it for other purposes, without any compensation to the broadcasters. At a time of budget deficits, this concern seemed especially real to them. They also worried that Congress would regard any auction revenue retained by the incumbent broadcaster as an unjust enrichment, since broadcasters did not themselves originally pay for the spectrum they use. They are concerned that Congress would impose a mandatory auction that would force them to sell their spectrum. They would also object to being required to bid on their spectrum in order to continue to use it for broadcasting purposes or in order to use it for any new purposes under a new flexible licensing arrangement. They are concerned that broadcasters who do not auction their spectrum would have to pay transition costs resulting from the FCC's repacking of the broadcast spectrum.

The shortage of spectrum for wireless broadband is most acute in these “NFL cities.”

If these concerns could be resolved, the broadcaster representative indicated that, in general, broadcasters would not be opposed to a truly voluntary incentive auction.

Would an incentive auction yield much spectrum suitable for wireless broadband? Broadcasters in major cities still have an attractive business and so might be less willing to sell spectrum. But the shortage of spectrum for wireless broadband is most acute in these “NFL cities.” In contrast, broadcasters in rural areas have a less attractive business and would be more willing to participate in an auction. But there is no real need for additional spectrum for wireless broadband in these rural areas. So, if this analysis is correct, it follows that the incentive auction

of broadcast spectrum for wireless broadband would work in those areas where it is not needed and would not work in those areas where it is needed. The only way to see if incentive auctions would provide for additional spectrum for wireless broadband would be to hold one and see if the spectrum offered as part of the auction was sufficiently attractive to providers of wireless broadband services.

Some participants expressed the view that with only 10 percent of the population still choosing to receive over-the-air broadcast signals, it is time to make it possible to use that spectrum for other purposes that might be more beneficial to a broader range of people. Others argued that the economic value of the spectrum is much greater for wireless broadband uses than for traditional broadcasting.²⁴

While these concerns seemed to lead to a conclusion that mandatory reallocation would be in the public interest, the participants did not embrace that conclusion. Instead, the thrust of the agreement among the conferees was that it would be an improvement in current spectrum management processes to grant the FCC the authority to hold truly voluntary incentive auctions for broadcasters and for other incumbent licensees.

Overlay Auctions

Overlay auctions would lift current use restrictions on the spectrum assigned to broadcasters and would auction the spectrum that is not being currently used to deliver a broadcast signal. One version of this proposal supposes the following elements:

- Divide the 294 MHz DTV Band into seven national overlay licenses
- Allocate to each overlay seven contiguous TV channels (42 MHz), reducing borders (as opposed to non-contiguous channel allotments)
- Allot overlays exclusive, flexible-use rights as defined in the 700 MHz licenses previously sold at auction, subject to incumbents' encumbrances

- Grandfather DTV broadcast incumbents indefinitely
- DTV stations are required to distribute video content free-to-viewer, but the mandate is platform-neutral
- Overlay licenses are sold at auction and
- Limit two per customer²⁵

The FCC has current authority to hold overlay auctions and has used this authority before in previous auction situations such as the PCS auction in 1995.²⁶ This provided extra flexibility compared to the incentive auction proposal, since it did not require authorizing legislation by Congress.

One advantage of overlay auctions is that it would provide substantial revenue to the Treasury, since only 17 percent of the spectrum assigned to television broadcasting is used for that purpose. The rest is used to protect against interference with the broadcast signal. However, the amount of revenue for the Treasury might be less than that derived from an incentive auction, since the auction winner would hold a license encumbered with the right of the incumbent to continue to use its licensed spectrum. Moreover, any sale of the incumbent broadcaster's license would generate revenue for the broadcaster, not for the Treasury.

Participants were concerned that overlay auctions might not be effective, since some broadcasters might refuse to participate in the process, thereby limiting the usefulness of the spectrum purchased by the new entrants. Wireless carriers need regional or national blocks of spectrum, not spectrum in particular locations. A pattern of holdouts might prevent the development of national contiguous bands that could be used for wireless broadband. This uncertainty would also affect the value of the spectrum and the revenue that could be expected to be raised from the auction.

Overlay auctions would provide a step in the right direction toward meeting the demand for wireless broadband and are a useful part of the FCC's spectrum management toolkit. But it is second-best compared to incentive auctions, since incentive auctions allow the FCC to repack the spectrum to form national contiguous band suitable for wireless broadband and would raise more for the Treasury than overlay auctions.

Flexible Use

Several participants thought that the easiest and most direct way for the FCC to respond to the need to reallocate broadcast spectrum to wireless broadband would be to simply remove the service restrictions on the broadcast licenses. The FCC has authority to liberalize the restrictions on current licenses. Participants made reference to the decision by the FCC in the SMR licenses.²⁷ As a result, this flexible-use approach would not require authorizing legislation.

A flexible-use approach would have the advantage of getting the government completely out of the business of determining what the best use of the spectrum would be.

Providers of broadband services could accumulate the needed spectrum through purchases from incumbent broadcast licensees. This would have the advantage of getting the government completely out of the business of determining what the best use of the spectrum would be.

In general, the group approved of greater flexibility in the use of the spectrum by licensees. Use restrictions seemed to suppose that the agency had better knowledge of marketplace needs than the marketplace participants themselves. It creates spectrum shortages when shifts in marketplace demand, unpredicted at the time of spectrum allocation, create a need for rapid reallocation. Fewer restrictions on use would create a more nimble marketplace.

However, participants were less convinced that mere flexible use would be a sufficient response to the current wireless broadband spectrum crisis. By leaving transactions to open-marketplace forces, there is no guarantee that national contiguous bands would be available to wireless broadband providers. Carriers want national or regional

Under this flexible-use model, the broadcast licensee would retain broad discretion to determine what is done with the spectrum. They could use it themselves for additional services; they could change their business model completely, ceasing to be broadcasters and offer an entirely different service; they could sell or lease it to other parties including to providers of wireless broadband services.

Once the use limitation is removed, the market could take care of the rest.

allocations, not local allocations. As one participant said, they need 20 MHz in the Northeast, not 6 MHz in Philadelphia.

In response, some participants pointed to the development of carriers such as Clearwire and Nextel. These entities accumulated spectrum over time in the marketplace and now have substantial capacity to provide national service. However, this process took a very long time—well over a decade—and the demand for wireless broadband spectrum has to be met more quickly than that.

The group as a whole recognized these difficulties, and in the case of wireless broadband seemed to think that speed required action by the FCC to repack spectrum to provide for national contiguous spectrum suitable for wireless broadband. If incentive auctions were not possible, then lifting use restrictions would be a second-best alternative.

Experts are also skeptical whether the proposal is politically feasible. The Treasury would not benefit from sales by incumbent broadcast licensees to wireless broadband providers. These sales might also be viewed as windfall profits. Incentive or overlay auctions would be more attractive to policymakers seeking revenue in a time of budget crisis.

Limitations on Flexible Use

The group generally endorsed greater flexibility in the use of assigned spectrum. The FCC should seek opportunities to lower use restrictions to allow licensees to respond more nimbly to market needs. However, there are some limitations. One is the need to determine which blocks of spectrum would be available for licensees to use. In the case of wireless broadband, the marketplace demands national contiguous spectrum. If the FCC does not aggregate spectrum into these bands, then the marketplace would be fragmented. Transaction costs, hold outs and balkanization would prevent the market from getting spectrum with the right characteristics in the right groupings to the right service providers.

This clearly creates a need for the FCC to retain some control over use in order to overcome these marketplace imperfections. In the long run, however, the aggregation function might be outsourced to the private sector rather than being housed in the FCC. The information demands and specialized marketplace knowledge required to serve as

a market aggregator in all cases would overwhelm the agency. Instead, is the possibility of a private clearinghouse that would take on the task of aggregating and bundling blocks of spectrum in response to marketplace demand. Participants were skeptical of the ability of the FCC to do this in all cases, and they looked favorably on the prospect of a private clearinghouse to perform this function.

There is reason to be concerned about the dangers of a spectrum management policy of unrestricted use for international harmonization. Common international decisions on the use of particular spectrum bands for particular purposes aid the marketplace by providing scale efficiencies. With the entire world using spectrum for the same purpose, the market could achieve scale economies in the production of equipment. Several participants pointed out that the U.S. market is no longer the biggest in the world. What the U.S. does in a particular part of the spectrum needs to be in concert with what other countries are doing so as to allow equipment vendors to build to what the spectrum market demands. Of note is the fact that multiband equipment is becoming more prevalent and is an essential part of the market, with the result that equipment costs are higher than they otherwise would be. Limitations on flexible use to accommodate the needs of the international marketplace might be a useful part of the FCC's spectrum management function.

Unlicensed Use

Several participants urged a policy of allowing unlicensed use on spectrum that is not being fully used by its licensee. The policy would require incumbents to "use it or share it." This policy of shared unlicensed use would require the development and use of multi-band, frequency-hopping radios. This would provide a reserve of frequencies that could be widely used, perhaps only temporarily, while the incumbent licensee built out its system. Advocates thought there would be no harm in adopting this policy, and many participants supported it as a long-term improvement in the FCC's spectrum management approach.

The reservation of spectrum for unlicensed use rests on the ability of new devices to recognize the interfering signals from the licensee and to shift to a different band for transmission when such interference is

detected. This creates a need on the receiving end for tuners that could receive signals accurately across a wide range of frequencies. But inexpensive, tunable filters have not yet been developed, which limits the potential use of unlicensed spectrum.

The question is whether this proposal would respond to the demand for spectrum for wireless broadband in such congested areas as Manhattan. In addition, it is unlikely that major commercial carriers would make the investment necessary to use the spectrum on a temporary basis, only to be removed from the spectrum at a later date. As a result of these concerns, unlicensed spectrum use represents a long-term improvement in spectrum management, but would not be likely to respond effectively in the short-term to the need for more spectrum for wireless broadband.

Designated Entity Participation in Auctions

Participants spent some time discussing whether new spectrum auctions should have a set-aside for small businesses, minorities, women and other designated entities. Designated entity rules in spectrum auctions provide these entities with the ability to augment their bids with a percentage credit, thereby enabling them to bid more competitively with larger companies. Designated entity rules were in force for the FCC's Advanced Wireless Services auction in 2006 and for the FCC's auction of 700 MHz wireless licenses in 2008 under new FCC auction rules, adopted in 2006, that reduced designated entities' success rates in these auctions to nearly zero. In August 2010, the Third Circuit Court of Appeals held that the FCC's 2006 adoption of the designated entity rules for these auctions had violated various due process requirements.²⁸

Some argued that these set-asides for designated entities help promote small business and entrepreneurs and contribute to a more innovative and dynamic wireless marketplace. Some voiced competitive concerns that companies with market power would be able to outbid new entrants who might threaten their customer base. They suggested that any new auctions be structured in a way that favor new entrants.²⁹ Alternatively, set-asides have the effect of reducing the value of the spectrum and so the revenue that could be generated from an auction would be reduced as well. Opponents added that designated entities often need

to partner with other companies, usually incumbents, to build out a system on any spectrum they won at auction. In the end, the group was unable to come to a consensus on this issue of restrictions on auctions.

New Directions in Management of Federal Government Spectrum

The context for the discussion of new directions in the management of government spectrum is the need to find 500 MHz of spectrum for wireless broadband. This was the goal announced in the President's June 2010 wireless broadband directive and contained in

The key to long-term reform is to improve the clearing and sharing of spectrum used by federal government entities.

the Commerce Department's interim reports released on the first day of the conference. It was also the premise of the conference itself. For this reason, participants sought changes in management of federal government spectrum that would make available additional federal spectrum for wireless broadband as well as long-range modifications of existing institutional practices.

The key to long-term reform is to improve the clearing and sharing of spectrum used by federal government entities with a goal of increasing the efficiency of government use of the spectrum.

In clearing the spectrum, the policy is to remove the need for the government to use the spectrum at all. For example, a different radio frequency system that uses different parts of the spectrum, or fewer MHz of the same spectrum, might be used instead. Or the function could be provided in a system that was entirely landline, and so no spectrum would be used at all. Alternatively, the function could be provided less expensively by purchasing the service from a private vendor rather than having the government agency operate its own radio frequency system. In any case, the spectrum is cleared and made available in its entirety for alternative uses.

Sharing involves the continued use of the spectrum by a government entity, but with the ability of other entities to use the same spectrum

on a geographic, time or interruptible basis. There are three main types of sharing. The department or agency can share (1) within its own department or agency, (2) with other departments or agencies, or (3) with private sector parties. Currently, some government spectrum is already shared.³⁰

Clearing the spectrum completely for non-government purposes has many advantages from the perspective of private sector users. For example, sharing subject to geographical exclusion zones or time limitations is better than no access to government spectrum at all for carriers and the public, but it is less than ideal and would inevitably limit the use of the spectrum for alternative purposes.

Government agencies also viewed sharing with some suspicion. Participants listed and discussed the traditional objections to sharing on the part of government spectrum users:

- In a sharing arrangement, private sector users should have only limited ability to use government spectrum, but the FCC will not enforce these limitations.
- Interference from private sector users would not be controlled because they will develop “squatters’ rights,” and they have substantial political power with Congress to defend their spectrum use, even if it is interfering. Agencies do not believe private sector assurances that they will respect existing use.
- Agencies are expected to accept sharing even before it has been demonstrated for the service in question. The one, large-scale DARPA study on spectrum sharing does not prove that it can be done for specific services.³¹
- Spectrum sharing schedules do not allow for testing first. Sharing is adopted as a policy and the technology is expected to deliver, but often that is too much risk for an agency to accept.
- Sharing is expected before the equipment that makes it possible is available. Sharing lacks credibility in the absence of spectrally efficient and flexible radios.

- Sharing limits the ability of agencies to develop innovative and efficient uses of the spectrum to satisfy their own mission needs.
- Sharing constrains the agency's ability to manage future growth.

These concerns need to be addressed adequately before government users of spectrum should be required or expected to embrace further sharing of government spectrum. Participants also considered several questions that helped them understand how government use of the spectrum could be improved through sharing or clearing. They urged government agencies engaged in inventories of current spectrum use and assessment of possible improvements to consider the following factors:

- Why is a government use located in that part of the spectrum? Historical? Technical?
- In an ideal spectrum plan, where should it be located?
- In which geographical location is the predominant use? Urban, suburban, or rural? Is it only used there, or is it just the largest fraction of use? Where is it NOT used?
- When it is used and for how long?
- What are the impacts of "unwanted signals" on these systems?
- Are these impacts due to physics or implementation?
- What is the cost of upgrading?
- What are the future spectrum needs of government users?

The participants were generally of the view that an examination of these factors would sometimes make it rational for a government agency to share spectrum or to clear it for alternative uses. But the group identified several barriers that might prevent this efficiency even when it made good economic sense:

- *A standard economic externality.* Why should an agency expend its scarce mission budget on spectrum improvements that will benefit other agencies or the private sector? Even if the benefits are substantial from a social point of view, the distributional aspects get in the way. The agency spends the money and other parties get the benefit.
- *Lack of pricing.* Without a resource cost attached to the use of the spectrum, government agencies can view it as a free good and continue to use it even when more efficient alternatives are available.
- *Principle-agent problems.* Spectrum managers have interests in continuing the use of spectrum that might diverge from the interests of the agency that employs them.
- *Resource constraints.* Clearing or sharing spectrum requires substantial relocation costs including research, planning, and purchase of new radio frequency equipment that are not included in agency budgets.

As a result of these considerations, the group concluded that government users needed incentives to clear or share spectrum when it makes economic sense to do so. The group reached a large degree of consensus around three proposals: to push for modifications that would allow **long-range strategic planning**, to provide for **improvements in the operation of the Commercial Spectrum Enhancement Act**, and to develop a **spectrum innovation fund**. Other improvements discussed below were also recommended. However, no consensus was reached on other measures such as spectrum fees or zero-base budgeting. The group also discussed ways in which these improvements could be financed.

Long-Range Strategic Planning

The group endorsed the idea of long-range strategic planning for major systems that involve both those who acquire the systems and those involved in spectrum management for them. Current reviews are

short-term, they take existing rules as a given and focus on compliance with them, and they are limited to single agencies or departments. The strategic review recommended by participants requires additional

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budget for long-term planning. The group agreed that strategic direction would have to come from the White House through an agency such as the Office of Science and Technology Policy (OSTP), with NTIA as the longer-term enabler of a collaborative process.

The recommendation for long-range strategic spectrum planning has three components:

- An inventory and measurement component
 - A long-term government-wide review
 - An on-going budget to support this planning process

The inventory and measurement component recommended is similar to the spectrum inventories proposed in congressional legislation in 2009 such as S.649 and H.R. 3125.³² The bills differ in details, such as the range of spectrum to be covered by the inventory, but they share these requirements:

- An inventory of radio spectrum band
- An identification of the radio services and the licenses and users authorized to operate in each band
- A description of the amount of spectrum allocated to each user and the geographic areas covered by the allocations
- A listing of the number of radio-frequency devices authorized to operate in each band of frequencies

The group also endorsed the inventory required under the President's June 2010 wireless broadband directive. This order directed the Department of Commerce to identify and make available government spectrum for repurposing for wireless broadband use. The overall goal is to make available over the next 10 years 500 MHz of federal and non-federal spectrum for this purpose. The Department of Commerce

released its interim report in November 2010. It identified 2,200 MHz of federal and non-federal spectrum suitable for evaluation and possible release for wireless broadband over the next 10 years.

Participants contrasted the inventory they were recommending with both the congressional and the presidential inventories. The purpose of the spectrum inventory recommended by the participants was to develop a snapshot of current uses in order to make possible a longer-range review and planning process. This scope goes beyond identifying as much spectrum as possible to provide greater availability of spectrum for wireless broadband, which seemed to be the underlying goal of the inventories contemplated in congressional legislation and in the presidential spectrum directive. The group did not object to an inventory for this purpose, but the participants had a longer-range purpose in mind. As one participant said, the group was seeking institutional improvement, including a spectrum inventory even if “it’s not going to get anyone MHz for the next generation iPhone.”

The group looked at who should conduct this inventory and measurement of current functions and uses. They recommended that the Commerce Department, acting through NTIA, should coordinate the process. They endorsed the interagency approach embodied in the President’s June 2010 wireless broadband directive, whereby agencies collaborate with NTIA in the assessment of current uses. The group did not endorse the idea of a review by NTIA alone, since that agency does not have the resources to conduct its own review, nor did the group recommend contracting with an outside party to conduct the review. Outside reviews would be resource intensive and might not be needed if full agency cooperation was forthcoming. The participants did, however, look favorably upon the fall-back approach embodied in the presidential directive to seek independent review panels if progress in conducting an inventory is not occurring.

To ensure full agency cooperation the participants recommended coordination of the review through the offices of executive branch agencies including the National Economic Council, the Office of Management and Budget and the Office of Science and Technology Policy, as well as the Chief Technology Officer and the National Security staff. These offices could assist the Department of Commerce

in organizing meetings, ensuring the availability of resources for the review, and assessing progress. Their participation in the inventory would assure the appropriate degree of cooperation and transparency.

Federal spectrum management should be organized subject to an on-going, long-term strategic review process. The major features of this long-term review are (1) an extended time frame, (2) a focus on the goals and objectives of system use, and (3) the attempt to compare uses across agencies.³³

There are different kinds of government use of the spectrum: broadcast, personal communications services, non-communications services such as radar, satellite, passive listener uses such as astronomical uses and short-range uses such as Wi-Fi and Bluetooth. Spectrum deployed for some uses might or might not be substitutable for other purposes, but for purposes of a long-term review they all have to be considered together. Moreover, the uses across agencies and departments have to be considered together. Limiting government spectrum management to a short-term, agency-by-agency process of obtaining approval to use government allocated spectrum might miss substantial opportunities for improving efficiency.

In that regard, it is important to make sure that the time frame involved in the review is long enough. Sensing systems, such as radar, have an extended life cycle. Once these systems are in place, it is extremely difficult to replace or alter them. As a result, the group recommended a planning horizon for the government-wide planning process of 30 years. Current institutional arrangements do not allow that kind of long-range planning time frame.

In addition, the personnel involved in the long-range planning must include more than just the spectrum managers. System operators, procurement officers and spectrum managers all need to be directly involved in the long-range planning process. There is a need to have both spectrum managers and operational people involved in the discussion of where in the spectrum to locate particular operations. The question cannot be simply whether a system proposal is compliant with existing government spectrum use rules, but whether it is the best way to achieve mission goals.

Finally, the group thought that a key way to find efficiencies is to expand the discussion beyond individual agencies and to allow engi-

neers, spectrum planners and operational staff from different agencies to discuss possible ways to reconfigure spectrum use that would achieve mission goals from different agencies at lower resource use.

The difference between this idea of a long-range, government-wide plan and existing spectrum management processes is illustrated by a discussion of the Department of Defense DOD Form 1494. This form is used by the department to describe the radio frequency characteristics of a system such as its power, emission bandwidth, antenna gains, antenna patterns, receiver selectivity and frequency band of operation, and then to request approval by NTIA for the system to operate. It is not, however, a device for long-range strategic planning designed to coordinate the different spectrum-using systems across the federal government and determine the most efficient pattern of spectrum use across these systems.

The contrast with Office of Management and Budget OMB Circular A11 also illustrates the new dimension the participants were envisaging in calling for a long-range strategic plan. As part of the budget process, OMB requires agencies to “obtain a certification by the NTIA, Department of Commerce that the radio frequency required can be made available before...[they]...submit estimates for the development or procurement of major radio spectrum-dependent communication-electronics systems [including all systems employing space satellite techniques].”³⁵ But these certifications simply note that a system request complies with existing rules. It does not go to the question of least-cost use within or across agencies. It does not take into account spectrum efficiencies.

Strategic direction for this long-term process has to be provided by a single government agency. As the government’s spectrum manager, NTIA would play this role. It would act as the enabler of a collaborative process. But long-term administration support would be required as well to ensure adequate agency cooperation and transparency. The need to balance agency interests to achieve overall spectrum efficiency in government would require the active involvement and support by high-level executive branch agencies. This high-level policy support could be provided by the following executive branch agencies: Office of Science and Technology Policy, Chief Technology Officer, National Security Council and Office of Management and Budget.

Commercial Spectrum Enhancement Act 2.0

In 2004, Congress passed the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494), which created the Spectrum Relocation Fund (SRF) to allow federal agencies to recover the costs associated with relocating their radio communications systems from spectrum bands that had been auctioned for commercial purposes. Under CSEA, these relocation expenses are paid from a portion of the proceeds of the auction.

In 2006, the FCC auctioned portions of the federal spectrum (1710–1755 MHz) for Advanced Wireless Services (AWS). This AWS auction raised \$13.7 billion. A portion of this auction revenue was used to reimburse federal agencies for their relocation costs. As of December 2009, agencies had spent \$375,092,227 of the total estimated \$1.194 billion in relocation costs.

CSEA provides a useful centralized mechanism to allow agencies to transition away from the use of certain portions of the spectrum to recover transition costs.

CSEA provides a useful centralized mechanism to allow agencies to transition away from the use of certain portions of the spectrum and to allow them to recover transition costs in a way that is revenue-neutral for the U.S. government as a whole. There are, however, two shortcomings of CSEA. The first is that funds that enable spectrum

improvements are needed before auction funds are available. These resources are needed before auctions to identify and evaluate possible bands for clearing or sharing and for planning a transition. By making the spectrum fund available only for relocation purposes and only after the fact, CSEA limits the efficiency gains that could be obtained from spectrum inventories and planning.

The second difficulty with CSEA is that it allows the revenue from auctions of cleared spectrum to be used only for relocation costs for moving away from the portion of the spectrum that has been auctioned. An agency cannot be reimbursed from the fund for the costs associated with clearing or sharing other spectrum bands.

The group embraced improvements in the CSEA to allow it to facilitate general improvements in government spectral efficiency.³⁶ The recommended improvements would provide funds for planning and demonstration, liberalize the standard under which funds could be used for new equipment, provide a research and development budget for interference tolerance or mitigation and include incentives for government to obtain services from commercial suppliers where appropriate.

Planning and Demonstration Funds. The current statute allows funding for relocation costs for spectrum that has been reallocated and auctioned. But it limits the possible efficiencies that could be obtained by spending resources available from spectrum auctions for additional uses. For example, whether or not a particular use of spectrum by a government agency can be reallocated in an efficient way calls for planning and research. In its interim report, the Department of Commerce has proposed statutory changes that would accommodate the need for planning and research. Some legislation calls for this as well.³⁷

In addition, beyond these planning and research funds, the group considered the need for demonstration projects that would allow agencies to test out equipment and technologies in the context of relocation projects. This focus on demonstration projects is new, an element not considered in previous proposals from the administration or Congress. Agencies should be authorized and funded to engage in such demonstration projects.

In sum, the group recommends that amounts in the fund should also be used for planning, research and demonstration that would improve the efficiency of federal use of spectrum.

Liberalize Equipment Standards. The current statute allows relocation expenses to be paid when the new equipment involved is “comparable.” Agencies are eligible for reimbursement of costs associated with relocating these systems from the affected spectrum, as specified in Section 202 of the CSEA, to achieve “comparable capability of systems, regardless of whether that capability is achieved by relocating to a new frequency assignment or by utilizing an alternative technology.”

The group considered this standard to be too restrictive. It seems to lock in the agency to whatever old technology they happened to be using at the time of relocation, even if there had been substantial improvement since the equipment had initially been acquired. Moreover, the old standard would not allow a change unless the resulting system had comparable capability, even if the needs of the system had changed and there was no longer any need for that kind of capability. A potential change from the standard of “comparable” to a standard of “related” would provide for the needed flexibility, both to obtain new and improved equipment and to avoid the need for unnecessary equipment.

R&D Budget for Interference Tolerance or Mitigation. From a testing standpoint, the spectrum reallocation fund does not allow agencies to seek ways to check equipment and technologies to see how much interference can be accepted and still accomplish mission objectives or whether, with more sensitive equipment, interference can be reduced to acceptable levels.

Incentives for Government to Go Commercial Where Appropriate. The group had a discussion of when government could use commercially available services as opposed to maintaining their own spectrum asset. The problem stems from the fact that with a capital investment in a spectrum asset, the agency does not need to go back to Congress for annual appropriations to pay for the service the spectrum provides. The service, in effect, has guaranteed funding. However, the on-going expense of obtaining services from commercial providers exposes agencies to the risk of losing appropriations funding for the service. The agency does not have assurance that year-to-year it will get funding for the service. Some in the group thought CSEA needed to be revised to accommodate that legitimate concern.

Spectrum Innovation Fund

Section 3 of the President’s wireless broadband directive calls for the Secretary of Commerce, working through NTIA, in consultation with the National Institute of Standards and Technology, National Science Foundation (NSF), the Department of Defense, the Department of

Justice, National Air and Space Agency and other agencies as appropriate to “create and implement a plan to facilitate research, development, experimentation, and testing by researchers to explore innovative spectrum-sharing technologies, including those that are secure and resilient.”

The participants in the conference reviewed this proposal for a spectrum innovation fund and concluded that it had considerable merit. They thought such a fund would be crucial in catalyzing thinking on improvements in spectrum efficiency. This fund would provide pilot programs for spectrum sharing with other government agencies or with commercial parties and identify obstacles to adoption. The focus would be studies on the feasibility of improving the efficiency of radio frequency systems and more effective ways of sharing spectrum. An innovation fund should focus on sharing opportunities among government agencies and should take up radar and next-generation aviation navigation systems as case studies. A good use of the innovation fund would be to overcome the “chicken and egg” problem described in the 2010 Aspen Institute report, *Rethinking Spectrum Policy*, where cognitive radios were not developed sufficiently because there was no confidence that they could be deployed.³⁸

The spectrum innovation fund could finance demonstration projects as well. The difference between these demonstration projects and the ones that might be funded through improvements in the CSEA is level of risk involved in the project: the innovation fund would support equipment, technologies and systems that have not been proven but which have potential to provide substantial improvements in spectrum efficiency. The CSEA demonstration projects are for more proven technologies, where the question is confirming that they will in fact function adequately for a given government purpose.

Investments in an innovation fund would pay substantial returns in terms of improved spectrum efficiency. Considerable oversight would be required by the NTIA to make sure that the program is targeted on improvements that would increase spectrum efficiency and not on other capacity or capability improvements of radio frequency systems.

Investments in an innovation fund would pay substantial returns in terms of improved spectrum efficiency.

One way to do this is to require that projects funded by the innovation fund identify spectrum that might be cleared or shared if the project were successful.

Spectrum Fees

Participants discussed the question of spectrum fees, but were unable to come to a consensus to recommend them or to oppose them. The National Broadband Plan, the presidential directive and the Commerce Department's reports urge the use of spectrum fees.³⁹ Some legislation also calls for it.⁴⁰ There is some movement in the direction of spectrum fees within the budget planning process as well as part of OMB Circular A-11.⁴¹ Moreover, some participants looked favorably upon the idea of incorporating spectrum fees into omnibus spectrum reform legislation. Nevertheless, it is uncertain whether moving ahead with spectrum fees would substantially improve spectrum efficiency in the public sector.

In principle, spectrum fees have the advantage of making government agencies conscious of the resource cost of using spectrum. Without a price or other impact on agency budgets, spectrum use can appear to be a free good and so appear to be more attractive than alternative ways of achieving mission goals even when these alternatives are less resource intensive. For that reason, many have recommended that spectrum fees, in some form, be introduced as a tool for efficient management of the government spectrum.

Some participants objected to spectrum fees. They noted that government programs are mission-based, not market-based and that a market price could not reflect the value of government services to the public. Others objected that policy should not be trying to re-create market incentives for government spectrum users, since if the costs exceed the benefits for a particular program, the agency cannot simply stop the program. That type of individualized agency-based cost-benefit analysis of spectrum use is not the way the agencies can or should work.

In addition, spectrum fees might make spectrum, new equipment and purchasing commercial services appear fungible within one agency's budget, but would not automatically allow assessments of spectrum uses across agencies. Agencies only have authority over their own budgets, not over the budgets of other agencies.

Some participants pointed out that spectrum fees do not automatically mimic market transactions. They are crude attempts to put a price on spectrum use, but they are outdated almost immediately. Participants were aware of the experiment in spectrum fees in the United Kingdom.⁴² But they thought that the results were limited in that the agency facing a spectrum fee could just request additional budget to pay the additional spectrum fee. Another financial concern was the possible international impact of spectrum fees as other countries might respond by charging their own spectrum fee for international uses.

An opposite problem also exists, namely, that in the current budget climate, agencies cannot obtain additional funding for spectrum fees. The result of imposing a spectrum fee might then be the degradation of important government missions. Even though the agency would pay any spectrum fee to the U.S. Treasury with the result that there would be no net loss to federal revenue, the realities of agency funding in tight budget times means that congressional appropriations committees are unlikely to increase the budgets under their control for a benefit that that accrues to the general treasury.

Zero-Base Spectrum Budgeting

Participants discussed the idea of zero-base spectrum budgeting, but were unable to come to a consensus on recommending it or opposing it. Harold Feld and Dr. Gregory Rose have proposed that “NTIA, the Secretary of Commerce and the Director of the OMB should ‘zero base’ federal spectrum use, requiring all federal agencies to reapply for spectrum allocations. Failure to reapply, and provide adequate detail on use, will result in elimination of existing spectrum allocation.”⁴³ The advantage of this proposal is that it forces agencies to think through and provide a reasoned justification for their use of the spectrum.

However, participants thought that proposals for zero-base spectrum budgeting missed the point and that the problem was not spectrum but equipment. Agencies are often victims and captives of the equipment designed to work with the spectrum available at the time the system was set up. A comprehensive plan of government spectrum use might conclude that some of these systems are located in the wrong place or

could use less spectrum. The solution to this problem is to develop a long-range planning capacity. Imposing a zero-budget requirement on spectrum will not bring about this long-range planning. The result of zero-based spectrum budgeting could be problematic for the agencies—if they fail to get the amount of spectrum that their equipment needs, they might be prevented from accomplishing important parts of their mission.

Budget

There was some discussion of the budget needed for the improvements recommended to increase the efficiency of government use of the spectrum. The group did not try to estimate the costs of these improvements. There was, however, some discussion of the price associated with an accurate inventory and measurement of existing government spectrum uses. The group thought that accurate measurements of existing uses could be expensive and did not disagree with the authorization of \$5 billion in S. 3610 to accommodate its inventory.

However, the resources required for an effective long-term review are likely to be considerably more. While a small adjustment based upon upgrading the existing spectrum reviews under A-11 or 1494 might be accommodated within existing budget constraints or small increases in these budgets, the recommended long-range review considered needs additional and on-going budgetary appropriations. The improvements in planning for spectrum clearing and sharing under the CSEA recommendation could be costly. Even when providing long-term improvements in efficiency, the upfront costs could be considerable. The same budgetary concern affected the funding for a spectrum innovation fund.

Funding for improving government spectrum efficiency can only be accomplished with additional authorizing legislation. Even if the funds in the CSEA spectrum relocation fund can be repurposed for general spectrum efficiency purposes under existing law, the current law requires that these funds return to the general treasury by 2014.⁴⁴ Moreover, funds for long-range planning and other improvements are typically not forthcoming as part of normal agency budget requests within the administration. The reason for this is that they do not generate offsetting revenue for

the general treasury and amount to requests for pure budget increases. For this reason, participants recommended legislation that would provide the assurance of adequate funding for this process.

Participants agreed, however, that the recommended measures to improve the efficiency of the government spectrum—the inventory, the long-range planning, the CSEA improvements and the spectrum innovation fund—should be budget neutral. They were aware that a spectrum inventory bill had been held up for cost reasons. Participants agreed that each of these steps must be justified on a budgetary basis, that the government will itself save money by taking these steps. A more efficient management process for government use of the spectrum has to be more efficient for the government. It cannot be justified solely on the basis that some other party will benefit, such as the providers of wireless broadband services and their customers. As a result, revenue from a variety of sources such as a portion of federal spectrum auctions, device certification fees and a portion of any spectrum fees could be devoted to defraying the costs of this planning process. This is discussed further in the section on legislation.

Other Recommendations

Participants discussed and looked favorably on several other ideas that might improve management of government spectrum:

- *Spectrum impact assessments.* Agencies are required under the Federal Privacy Act to publish a System of Records Notice when they collect information about individuals and under the E-Government Act of 2002 to conduct privacy impact assessments. Other federal laws require environmental impact assessments and economic impact assessments when agencies consider projects or regulations that affect the private sector. In a similar way, agencies could be required to conduct and publish (where appropriate) spectrum impact assessments as part of seeking certification for a radio frequency system. These assessments could discuss the alternatives to the chosen system and contain a justification of why it is the best of the available alternatives both in terms of accomplishing mission objectives and in efficient use of the spectrum.

- *Prizes and awards.* Agencies should award a substantial annual bonus to the employees who come up with the best spectrum efficiency ideas. The prizes and awards program should have a dedicated budget and be a focus of management in order to be successful. Agencies should also be able to retain some portion of the revenue raised from auctions of spectrum that they return for reallocation for alternative purposes.
- *In-kind contributions.* Outside parties should be allowed to make in-kind contributions to government agencies to facilitate any improvements in spectrum efficiency, with adequate precautions to avoid any perception of improper influence over agency decision making.
- *The Commerce Spectrum Management Advisory Committee (CSMAC).* CSMAC should be used as an institutional mechanism to discuss, debate and develop new ideas for spectrum efficiency. The mandate of the CSMAC is up for renewal in 2011, so this would be an opportunity to write these responsibilities into its charter.
- *Procurement reform.* Spectrum efficiency should be included in the list of requirements in any radio frequency system acquisition proposal.
- *Mutual Benefit.* Agencies should be encouraged to seek out win-win situations, where the agency and the alternative user both benefit from sharing. Examples discussed included the following:
 - Sharing by radio astronomers on a temporal basis
 - Consolidating satellite earth stations used by different government agencies to provide for geographic sharing
 - Advantageous swaps of spectrum between government and commercial users such as where a portion of the spectrum has become less attractive for commercial purposes, but it still usable for government purposes

- Sharing arrangements that could also take advantage of the fact that wireless downlink traffic is 70 percent of the total
- Auctions or fees for commercial sharing so that the agency would generate revenue from making its spectrum available for commercial use

Spectrum Reform Legislation

The combination of the crisis in the availability of spectrum for wireless broadband and the need for revenue for deficit reduction have created a unique opportunity to implement substantial long-term spectrum reform both on the government side and on the commercial side.

Spectrum reform legislation has been on the congressional agenda. Several bills were introduced in the 111th Congress and others are expected to be introduced in the new 112th Congress. The FCC and the administration advocate legislation, and leaders of the relevant congressional committees were deeply involved in drafting legislation and holding hearings on spectrum reform.⁴⁵

The primary focus of the discussion was whether new legislation should be narrowly tailored to provide the FCC with incentive auction authority or whether it should contain additional reform measures, perhaps rising to the level of an omnibus reform bill embracing changes in spectrum management for both the private sector and government use of the spectrum. In the end, the group favored a more comprehensive approach.

A number of participants advocated for a narrow piece of legislation that authorized the FCC to move ahead with incentive auctions only. If Congress attempted broader legislation, they argued, it would inevitably become bogged down in controversy. They pointed out the difficulties of getting the inventory bill passed in the 111th Congress and warned that the attempt to craft comprehensive legislation might result in a significant delay in moving forward with incentive auctions, perhaps as long as 6 to 10 months. Given the extreme urgency in finding enough spectrum to meet the demand for wireless broadband, they recommended a narrow incentive auction bill.

Other participants pointed out that the incentive auction approach was itself likely to be very controversial. Some senators would raise questions about the incentive auction on the floor. They might view incentive auctions favorably because they would raise some revenue, but they could also be concerned that less than 100 percent of the revenue raised would go to the government. Especially in light of the budget and deficit concerns that were prominent in the 2010 mid-term election, these senators might have significant concerns about allowing incumbents to retain any proceeds from an auction. They could conceivably hold up the legislation on the Senate floor if their concerns were not addressed.

Advocates of more comprehensive legislation warned against trying to take a piecemeal approach. Congress addresses complex issues like spectrum management only once in a great while. Once Congress passes a bill addressing spectrum issues, they will move on to other issues, even if they have only addressed one aspect of the spectrum management problem. If there is a need for other measures, this would be the opportunity to move forward with them because another chance to do so might not arrive for a long time.

Some participants warned that some in Congress were looking at auction authority solely as a revenue raiser to lower the federal deficit and others were looking to dedicate revenue from auctions to other purposes. For example, S. 3756 introduced by Senator Jay Rockefeller (D-WV), would require that any revenue raised from an incentive auction below \$11 billion be devoted to the construction, operation and maintenance of a national public safety network, and incentive auction revenues that exceed \$11 billion be devoted to specific projects unrelated to improving the efficiency of the federal use of spectrum.⁴⁶ In this context, spectrum auctions would raise billions of dollars but could not be viewed as the way to balance the budget.

A big issue is the legislative chicken and egg problem, where Congress will want to know exactly how incentive auctions will work in great detail, and the FCC will be unable to commit resources to develop the details until it knows, with a reasonable degree of certainty, that it will get the authority. In addition, legislation authorizing incentive auctions involves a larger range of committees on the Hill, including the appropriations committees who will want to know how much will be given back to the incumbents.

In the end, the question comes down to a matter of legislative tactics. The group as a whole, however, seemed favorably inclined, on substantive grounds, to legislation that embodied the following elements:

- Authority for the FCC to hold incentive auctions that allow incumbent licensees to retain some portion of the revenue raised from the auction of spectrum they currently occupy
- Funding for agencies to engage in long-range strategic planning
- Funding for an innovation fund to create and implement a plan to facilitate research, development, experimentation and testing by researchers to explore innovative spectrum-sharing technologies
- Improvements in CSEA and funding to provide for these improvements

Linking incentive auctions and the revenue that would be generated from these auctions to needed government spectrum reforms is the only practical way to provide the revenue the government would need to implement these key internal reforms.

There is crucial revenue needed to fund the long-range planning and the innovation that is needed to improve the government spectrum management process. Participants suggested building on the mechanism in CSEA, which currently allows for money from the auction of repurposed federal spectrum to be used to defray the costs of moving government users to different spectrum. The principle would be akin to how the gas tax is dedicated to the highway trust fund. Under this approach, some portion of the revenue raised from spectrum auctions would be recycled into a fund dedicated for further improvements in efficient use of spectrum by government through long-term planning and research and development in innovation. This revenue could be viewed as “seed” money for long-range planning, research and development and innovation.

In addition to a set-aside from federal auctions of spectrum, participants discussed using a variety of fees to pay for long range planning, CSEA 2.0 and the innovation fund. One type of fee is a device certification fee. Whether the spectrum used is licensed or unlicensed, no device

can operate without being certified by the FCC. A small, one-time fee could be levied on the certification of these devices. Over time this device certification fee could raise a substantial amount of revenue. This is similar to the access fee currently in place for TV white space devices to access the database that provides information about uses of the TV spectrum.

Some participants supported the idea that the use of the spectrum by non-government entities could be subject to a fee, and the revenue from this on-going charge could be used to fund improvements in the use of government spectrum. They also noted that if federal users of spectrum were required to pay a spectrum fee for their spectrum

In these tight budgetary times, any spectrum reform bill would have to be budget neutral or positive.

use, this revenue could be deposited in a spectrum improvement fund that would be returned, in effect, to the federal users to pay for further spectrum use efficiencies.

Legislation introduced by Senator Olympia Snowe (R-ME) embodied some of these ideas on dedicated use of spectrum fees. It authorizes the Department of Commerce to assess and collect a spectrum fee on federal spectrum uses and requires

that 60 percent of this fee be dedicated to a spectrum efficiency and relocation fund for federal spectrum uses.⁴⁷

Participants in the conference welcomed this approach toward making funds for improving the federal use of the spectrum self-sustaining. They did not, however, endorse the idea of a spectrum fee as way to raise revenue. The group did think that if spectrum fees on either federal or non-federal users were adopted, then some or all of the revenue from these fees should be returned to the government for increases in spectrum efficiencies.

Despite these concerns, some part of revenue raised through spectrum auctions or fees should be dedicated to improvements in the federal use of spectrum. Additionally, a goal of federal spectrum management policy should be to create a self-sustaining model, where revenues from improvements in federal spectrum use are devoted, in part, to further improvements in federal spectrum use. In these tight budgetary times, the group concluded that any spectrum reform bill would have to be budget neutral or positive.

Conclusion

Conference participants divided into two groups: management of the non-governmental use of the spectrum and the management of the federal government use of the spectrum. In both cases, the discussion focused on process reforms intended to improve the efficiency with which spectrum is used. But there was an interesting interaction between process concerns and substantive concerns and there was an ambiguity in the idea of efficiency in spectrum management that concealed very different goals for spectrum management.

In the area of non-governmental spectrum management, participants recommended that Congress grant the FCC authority to hold incentive auctions and that the FCC make greater use of its existing authority to loosen service restrictions on incumbent licensees. In the area of federal spectrum management, participants recommended a policy of long-term strategic planning, improvements in the operation of the Commercial Spectrum Enhancement Act, and the introduction and maintenance of a spectrum innovation fund. They also recommended spectrum reform legislation that would authorize and provide funding for these process reforms.

A key point to note, however, is that these proposed process reforms were driven by substantive concerns about the current use of the spectrum. The National Broadband Plan, the presidential directive, the theme of the FCC's Spectrum Summit and the Commerce Department's reports each worked from the premise that wireless broadband services need more spectrum. Indeed, the underlying assumption of the conference itself was that there needs to be more spectrum suitable for wireless broadband. This is the "looming spectrum crisis:" a failure to deliver what industry experts and government officials almost uniformly agree is the best and highest use of the spectrum. Conference participants largely adopted this perspective. They generally embraced the view that private parties would provide the most value to society if they used spectrum currently used for broadcast services for wireless broadband services instead. In the federal area, there was a tacit consensus that the existing users of government spectrum should use less of it. The entire point of the discussion about approaches to clearing and sharing government spectrum was based, as one participant put it, on the "fait accompli that you want to either clear or share the government spectrum." Again, the

consensus seemed to be that it would benefit the nation if private parties were allowed to use some of the spectrum now used for government purposes for the provision of wireless broadband instead.

On the one hand, the process reforms are intended to look beyond the current looming spectrum crisis and to put in place a mechanism that could, over the long run, allow large numbers of people acting in a decentralized way to determine spectrum uses. On the other hand, there is a substantive goal behind the process reform—to get more spectrum into the hands of those who would use it to provide wireless broadband. The long-term process reforms that the group recom-

mends are structured to produce this short-term outcome.

...the judgment of government policymakers should not be the sole determinant of what is a more attractive use of the spectrum.

In principle, the long-term process reforms of incentive auctions, flexible use and improvements in clearing and sharing government spectrum are intended to be agnostic about the “right” use of the spectrum. The entire point is supposed to be that the judgment of government policymakers should not be the sole determinant of

what is a more attractive use of the spectrum. Their role is to set up a process that substantially allows the desires and wishes of decentralized actors to determine the uses that are best for society. But process and outcome interact, and it was hard to avoid the suspicion that the participants in the conference would not have endorsed process reforms that would have put insuperable obstacles in the path of allowing wireless carriers to obtain large amounts of spectrum for wireless broadband. Participants seemed to accept the idea that this use was the highest and best use of the spectrum and process should be arranged to ensure or make likely that this end be achieved.

Two notions of efficiency are at play in this discussion. One is the idea that the same results can be achieved with less expenditure of resources, including spectrum. This is essentially a notion of cost effectiveness, achieving a given goal with the least cost. Different measures of this kind of cost effectiveness might be appropriate for different spectrum uses:

broadcast, personal communications services, non-communications services such as radar, satellite, passive listener uses such as radio astronomical uses, and short range uses such as Wi-Fi and Bluetooth. But they all have in common the idea of the least resource intensive way to achieve given purposes. The cost-effectiveness idea applies especially in the discussion of federal use of the spectrum, where some participants were inclined to think that the lack of market pressures and prices creates an incentive for the overuse of spectrum to achieve mission goals. Using this notion of efficiency, one goal of government spectrum management is to eliminate this waste of social resources.

The second notion of efficiency is that one use of the spectrum is better than another use. This is the social welfare notion of directing resources to their best use. Existing users might be exploiting the spectrum for its designated purpose in the least resource intensive way, but since there are other uses that are more valuable, these resources are not being used as efficiently as they could be. This cost-benefit notion of efficiency came out most clearly in the discussion of private sector use of the spectrum, where many participants seemed to think that broadcaster use of the spectrum was less valuable than wireless broadband use of the spectrum.⁴⁸ The goal of private sector spectrum management is to shift spectrum resources out of low-value uses and into higher-value uses.

But occasionally the two ideas cross. Some think that commercial use of spectrum for wireless broadband is a more valuable social purpose than the current use of spectrum for government purposes. Applying the social cost-benefit idea to government use of the spectrum in this way suggests that government-used spectrum should be reallocated, cleared or shared to allow this higher valued use of spectrum. The implicit idea is that the goal of government spectrum management is not just cost-effectiveness, but to promote the most valuable use of spectrum, whether by government or by private parties.

These implicit ideas were not clearly articulated, but they arose around the edges of the discussions. Some participants, for example, raised the idea that markets cannot evaluate the government use of spectrum because those purposes are inherently public and are not subject to marketplace trading. Nevertheless, the group formed no

consensus on the idea that government programs should be subjected to this kind of social cost-benefit test. There is clearly a tension regarding the goals of government spectrum management that deserves to be discussed more clearly and openly.

The conference concluded with a clear consensus in some areas of spectrum policy reform and a sense that there are substantial opportunities for progress to be made in spectrum reform through the legislative process. The conference participants recommended legislation that would grant the FCC authority to hold incentive auctions; authorize and fund the ability of agencies to engage in long-range strategic spectrum management planning; create and maintain a spectrum innovation fund; and fund various improvements in the commercial spectrum enhancement. The hope and intention of this report is that these ideas might prove to be useful to policymakers engaged in this difficult but worthwhile process.

Further Developments after the Roundtable

Several developments after the conference advanced the ideas discussed in this report. Together these developments make it more likely that spectrum reform legislation will move higher on the congressional agenda, and increase the probability that reform legislation will become law in the 112th Congress.

On November 30, 2010, the FCC proposed initial steps to open the TV spectrum to new wireless broadband services. The FCC indicated that it would like to reclaim as much as 120 MHz of broadcast spectrum. It proposed rules to reclassify broadcast spectrum so that it could be used for wireless broadband, to allow channel sharing by broadcasters, and to increase opportunities for flexible use.⁴⁹

In a January 2011 speech to the Consumer Electronics Association, FCC Chairman Genachowski reiterated his call for incentive auctions. He made it clear that finding new spectrum for wireless broadband

is “at the top of the FCC’s 2011 agenda.” He noted that the FCC had “begun to pave the way for incentive auctions, moving to lift technical restrictions so prime bands of spectrum can be freed for flexible broadband use.” These initiatives prepared the way for incentive auctions “so that we can move quickly should Congress give us the authority to conduct them.” He concluded that “the time is right for speedy action. Bipartisan bills were introduced last year in Congress. President Obama has endorsed this proposal.”

In his State of the Union speech on January 25, 2011, President Obama pushed spectrum issues onto the national agenda:

Within the next 5 years, we’ll make it possible for businesses to deploy the next generation of high-speed wireless coverage to 98 percent of all Americans. This isn’t just about — (applause) — this isn’t about faster Internet or fewer dropped calls. It’s about connecting every part of America to the digital age. It’s about a rural community in Iowa or Alabama, where farmers and small business owners will be able to sell their products all over the world. It’s about a firefighter who can download the design of a burning building onto a handheld device, a student who can take classes with a digital textbook or a patient who can have face-to-face video chats with her doctor.

The administration also announced its support for allocating the D-Block for public safety purposes.⁵⁰ This decision was widely viewed as giving life to the legislation introduced by Senator Rockefeller, S. 28 the Public Safety Spectrum & Wireless Innovation Act, which combines allocation of spectrum for public safety with giving authority to the FCC to hold incentive auctions.⁵¹ While the participants in the conference did not endorse any position on the use of the D-Block for public safety, the administration’s position makes spectrum reform legislation more likely.

Notes

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39. The FCC's National Broadband Plan called for legislation granting authority "to NTIA to impose spectrum fees on users of government spectrum." The Commerce Department's 10-Year Plan and Timetable reiterates this idea.
40. Section 6(b) of S. 3610 calls for a spectrum fee.
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42. See, for example, Department for Business Enterprise and Regulatory Reform, *Forward Look, A Strategy for Managing Major Public Sector Spectrum Holdings*, April 2009, <http://www.berr.gov.uk/files/file46420.pdf>. This report describes the UK's use of Administered Incentive Prices (AIP), which is defined at pp. 14–15 as a "spectrum management tool used by Ofcom to simulate market conditions by signaling to spectrum users the opportunity cost that their use imposes on other spectrum users. AIP is intended to ensure that decisions by spectrum planners and users reflect the value the spectrum has—not just to themselves but also to other users. AIP has been used since the late 1990s and the government decided at that time that public sector spectrum users should pay AIP on a comparable basis to the private sector."
43. Harold Feld and Gregory Rose, "Breaking the Logjam: Some Modest Proposals for Enhancing Transparency, Efficiency and Innovation in Public Spectrum Management," June 3, 2010, 2, <http://www.publicknowledge.org/pdf/pk-fed-spectrum-transparency-whitepaper.pdf>
44. Section 204 of CSEA specifies in sub-section d(3) that Spectrum Relocation Fund balances return to the general fund of the Treasury 8 years after the associated auction. The AWS auction funds were deposited in December 2006 and will no longer be available for spectrum efficiency purposes after December 2014.
45. Participants were aware of the discussion of whether the D-Block spectrum should be auctioned to a private carrier with the aim of making spectrum available for public safety users or whether it should be allocated directly to public safety for the construction and operation of a dedicated public safety network. S. 3756, the legislation by Senator Jay Rockefeller addressing these issues, had been introduced in the 111th Congress and linked to the grant of incentive auctions. Participants did not devote much time to this issue, however, and did not reach any consensus on it.
46. See Sec. 204(b)(1)(B) of S. 3756, the Public Safety Spectrum and Wireless Innovation Act, introduced by Senator Jay Rockefeller, August 5, 2010, which requires that all proceeds from incentive auctions below \$11 billion be devoted to the construction, maintenance and operation of a national public safety network and auction revenue above \$11 billion be made available "for growth-enhancing infrastructure projects, including the NextGen aviation navigation system, development of high-speed rail transportation, and Smart Grid electrical power transmission and management technology."
47. See the requirements for spectrum fees and set-asides set out in Sec. 6(b) of S. 3610, the Spectrum Measurement and Policy Reform Act, introduced by Senator Olympia Snowe, July 19, 2010.
48. See Bazelon study

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APPENDIX

***The Search for 500 MHz:
Spectrum for the Next Generation of Wireless***

November 14-16, 2010
Aspen Wye River Conference Center
Queenstown, Maryland

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Silicon Flatirons Center
and
Adjunct Professor
University of Colorado at
Boulder

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

Thomas Hazlett

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Matthew Hussey

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Charla Rath

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Wireless Innovation Forum

Stuart Timerman

Director
Defense Spectrum Organization

Jennifer Warren

Vice President, Technology
Policy and Regulation
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Philip Weiser

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About the Author

Mark MacCarthy joined the Software and Information Industry Association in February 2011 as Vice President for Public Policy. He directs their public policy initiatives in the areas of intellectual property enforcement, information privacy, cybersecurity, cloud computing and the promotion of educational technology. He is also an adjunct faculty member at Georgetown University, where he teaches courses in information privacy and tech policy in the Communication, Culture, and Technology Program, and courses in political philosophy in their Philosophy Department. His previous public policy experience includes senior positions with Visa, Inc., the Wexler Walker Group and Capital Cities/ABC and the Energy and Commerce Committee of the U.S. House of Representatives. He holds a Ph.D in philosophy from Indiana University and an MA in economics from the University of Notre Dame.

Select Publications from the Aspen Institute Communications and Society Program

Rewriting Broadband Regulation, by David Bollier

The report of the 25th Annual Aspen Institute Conference on Communications Policy in Aspen, Colorado, considers how the United States should reform its broadband regulatory system. Participants looked at international models and examples and examined how data and communications should be protected in the international arena. The resulting report explores a range of policies for U.S. broadband regulation, many of them derivative of the National Broadband Plan adopted by the Federal Communications Commission only a few months before the conference.

Participants also ventured into new and interesting territory with the novel concept of “digital embassies.” They saw this as a way of dealing with jurisdictional issues associated with the treatment and protection of data in the cloud, i.e., data that is provided in one country but stored or manipulated in another. The concept is that the data would be treated throughout as if it were in a kind of virtual embassy, where the citizenship of the data (i.e., legal treatment) goes along with the data. This policy seed has since been cultivated in various other regulatory environments. 2011, 37 Pages, ISBN Paper: 0-89843-548-X, \$12.00

Scenarios for a National Broadband Policy, by David Bollier

The report of the 24th Annual Aspen Institute Conference on Communications Policy in Aspen, Colorado, captures the scenario building process that participants used to map four imaginary scenarios of how the economy and society might evolve in the future, and the implications for broadband policy. It identifies how certain trends—economic, political, cultural, and technological—might require specific types of government policy intervention or action. 2010, 52 pages, ISBN Paper: 0-89843-517-X, \$12.00

Rethinking Spectrum Policy: A Fiber Intensive Wireless Architecture, by Mark MacCarthy

Rethinking Spectrum Policy: A Fiber Intensive Wireless Architecture is the report resulting from the Aspen Institute Roundtable on Spectrum Policy, held at the Aspen Wye River Conference Center in November 2009. Written by rapporteur Mark MacCarthy, the report captures the insights of the participants, exploring innovative ways to respond to the projections of exponential growth in the demand for wireless services and additional spectrum. In addition to discussing spectrum reallocations, improved receivers, shared use and secondary markets as important components for meeting demand, the report also examines opportunities for changes in network architecture, such as shifting the mix between fiber and wireless. 2010, 58 pages, ISBN Paper: 0-89843-520-X, \$12.00

ICT: The 21st Century Transitional Initiative, by Simon Wilkie

The report of the 23rd Annual Aspen Institute Conference on Communications Policy in Aspen, Colorado addresses how the United States can leverage information and communications technologies (ICT) to help stimulate the economy and establish long-term economic growth. The report, written by Roundtable rapporteur Simon Wilkie, details the Aspen Plan, as developed in the summer of 2008, prior to the economic meltdown beginning in September 2008 and prior to the election of Barack Obama as President. The Plan recommends how the Federal Government—through executive leadership, government services and investment—can leverage ICTs to serve the double bottom line of stimulating the economy and serving crucial social needs such as energy efficiency and environmental stewardship. 2009, 80 pages, ISBN Paper: 0-89843-500-5, \$12.00

A Framework for a National Broadband Policy, by Philip J. Weiser

While the importance of broadband access to functioning modern society is now clear, millions of Americans remain unconnected, and Washington has not yet presented any clear plan for fixing the problem.

Condensing discussions from the 2008 Conference on Communications Policy and Aspen Institute Roundtable on Spectrum Policy (AIRS) into a

single report, Professor Philip Weiser of the University of Colorado at Boulder offers a series of specific and concrete policy recommendations for expanding access, affordability, and adoption of broadband in the United States. 2008, 94 pages, ISBN Paper: 0-89843-484-X, \$12.00

The Future of Video: New Approaches to Communications Regulation,
by Philip J. Weiser

As the converged worlds of telecommunications and information are changing the way most Americans receive and relate to video entertainment and information, the regulatory regimes governing their delivery have not changed in tune with the times. These changes raise several crucial questions: Is there a comprehensive way to consider the next generation of video delivery? What needs to change to bring about a regulatory regime appropriate to the new world of video? The report of the 21st Annual Conference on Communications Policy in Aspen, Colorado, outlines a series of important issues related to the emergence of a new video marketplace based on the promise of Internet technology and offers recommendations for guiding it into the years ahead. 2006, 70 pages, ISBN Paper: 0-89843-458-0, \$12.00

Clearing the Air: Convergence and the Safety Enterprise, by Philip J. Weiser

The report describes the communications problems facing the safety enterprise community and their potential solutions. The report offers several steps toward a solution, focusing on integrating communications across the safety sector on an Internet-Protocol-based backbone network, which could include existing radio systems and thus make systems more dependable during emergencies and reduce costs by taking advantage of economies of scale. The conference participants stressed that the greatest barriers to these advances were not due to lagging technology but to cultural reluctance in adopting recent advances. Writes Weiser, "The public safety community should migrate away from its traditional reliance on specialized equipment and embrace an integrated broadband infrastructure that will leverage technological innovations routinely being used in commercial sectors and the military." 2006, 55 pages, ISBN Paper: 0-89843-4, \$12.00

Reforming Telecommunications Regulation, by Robert M. Entman

The report of the 19th Annual Aspen Institute Conference on Telecommunications Policy describes how the telecommunications regulatory regime in the United States will need to change as a result of technological advances and competition among broadband digital subscriber line (DSL), cable modems, and other players such as wireless broadband providers. The report proposes major revisions of the Communications Act and FCC regulations and suggests an interim transitional scheme toward ultimate deregulation of basic telecommunications, revising the current method for universal service subsidies, and changing the way regulators look at rural communications. 2005, 47 pages, ISBN Paper: 0-89843-428-9, \$12.00

Challenging the Theology of Spectrum: Policy Reformation Ahead,
by Robert M. Entman

This report examines the theology of spectrum—that is, the assumptions and mythology surrounding its management and use. The report looks at how new technologies affecting spectrum, such as software-defined radio, can challenge the conventional wisdom about how spectrum should be managed. Such innovations allow for access to unused frequency space or time on frequencies that are otherwise licensed to an exclusive user. 2004, 43 pages, ISBN Paper: 0-89843-420-3, \$12.00

Spectrum and Network Policy for Next Generation Telecommunications,
by Robert M. Entman

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 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: operate the NGN on a price-deregulated basis and begin to address access regulation issues, secure the intellectual property rights of content suppliers, and adjust the system of subsidized pricing to bring about competitively neutral pricing. 2004, 92 pages, ISBN Paper: 0-89843-394-0, \$12.00

Balancing Policy Options in a Turbulent Telecommunications Market,
by Robert M. Entman

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, as well as new business realities, might affect current regulatory regimes for the telecommunications industries. The report includes an essay on spectrum management, “The Current Status of Spectrum Management,” by Dale Hatfield. 2003, 79 pages, ISBN Paper: 0-89843-370-3, \$12.00

Telecommunications Competition in a Consolidating Marketplace,
by Robert M. Entman

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. The report also includes an essay on an innovative approach to wireless regulation, “Opening the Walled Airwave,” by Eli Noam. 2002, 64 pages, ISBN Paper: 0-89843-330-4, \$12.00

Transition to an IP Environment, by Robert M. Entman

This report examines a “layered approach” to regulation. By viewing telecommunications in four separate layers—content, application, network, and data link—policy discussions can address concerns in one layer without negatively affecting useful existing policy in other layers. Also presented are beliefs that the growth of broadband should prompt a new discussion about universal service reform. The report also includes “Thoughts on the Implications of Technological Change for Telecommunications Policy,” by Michael L. Katz. 2001, 78 pages, ISBN Paper: 0-89843-309-6, \$12.00

Six Degrees of Competition: Correlating Regulation with the Telecommunications Marketplace, by Robert M. Entman

This report addresses basic conceptual questions about what the nature of regulation should be in a competitive, broadband future. It also examines how fundamental policy issues such as interconnection, mergers, spectrum allocation, jurisdiction, universal service, and consumer protection should be handled in the interim. The report also includes "Regulation: The Next 1000 Years," by Michael L. Katz. 2000, 65 pages, ISBN Paper: 0-89843-279-0, \$12.00

Reports can be ordered online at www.aspeninstitute.org/publications or by sending an email request to publications@aspeninstitute.org.

About the Communications and Society Program

www.aspeninstitute.org/c&s

The Communications and Society Program is 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 multi-disciplinary space in the communications policy-making 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 policy-making process and society.

The Program's projects fall into one or more of three categories: communications and media policy, digital technologies and democratic values, and network technology and social change. Ongoing activities of the Communications and Society Program include annual roundtables on journalism and society (e.g., journalism and national security), communications policy in a converged world (e.g., the future of video regulation), the impact of advances in information technology (e.g., "when push comes to pull"), advances in the mailing medium, and diversity and the media. The Program also convenes the Aspen Institute Forum on Communications and Society, in which chief executive-level leaders of business, government and the non-profit sector examine issues relating to the changing media and technology environment.

Most conferences utilize the signature Aspen Institute seminar format: approximately 25 leaders from a variety of disciplines and perspectives engaged in roundtable dialogue, moderated with the objective of driving the agenda to specific conclusions and recommendations.

Conference reports and other materials are distributed to key policymakers and opinion leaders within the United States and around the world. They are also available to the public at large through the World Wide Web, www.aspeninstitute.org/c&s.

The Program's Executive Director is Charles M. Firestone, who has served in that capacity since 1989, and has also served as Executive

Vice President of the Aspen Institute for three years. He is a communications attorney and law professor, formerly director of the UCLA Communications Law Program, first president of the Los Angeles Board of Telecommunications Commissioners, and an appellate attorney for the U.S. Federal Communications Commission.