INCENTIVES SUBCOMMITTEE REPORT

I. *Introduction and Background*

The Incentives Subcommittee seeks to foster the following outcomes:

- To promote more efficient use of spectrum in general
- To expand access to existing spectrum capacity, whether for meeting existing users' own demands, for reallocation, or for shared use
- To ensure that spectrum-based solutions are required and cannot be met with alternative systems/services
- To ensure the protection of systems serving important public needs, including military, public safety and other uses.

Spectrum in the United States is managed in different ways. Some is managed among commercial and other non-federal users by the Federal Communications Commission (FCC). The National Telecommunications and Information Administration (NTIA) manages the Federal use of spectrum. According to the Commerce Department's Office of Spectrum Management, federal agencies have exclusive use of 18.1% (629 MHz) of the "beachfront" frequencies between 225 and 3700 MHz, while non-federal users have exclusive licenses to 30.4% (1058 MHz). The remaining 51.5% is shared, with federal use primary and private sector use secondary.[1]

Under the existing regulatory regime, some bands of spectrum can be used for a wide range of applications; other bands are restricted to narrow, specific purposes. Beginning in the 1990s, flexible use licenses began to allow a steadily increasing share of non-Federal commercial licensees to transfer, lease or subdivide their spectrum rights. Some spectrum can easily be bought or sold to entities that value it most highly; other spectrum cannot easily be transferred; and still other spectrum cannot be transferred at all. In addition to transfers between users, some spectrum can easily be repurposed to different uses and different technology with limited regulatory action, whereas other spectrum has restrictions that limit or prevent such transitions. Frequency channels licensed for terrestrial television broadcasting are an example of the latter.

The net result is that some spectrum is used intensively and efficiently, while other spectrum is used inefficiently or not all. While nearly all valuable spectrum frequency bands are assigned to users, a 2005 study funded by the National Science Foundation (NSF) indicates that the vast majority of spectrum is not used in most locations and at most times even in the so-called

[1] Karl Nebbia, Director, NTIA Office of Spectrum Management, presentation to the Commerce Spectrum Management Advisory Committee (CSMAC), December 9, 2009.

"beachfront" bands below 3 GHz.[2] Across the country, this underutilized spectrum represents an enormous untapped capacity for broadband.

The efficiency or inefficiency of the use of spectrum would not matter if access to spectrum – and especially spectrum with the most desirable propagation characteristics – was not a limited resource. Many current users and potential users would like to use more spectrum, but simply cannot obtain additional spectrum resources. In some cases this is a question of the market price of spectrum being higher than they are willing to pay or capable of raising capital to pay for, but in other cases it is because of the transaction costs and uncertainty of acquiring spectrum that increases artificially the total cost. In other cases, there are regulatory barriers. For example, the frequency bands with the necessary technical conditions may be allocated to other services without flexible use.

In an open market, the issues described above would be resolved by the laws of supply and demand. Entities that valued spectrum the most would bid up the price of spectrum and purchase the spectrum from those who place a lower value on that spectrum. In such an open market, spectrum owners would face clear incentives: those who value the use of spectrum at more than the market-clearing price for spectrum are buyers; those who value it at less than the market-clearing price are sellers.

Spectrum markets in the United States are not such open markets; moreover, the market may not adequately reflect the highest purpose or use of the spectrum considering the spectrum-based public services provided at federal, state and local levels. While some spectrum is easily transferrable and does wind up with those who value it most, much of the spectrum cannot be easily transferred if at all. Much spectrum is limited by FCC rule as to its uses, and some of those uses in an open market would have greater or lesser value than others. Owners of spectrum that cannot easily be transferred (if it all) and those owners that have a limited use do not face clear incentives or price signals. No one can meaningfully offer to purchase their spectrum rights or to put those spectrum rights to higher-valued use. No one can determine whether their use of spectrum is above or below the market-clearing price because there is no market-clearing price.

Under these circumstances, current and prospective users of spectrum who place a high value on spectrum are denied the benefits of full access to spectrum. Current owners of spectrum use rights who place a low value on spectrum are often denied the option of being paid for either exclusive or shared access to their spectrum rights. The resultant inefficiencies could put U.S. global competitiveness and technological leadership at risk.

---

[2] The 2005 study measured actual spectrum frequency occupancy and use. It demonstrated in a mix of urban, suburban and exurban areas that the vast majority of the most valuable spectrum bands are vacant or unused for the majority of the time. The highest occupancy rate on the prime beachfront spectrum below 3 GHz was just 13 percent in New York City, while the average across locations studied was just 6 percent. Mark McHenry, "NSF Spectrum Occupancy Measurements: Project Summary," Shared Spectrum Company (August 2005), available at http://www.sharedspectrum.com/measurements/. McHenry's 2005 study collected frequency use data in six locations along the East coast in 2004 and documented an average total spectrum use of less than 10%. Specific findings over a day-long period included: 3.4% in Great Falls, Virginia; 6.9% in Vienna, Virginia (location 1); 11.4% in Arlington, Virginia; 13.1% in New York City; 1.0% in Green Back, West Virginia; and 11.7% in Vienna, Virginia (location 2). .

In 2005, the UK completed its Spectrum Framework Review where it examined and proposed changes to its spectrum management approach. The review recognized three different ways to manage spectrum: traditional "command & control," market mechanisms, and license-exempt. The review concluded that the balance between these spectrum management approaches should shift substantially toward market mechanisms, recognizing that a few areas will continue to require traditional approaches for the foreseeable future. These areas include situations where radio signals cross borders (e.g., satellite transmissions and low frequency transmissions), where international mobility is critical (e.g., maritime and aeronautical applications, including communications and radar), and situations subject to binding EU agreements.[3] The Incentives Subcommittee recognizes that a shift toward market mechanisms and other appropriate incentives that encourage more efficient spectrum allocation and use will also be beneficial in the U.S.

II. *Consideration of Spectrum Fees*

The FCC's National Broadband Plan advocates expanding incentives and mechanisms to reallocate or repurpose spectrum and that "Congress should consider granting authority to the FCC to impose spectrum fees on license holders and to NTIA to impose spectrum fees on users of government spectrum." NTIA published a plan regarding incentives that promote greater efficient and effective use of spectrum, including a section indicating an intent to carefully consider the extent to which fees would be effective in increasing efficiency of federal uses of spectrum, and how they could be applied fairly.[4]

The federal government has limited options to obtain a more efficient allocation or usage of the spectrum resources assigned for government use. The lack of flexibility of use of much of this spectrum and its lack of transferability cannot easily be relaxed while maintaining mission integrity.

One step towards greater efficiency of spectrum usage would be for the federal government to apply a simple fee on spectrum. The fee would have the effect of providing an incentive for those who value their assigned spectrum – or portions of it – little if at all to reduce or abandon their spectrum holdings or to use them more efficiently. It could also provide incentives for future spectrum-using programs planned by government agencies to give greater consideration to efficient use in the choice of technologies, systems or services.

Under one concept, the fee could be a simple flat rate per megahertz pop (MHz-pop), quite likely starting at a rate considerably below the market-clearing price for flexible-use spectrum, but then increasing gradually toward the market price over a period of years. This gradual phasing in of user fees that reflect the actual opportunity cost of the resource would recognize that many systems cannot be replaced or updated for many years. A gradual phase-in would also give users

[3] http://www.ofcom.org.uk/consult/condocs/sfr/sfr2/; *see also Spectrum Policy Task Force Report*, ET Docket No. 02-135 (Nov. 2002) (reaching similar conclusions), *available at* http://www.fcc.gov/sptf/reports.html.
[4] U.S. Department of Commerce, *Spectrum Management for the 21st Century: Plan to Identify and Implement Incentives that Promote more Efficient and Effective Use of Spectrum* (undated), available at http://www.ntia.doc.gov/osmhome/reports/Incentives_Plan.pdf

time to budget for paying spectrum fees, and to have the rate adjust to the efficient market-clearing price over time.

Assessing the fee on a MHz-pop basis may be most appropriate, since spectrum bands in more densely populated areas are generally more intensively used and more highly valued for commercial use than the same frequencies in rural or small town markets. A fee using differential rates will better internalize opportunity costs if it reflects the relative scarcity and market value of spectrum due to location, propagation characteristics, and whether the user has exclusive or shared use of the band. For this reason, fees would likely be lower for spectrum in higher frequency bands, for secondary and encumbered users, and for those who share a spectrum band with other services and/or users. Generally, regardless of the role of fees, efficiency would also be greatly enhanced if spectrum were able to be used more flexibly.[5]

The mechanics of both what rate to apply and how to apply the fee would take substantial care and detail in preparing. Such detail is beyond the scope of this report. This report recommends that the NTIA and FCC study the implementation of such a spectrum fee and solicit input from both federal government users and commercial users who might be subject to fees. Some of the issues to be considered include the following:

- What would the fee structure look like for FCC license holders?
- What would the fee structure look like for government users?
- What frequency bands and what services should be subject to fees?
- What frequency bands and what services should not be subject to fees?
- How would the fee be allocated among primary and secondary users in the same band?
- How would the fee be allocated among federal and non-federal users sharing the same band?
- How would the fee be allocated among licensed and unlicensed users in the same band?
- How would federal agencies budget for a fee?
- What would the use be for the receipts raised by the fee?
- Assuming that implementation of spectrum fees would require a statutory provision, what would be the statutory language?
- In which federal agency would the administration of such a fee be housed?
- Which if any licensees or users of spectrum would be excluded from the fee structure?
- What metrics should regulators collect to determine the effectiveness and rates for fees on an ongoing basis?

As a matter of economics, without market power concerns, there do not appear to be substantial structural inefficiencies in the use of non-governmental spectrum to the extent that users face the full opportunity cost of spectrum use. Non-Federal licensees with (1) rights to resell licenses, (2) very flexible rights of usage, and (3) the ability to recover value from repurposing the use of the spectrum, can realize most if not all of the opportunity cost of their spectrum use. That is, even

[5] The practical impact on federal agencies would need to be assessed, as well as the possibility of increased budgets to pay for any federal user fees.

if the licensees of a band of completely flexible-use spectrum have never compensated the public for use of the resource, the current spectrum rights holder nonetheless has an incentive to use the band in a manner that maximizes its economic self-interest.

There are at least two exceptions where non-governmental spectrum users do not realize the full opportunity cost of spectrum use. First, there are areas where spectrum use is restricted – such as broadcast television – and where the licensees do not have flexibility in repurposing the spectrum to alternative uses. To achieve the goal of more efficient spectrum use, granting or auctioning flexible usage rights should make a large improvement. Instituting fees on these uses would be at best an indirect mechanism to correct for this government failure to design property rights more efficiently because it would not lead to repurposing of spectrum to more highly-valued uses if such uses were precluded.

Second, there are bands such as the 450-470 MHz private radio band where users do not have licenses that make them realize the full opportunity cost of their spectrum use. In these bands, spectrum coordinators are supposed to work to accommodate all entrants to the band. As a result, if a user adopts a more efficient technology for its use, the benefits redound to the benefit of new users who might be able to fit into the band and existing users who have a better chance of clear communications. In this case, it might be possible to use appropriate fees to get users to adopt appropriate efficient technology.

[Consider adding a third exception for unlicensed devices using the spectrum?]

For government spectrum, there are two related margins on which to promote efficiency: allocating spectrum among government users; and allocating spectrum between the government and the market. The Incentives Subcommittee has focused attention on different mechanisms to try to improve spectrum use on both of these fronts: *viz*., spectrum fees and, as discussed in Sections III and IV below, a Spectrum Innovation Fund (to reimburse agencies for the cost of vacating and/or sharing underutilized spectrum bands) and adding more substance and "teeth" to the requirements of Office of Management and Budget Circular A-11, which requires that federal agencies take the market value of spectrum into account when procuring new spectrum-using systems.

Whatever mechanisms are used to improve spectrum efficiency, they should take into account the importance of transition times. Spectrum-based systems and networks require upfront design and investment. Hence a flash cut to a new mechanism could risk disrupting an agency's core mission. As a result, any change should be announced well in advance and should be phased in gradually. Setting a process in place is also important to minimize subsequent opposition that would prevent ultimate use of the mechanisms at the time they are to be implemented.

The implementation of an Administrative Incentive Pricing (AIP) mechanism in the United Kingdom by Ofcom provides some guidance for thinking about spectrum fees for government users. In Ofcom's 2009 Policy Evaluation Report, Ofocm stated the following:

> We believe that, in the main, AIP has met its primary objective in helping to incentivise spectrum users to consider more carefully

> the value of the spectrum they use alongside that of other inputs, and to take decisions that are more likely to lead to optimal use of the available spectrum. Because each individual user's decisions reflect their particular circumstances and objectives, improvements in spectrum allocation are difficult to attribute, with confidence, solely to the influence of AIP. However in the course of this evaluation we have identified a number of important actions by users, in the period since AIP has been implemented, where we believe AIP may have contributed to incentivising more efficient use.[6]

Several lessons can be learned from the UK experience with AIP. First, the goal should remain efficient usage of spectrum, not to attempt to have users "give back" spectrum or to generate new revenue. The UK's experience to date is that while fees have resulted in the return of some spectrum from government agencies, the spectrum turned over was as yet essentially unused and had limited value for the commercial sector. The effectiveness of an AIP process cannot be measured by the amount of spectrum given back for several reasons: first, the government may be repurposing it to other government users; second, the initial allocation and/or assignment to the federal user is close to efficient; or third, changes take time to effectuate because of legacy system investment. Moreover, while it may not be feasible for a user to vacate a band, fee reductions in exchange for cooperating in opening unused capacity for band sharing by other users could provide the incentive needed to open much of the vast majority of spectrum that actual use measurements indicate are grossly underutilized.

A second lesson is that once fees are set, it may be difficult to change them in the future. AIP fees initially imposed by the Ofcom were set at approximately 50% of the level that was thought to be appropriate. Instead of having a mechanism in place to increase the level to be more appropriate, the fees appear to have become fixed at levels substantially below-market.[7] Fees should not ultimately be set at a level so far below the market-clearing price.

Third, spectrum fees imposed on government use face objections from some parties that spectrum-based services provide intangible public benefits in exchange for access to this public resource, and that transaction costs are undervalued. These concerns have not affected the UK experience detrimentally, which suggests that a carefully designed AIP system can mitigate these concerns. Additionally, the valuation of intangible assets is normal business practice. Various models exist for determining the fee that should be charged for spectrum, and these models can be adjusted to include intangible factors.[8]

---

[6] Policy Evaluation Report: AIP, Ofcom, 3rd July 2009, http://stakeholders.ofcom.org.uk/binaries/research/spectrum-research/evaluation_report_AIP.pdf

[7] A later independent review commissioned by Ofcom called for AIP to be applied at more realistic levels. The UK agreed and updated its original spectrum valuation work. http://stakeholders.ofcom.org.uk/binaries/consultations/spec_pricing/statement/statement.pdf

[8] 'FORWARD LOOK: A Strategy for Management of Major Public Sector Spectrum Holdings," April 2009, http://www.berr.gov.uk/files/file46420.pdf, discusses the UK's experience.

Some subcommittee members stress that several additional lessons learned from the UK experience with AIP warrant additional consideration. First, fees in the UK are not determined by the open market through an auction process and do not reflect the market price of spectrum or the precise opportunity cost of alternative spectrum uses. Rather, fees reflect the fee-setters' estimate of the appropriate price to meet the desired objectives. Attempting to set a "market-based" value on government spectrum can be difficult given those spectrum bands are not sold, traded or leased on the commercial market; nor for many spectrum-based federal uses are there commercial analogues or even substitutes. Second, the opportunity cost includes factors such as enabling scientific exploration and ensuring national security. In order to ensure an Administration's ability to provide essential government services and its policy objectives are satisfied, it may be necessary to establish a band-specific, demand-specific approach to determining whether a fee is appropriate and, if so, to setting the amount of the fee. Third, fees based on AIP are paid by the majority of commercial and government spectrum users in the UK for access to scarce spectrum that has not been auctioned.

Circular A-11 could serve as a point of departure to inform for spectrum fees. Section 33.4 calls upon agencies to no longer regard spectrum as a "free resource" and to estimate the value of the spectrum they use "based on recent prices of similar bands in spectrum auctions, or through other estimation methods." Section 33.4's valuation process could, if properly implemented, provide the foundation for a greater use of market mechanisms as part of a strategy for improved spectrum management.

There may be some differences in systems using spectrum for the first time (new acquisitions of spectrum) and existing users of spectrum. We think it is potentially important for new systems to realize the full opportunity cost of their spectrum use immediately because of the substantial sunk investment in new networks and equipment that may be long-lived. However, treating new systems and changes to existing systems differently will lead to incentives for agencies to maintain older inefficient systems if spectrum charges for older systems are substantially lower. As a result, it is important to have a clear and relatively rapid time path for equalization of charges for new and existing systems.

There is some concern that government agencies will not be able to afford the spectrum that they need to fulfill their missions. This concern is one reason why it is important to publicize the fees well in advance of their implementation, provide certainty about the fee levels for a reasonable amount of time into the future (possible a rolling 5–year window of future fees), and gradually introduce the fees (e.g., 20% per year over 5 years).

Some subcommittee members expressed concern, however, that fees do not fit into the government's annual appropriations process and new appropriations to cover fees are neither realistic nor perhaps warranted in the current budget environment. In their view, this issue must be addressed before fees for government use of spectrum could be considered. These members are concerned that either the funding would be appropriated or essential services and missions would be impacted, neither of which may be an "efficient" outcome. Other subcommittee members noted that "the current budget environment" argument is not applicable – government agencies would be paying fees to the government so that there would be no overall budget impact if government agencies did not change behavior.

There is also some concern that fees will have *no effect* because agencies will be assured additional funds for their spectrum needs, or because the fees will be treated as general "overhead" and not trickle down as a significant consideration for the staff actually designing, procuring or operating spectrum-dependent systems. While budget increases to pay spectrum fees are possible (and possibly likely in the very short term), over time budget officers will see the true cost of using spectrum and better be able to understand the tradeoffs between spectrum use, capital investment and other techniques to accomplish missions. In a well-run agency, responsibility for choices based on these tradeoffs will indeed be pushed down to the operational level. In the event that spectrum fees have no effect, the cost of spectrum fees will also be relatively small, because the transaction costs of determining and administering a set of fees is likely to be small relative to the value of spectrum at issue. As a result, the downside risk of no effect is low.

Overall, it is important to evaluate incentive mechanisms to see how they increase the efficient use of spectrum overall and to rationalize the use of spectrum within the government. Spectrum fees, to the extent that they are applied to users that do not realize the opportunity cost of spectrum, provide one mechanism to increase efficient use of spectrum.

At the same time, decisions regarding fees for spectrum use must take into account a host of other sometimes divergent factors. These include: maximizing efficiency and flexibility; avoiding harmful interference; enabling specific capabilities; taking technical characteristics (e.g., propagation) into account; sustaining essential government services and meeting other policy objectives; and considering potential international implications and government appropriations processes. Indeed, the far-reaching consequences of user fees on government users are particularly relevant when considering international access to spectrum, which affects a wide range of operations, including satellite systems, national security operations and NASA.[9] In order to foster the outcomes described in the background section (i.e., efficient use, expanded access, assurance that spectrum-based solutions are required, and ensuring protection of systems serving important public needs), a holistic approach to spectrum management is needed.

In considering fees, it is important to clearly articulate and agree on the intent of the fee. The Incentives Subcommittee focus was not to drive users out of frequency bands by introducing costs for spectrum access, but rather to try to drive greater efficiency in an environment where both federal and non-federal users are experiencing great increases in need for bandwidth, both domestically and internationally. Fees should not be used simply to reallocate frequency bands from one service to another; instead, technical and economic considerations should drive this process. Consideration of fees also should not be limited to Federal users of the spectrum.

The following additional considerations must be taken into account:

[9] For example, a domino effect could occur should the U.S. impose fees on domestic spectrum use, in terms of other countries then seeking to monetize spectrum access required by U.S. users abroad. For all countries where the U.S. seeks spectrum access, such fees could pose a potential source of new revenue. At the same time, for the U.S., such fees could pose a new level of budgetary and planning risk. Further, for some countries with an adversarial posture, spectrum fees could also become a lever against U.S. security interests. Thus, for U.S. national security users, there could be downstream implications given the sheer magnitude of U.S. deployment overseas.

- **Fees should form but one part of any approach to spectrum reform**. The commercial and government spectrum uses to which fees should be applied requires careful consideration – one size may not fit all. The FCC's National Broadband Plan also recognized this factor, noting that "a different approach to setting fees may be appropriate for different spectrum users. A fee system must avoid disrupting public safety, national defense and other essential government services that protect human life, safety and property and must account for the need to adjust funding through what can be lengthy budgetary cycles."[10]

  At the same time, while implementation details may differ across different user groups, application of fees must be equitably assessed for all users. In some ways, it is difficult to reconcile the emphasis on market-based spectrum fees with the regulatory focus in the U.S. on unlicensed spectrum users. For example, it is not clear, under scenarios for unlicensed use, how fees would be assessed against a diffuse group of end-users. It would seem that the fees would either have to be assessed as a user device fee from the manufacturer or as part of a tax at the point of sale.

- **There are important downstream implications internationally for the application domestically of fees to U.S. operations that require global spectrum access**. Critical Federal government spectrum-based operations -- including satellite, aeronautical and radionavigation services -- rely on global access to spectrum, including NASA, FAA, DoD and other agencies' missions. A persistent concern is that application of fees domestically within the U.S. would create a domino effect in which administrations elsewhere would follow this policy lead and impose fees on U.S. operations within their own borders. The challenge is that such global operations, which include not just Federal operations but commercial satellite and other systems, require worldwide spectrum access and cannot be "disaggregated" at borders that impose spectrum fees.[11] This opens substantial risk to the Federal budget for existing and future global operations and to industry, which would have to incorporate this expense in the cost of service.

- **Different policy solutions may be required for different users:** Spectrum used for satellite and low frequency transmissions, maritime and aeronautical applications (including communications and radar) – i.e., most non-communications services and those services that are subject to bilateral agreements – could require more traditional management approaches.

  As an example, on 15 June 2010, the U.K.'s regulator Ofcom ruled on the proposal to apply AIP to the maritime sector and spectrum used with radar and aeronautical navigation aids. Ofcom set or modified fees for different maritime channel types based upon demand and other factors. Ofcom decided not apply AIP, to licenses used with radar and aeronautical navigation, however, noting there is a lack of excess demand within the existing community

[10] FCC National Broadband Plan, Chapter 5: Spectrum, Recommendation 5.6, http://www.broadband.gov/plan/5-spectrum/#r5-6

[11] The passage in 2000 by Congress of the ORBIT Act bars the use of license auctions to select among mutually exclusive applicants to furnish international or global satellite communications service. A key consideration in this provision was a concern about the potentially onerous implications for commercial satellite operators when signal coverage extends over numerous countries. Consecutive domestic auctions in multiple countries would create a nearly insurmountable financial hurdle.

of users. Ofcom will establish a work program to examine ways to ensure efficient use of this spectrum, taking into account the interests of citizens, consumers, and the transport and defense sectors.[12] As another example, in its response to Ofcom's *SRSP: The Revised Framework for Spectrum Pricing* consultation, the UK Civil Aviation Authority (CAA), stated it was not convinced that the argument has been made to support applying AIP to the heavily regulated aviation environment.[13] Aeronautical spectrum is coordinated and harmonized on a worldwide basis to ensure safety of flight and the option to use other frequency bands does not exist.

- **Fees can be an effective tool at promoting efficient use of the spectrum, but cannot change the fundamental characteristics of the spectrum**. Fees may cause some users to find substitutes for specific frequency bands (other frequency bands, different technology, or non-spectrum communication alternatives), but physics determines propagation characteristics and which type(s) and how many users can share a frequency band. Nationally and internationally, frequency bands are allocated to services whose technical viability to operate and co-exist has been proven. Individual frequency bands are allocated to several services based on proven sharing criteria that enable co-frequency operation without harmful interference.

- **Cost-based fees provide some incentive for using spectrum efficiently**. Federal agencies currently pay NTIA a fee for frequency assignments to help recover its cost of managing the spectrum. The International Telecommunication Union implemented cost recovery for satellite network filings in 1999 and has adjusted the fee schedule, arriving at a point where invoices are being paid and more efficient use is being made of the spectrum and satellite orbits. This fee is based on the number assignments and stations rather than bandwidth, and is "flat" for most satellite network filings. Any fee proposals will need to account for these other fees as well and the lessons learned by these experiences.

It has been more than a decade since the UK began charging for the value of the spectrum. As discussed above, while AIP appears to have had some effects, these results evolved over a substantial period of time during which significant time and resources were expended developing and implementing AIP. What is clear is that fees should be viewed as a long-term process, which should be evaluated regularly to determine whether the stated objectives are being achieved. As the UK frequently notes, AIP should be used in combination with other spectrum management tools and not in isolation.

III. *Strengthening the OMB Circular A-11 Process Pertaining to Spectrum*

The current Office of Management and Budget (OMB) Circular A-11, Section 33.4, seeks to integrate spectrum resources into the capital planning and management process. OMB directs agencies to consider the economic value of spectrum "when developing economic and budget justifications for procurement of these systems. . . . Spectrum should generally not be considered

[12] http://www.ofcom.org.uk/consult/condocs/aip_maritime/statement/
[13] http://stakeholders.ofcom.org.uk/binaries/consultations/srsp/responses/caa.pdf

a free resource, but rather should be considered to have value and be included, to the extent practical, in economic analyses of alternative systems."

To date, the focus of the Circular A-11 process seems to have been on the more difficult aspect of that equation – the capital planning. The Committee believes it would be more useful to focus on ensuring the agencies/departments give more consideration to trade-offs in spectrum use in their management processes. Doing so will likely yield more measurable and impactful elements for management processes to demonstrate and achieve greater improvements in overall spectrum management and use. Toward that end, with respect to the budget for major spectrum-dependent communications systems, the Committee undertook to rewrite the circular to focus on the following key elements:

- Require agency/department to specify in its Request for Proposal to procure a spectrum-dependent communications-electronic system that respondents address spectrum "efficiency" factors (examples: e.g., greater adjacent band compatibility, lesser bandwidth….) and assess trade-offs between investment in equipment and spectrum requirements.

- Require agency/department, as the means of considering the economic value of the radio spectrum -- to indicate whether it chose the spectrum "efficient" solution among those bids that met mission/operational requirements, and, if not, indicate the investment difference between the solution chosen and the more spectrum "efficient" qualified solution.

- Require agency/department to indicate whether the system will share spectrum with other existing systems/operations; and if so, what is the nature of the sharing use and parties.

- Require agency/department, when replacing systems, to indicate improvements in spectrum "efficiency" and "effectiveness" compared to the prior system.

- Require agency/department to certify consideration of non-spectrum dependent or commercial alternatives to meet mission / operational requirements.

To give effect to the approach above, the Committee recommends that Section 33.4 be revised as follows:

Proposed OMB Circular A-11, Section 33.4

33.4 Radio spectrum-dependent communications-electronics systems

To ensure the federal government demonstrates proper stewardship of the spectrum resource in their procurement decisions, and thus yield improvements in overall federal spectrum management and use, agencies must include in the development of their budget justifications for procurement of major telecommunication, broadcast, radar, and similar systems consideration of the economic value of the spectrum being used. The extent of economic and budget analysis

required will depend upon the nature and value of the systems and spectrum involved, and agencies should work with their OMB contacts to ensure a proper level of analysis is conducted. To demonstrate consideration of the value of the relevant spectrum, agencies shall indicate whether the system procured was the most spectrum "efficient" solution among those qualified bids (i.e., that met specified mission/operational requirements); if an agency is unable to so indicate, then the agency shall indicate the investment difference between the solution chosen and the more spectrum "efficient" qualified solution. To further advance federal stewardship of the spectrum resource, agencies shall also include the following in their budget justifications for major spectrum-dependent communications systems:

- In a Request for Proposal (RFP) to procure the system, the requirement that respondents address spectrum "efficiency" factors (examples: e.g., greater adjacent band compatibility, lesser bandwidth….) and assess trade-offs between investment in equipment and spectrum requirements.

- Whether the system will share spectrum with other federal or non-federal existing systems/operations and, if so, the nature and extent of the sharing relationship.

- When proposing a new system, whether sharing an existing federal system to meet the capability requirement was required, or exploring sharing this system with other similar federal users was considered.

- When replacing systems, what improvements in spectrum "efficiency" and "effectiveness" exist compared to the prior system.

- Certification of consideration of non-spectrum dependent or commercial alternatives to meet mission / operational requirements.

Spectrum should be considered to have value and be included, to the extent practical, in economic analyses of alternative systems/solutions. In some cases, greater investments in systems could enhance federal system spectrum efficiency (e.g., purchase of radios that use less bandwidth than less expensive models); in other cases, the desired service can be met with other forms of supply (e.g., private wireless services or use of land lines). In addition to considering cost minimizing strategies, agencies are encouraged to consider whether the investment would provide net benefits.

Spectrum certification. You must obtain a certification by the National Telecommunications and Information Administration (NTIA), Department of Commerce, or your agency as designated by NTIA, that the radio frequencies required can be made available before you submit estimates for the development or procurement of major radio spectrum-dependent communication-electronics systems (including all systems employing space satellite techniques). The NTIA, which is responsible for assigning spectrum to Federal users, may also review these analyses, during the assignment process.

IV. *Spectrum Innovation Fund*

The use of spectrum by the Federal departments and agencies enables effective national security, transportation safety, and other vital government functions. While Federal agencies often are forced to do more with less spectrum or fit more into their existing spectrum assignments, like many non-exclusive private sector licensees they have little additional incentive to undertake the costs – and the risks – associated with upgrading systems or processes in ways that promote spectrum efficiency or that facilitate additional band sharing (with either commercial or other federal users) because they will only receive small portion of the benefits (if any). This may increasingly be mitigated by the fact that Federal agencies are experiencing their own significant increases in spectrum demand to accommodate new bandwidth-intensive systems and solutions within existing federal allocations – thus creating new incentives to develop solutions to squeeze even more from the same allocation.

In addition, federal government agencies typically are required to react to proposed policy changes, such as a decision to reallocate a federal frequency band for exclusive commercial use, but with few resources made available by Congress or the NTIA to support spectrum sharing or efficiency efforts initiated by a federal agency/department. Specifically, a significant challenge associated with studying and investing in spectrum sharing, reallocation, or alternative technology solutions within federal agencies/departments is the lack of a targeted budget. For fundamental shifts in domestic spectrum policy to be successful – including the promotion of innovation in spectrum management – new strategies and processes based upon technical, regulatory, and policy studies are needed.

The one exception to this lack of dedicated resources – and a promising precedent – has been the Spectrum Relocation Fund created by Congress under the Commercial Spectrum Enhancement Act (CSEA) of 2004.[14] The CSEA earmarked revenue from the auction of certain federal bands to new commercial AWS licensees into a Spectrum Relocation Fund. The auction proceeds in the fund are available for a period of years to reimburse federal agencies for the cost of relocating their operations from certain "eligible frequencies" that have been reallocated from federal to non-federal use and auctioned in 2006.[15] Although billions of dollars remain available in the Fund for any additional costs associated with federal users clearing the specific frequencies that were reallocated for exclusive commercial use, the CSEA does not currently permit the earmarked auction revenues to be used to reimburse agencies for the costs associated with clearing, sharing or improving spectral efficiency on any other frequency bands. In addition, the fund does not cover the upfront research and planning costs of the impacted agencies, a shortcoming that potentially could be addressed by a provision in legislation introduced in both the House and Senate.[16]

---

[14] Commercial Spectrum Enhancement Act, Pub. L. No. 108-494, 118 Stat. 3986, Title II (2004) (codified in various sections of Title 47 of the United States Code) ("CSEA").

[15] CSEA §§ 201-209. Eligible frequencies comprise four bands specified in CSEA (the 216-220 MHz, 1432-1435 MHz, 1710-1755 MHz and 2385-2390 MHz bands), as well as any other band of frequencies reallocated from federal use to non-federal use after January 1, 2003, and assigned by the Commission through competitive bidding. *Id.* § 202 (codified at 47 U.S.C. § 923(g)(2)).

[16] *See* H.R. 3019, The Spectrum Relocation Improvement Act, introduced in the House by Rep. Jay Inslee (2009) and in the Senate by Sen. Mark Warner (2010). Indeed, in its recently-released plan and timetable to make 500 MHz of spectrum available for wireless broadband, NTIA noted that the Administration "expects to propose early in

We believe that the most effective incentive for the military and other federal agencies would be an added and streamlined source of funding to modernize systems, while bearing in mind that when the government plans for complex systems (such as NASA operations, FAA systems or DoD operations), much sophisticated spectrum engineering goes into supporting these systems before they go on-line.[17] Federal spectrum incumbents need the resources to take affirmative steps to enable more efficient and intensive use by existing or other users, to facilitate band sharing, and even frequency migration where feasible. We recommend that the authorized purposes of the Spectrum Relocation Fund be broadened, turning it into a revolving fund for modernizing federal systems to achieve these goals. Agencies then would have the resources to pay for research, planning, testing and a potential upgrade of their radio system capabilities without depleting their appropriated mission budget.

We recommend that a Spectrum Innovation Fund (SIF) be created within, and managed by, the NTIA/Department of Commerce. The fund's resources would not only be used in response to Congressional or Administration identification of federal bands that can be cleared and reallocated for auction, but also for band sharing and other opportunities to enhance spectrum efficiency identified for exploration by the federal agencies/users themselves. These funds should include funding for NTIA to manage the fund distribution and lead federal spectrum management into a new era. Enhancing agency budgets with upfront revenue tied to reimbursing the costs of research, planning, testing and possibly even upgrading to state-of-the-art equipment, would support a broader, ongoing and potentially self-financing federal effort to both optimize government spectral efficiency and to open larger increments of spectrum capacity to the private sector. The existing Spectrum Relocation Fund created by the CSEA has proven to be an effective way to tap spectrum auction revenue to relocate federal users' operations. However, since it will become increasingly difficult to auction current federal bands for exclusive commercial use, a broader Spectrum Innovation Fund is needed to facilitate band-sharing and not only band-clearing.

Studies of actual spectrum use indicate that most of the communications capacity is not being used in all geographic locations at most times – even in the so-called "beachfront" bands with highly-valuable propagation characteristics. However, it is important to understand that just because a frequency band is not fully or frequently utilized in a particular geographic area, or over a particular time period, does not mean it is not serving its assigned purpose, or that its use can be effectively relocated to a different band. Many military bands in particular are assigned for mission-critical training and emergency purposes that are episodic or geographically limited

---

the next Congress to expand and improve the successful CSEA." This legislation would allow relocation funds to be used to facilitate agency planning and to fund demonstration projects and research regarding alternative technologies; allow agencies to enter into sharing arrangements (with NTIA approval) and receive funding to facilitate those arrangements; and provide additional resources to improve communications equipment. See U.S. Department of Commerce, "Plan and Timetable to Make Available 500 Megahertz of Spectrum for Wireless Broadband," at 16-17 (Oct. 2010), *available at* http://www.ntia.doc.gov/reports/2010/TenYearPlan_11152010.pdf.

[17] In planning and designing these systems, spectrum engineers are asked to make difficult tradeoffs between spectrum efficiency and performance requirements. Often, spectrum efficiency drives these decisions as systems must accommodate increasing requirements for bandwidth without a hope that more spectrum will be made available to meet growing demands. These are often far more complex undertakings than commercial users must undertake as part of parallel equipment and network design considerations.

in nature, but tied to the propagation characteristics of specific frequency bands. While in many such cases "clearing" a band of its current use and reassigning it exclusively to private sector licensees cannot be justified, there may be communications capacity that could be productively used at no cost or harm to the incumbent – just as the military today shares some radar spectrum with unlicensed users of low-power unlicensed devices.[18] A band of frequencies can be "white" (underutilized) and potentially shared on a number of different dimensions.[19]

Federal spectrum incumbents need additional, earmarked funding if they are to be expected to take affirmative steps to enable more intensive use and efficient use and band-sharing by other users. Although the DoD, for example, has recently begun sharing military radar spectrum (at 5 GHz) with low-power unlicensed operations (such as WiFi backhaul and in-building routers), there is no government process by which federal agencies can easily initiate private sector use of lightly-used bands. This is understandable since to date no budgetary resources have been appropriated either to study or to implement the upgrades necessary for more intensive spectrum band-sharing. It has been argued to the CSMAC, that with the right incentives "a third generation of sharing could be based on new technologies for federal government radio systems that are designed with sharing in mind and that can actually *facilitate* sharing."[20] New and upgraded federal systems could be designed and procured with the broader public interest in mind, including enabling greater use by the Federal Government within those existing allocations – and not only in the very limited case of a band being cleared entirely of federal use. Even where funding exists to support band sharing, however, sharing may not always be feasible; the rules and technologies that govern sharing (such as dynamic frequency selection and geolocation databases) will need to anticipate that sharing ultimately can limit spectrum availability to incumbents and their long-term flexibility to change technology.

A SIF Could be Narrow or Broader in Scope

While we believe there are clear benefits to expanding on the concept of the CSEA's Spectrum Relocation Fund to facilitate band sharing and overall spectrum efficiency, the appropriate size and scope of a Spectrum Innovation Fund is not so clear cut. On the one hand, we recommend that at a minimum the SIF should provide upfront funding for studies concerning the feasibility of more efficient systems and sharing arrangements. Even a relatively small fund could finance studies that demonstrate the returns on a larger, future investment in a particular band or system. On the other hand, we recognize that a larger and more ambitious fund could move beyond

[18] *See* Michael J. Marcus, "New Approaches to Private Sector Sharing of Federal Government Spectrum," Wireless Future Program Issue Brief #26, New America Foundation (June 2009).

[19] Retired NTIA engineer Robert Matheson has described seven dimensions that define the potential capacity of a given band of spectrum – and the potential for dynamic, or flexible, spectrum usage rights Robert J. Matheson, "Flexible Spectrum Use Rights," *Journal of Communications and Networks*, 8 (June 2006), 144, available at http://www.its.bldrdoc.gov/pub/ntia-rpt/05-418/05-418_matheson.pdf.
See also Robert J. Matheson, "The Electrospace Model as a Tool for Spectrum Management," NTIA Institute for Telecommunications Sciences, presented at ISART 2003. Matheson adapted his Electrospace Model from the work a quarter-century earlier of W. R. Hinchman. *See* W.R. Hinchman, "Use and Management of Electrospace: A New Concept of the Radio Resource," in *Proc. IEEE ICC'69*, 1969.

[20] *See* Michael J. Marcus, "New Approaches to Private Sector Sharing of Federal Government Spectrum," Issue Brief #26, New America Foundation (June 2009).

research to reimburse federal agencies for the cost of pre-approved testing, planning and perhaps even the incremental cost of equipment or system upgrades.

At the same time, the allowable uses of a Spectrum Innovation Fund should also be carefully circumscribed so as not to encourage "gold-plating" or to absorb the cost of systems or upgrades for non-spectrum-related reasons. For these reasons, we believe that eligibility for the innovation fund would need to be conditioned on the applying agency's identification of spectrum capacity that could be freed should its studies prove to be successful. If Congress authorizes a SIF to reimburse agencies for activities that extend beyond studies linked to specific spectrum, OMB should also approve expenditures over a certain threshold level after they are first recommended by the agency administering the SIF (e.g., NTIA). We recognize as well that the focus and scope of a SIF may be driven by fiscal constraints and trade-offs as well – and some potential ways to seed and replenish the fund on a revenue-neutral basis are discussed just below.

Whatever Congress initially determines is the appropriate scope for reimbursements funded from a SIF, we recommend that an agency with relevant expertise should administer the fund and make the initial determination of awards (subject to review and approval by OMB, as noted above). While reimbursements from the current Spectrum Relocation Fund under CSEA are reviewed and approved directly by OMB – because agencies are entitled to reimbursement based on their mandatory clearing of a band reallocated exclusively to the private sector – we anticipate that applications for funding from the SIF would be competitive and selected based on potential, relative impact.

Based on its role and expertise as the federal government's spectrum manager, we assume that NTIA is the entity best qualified to administer the fund and approve grant applications based on the likely cost-effectiveness of the activity in relation to making more spectrum capacity available for new or more efficient uses. The federal agency, when seeking to initiate a spectrum study, or other allowable activity, would submit a formal request to NTIA for funding. The funding tiers and conditions associated with requests, as well as caps on awards, presumably would be defined by implementing legislation and would vary depending upon the scope of the study or other fundable activities.

NTIA would review the request and have the authority to distribute the funds, monitor progress, and assess the results. Disbursement of funds would be allowed only after consultation between NTIA and the Director of OMB. To ensure proper oversight and accountability, NTIA would notify OMB and oversight committees on a regular basis of awards made, progress towards innovation, and the result of the investment.

If a change in federal spectrum allocation or use is driven by a congressional mandate, or by an Administration or NTIA inquiry, the agency should automatically qualify for funding in an amount to be determined by NTIA, but subject to any cap or other conditions. In the context of a mandated change in spectrum allocation or use, it would seem particularly important for the SIF to reimburse agencies upfront for all necessary costs related to research, planning and testing that were not fully covered under the current CSEA model.

Financing a Spectrum Innovation Fund

Although there is widespread consensus that spectrum management reform is critical to meeting the increased demands of both the commercial and federal communities, we recognize that given the budget constraints currently faced by the Federal government, and concern over deficits, any new funding for the SIF is problematic. We believe, nonetheless, that like the CSEA's Spectrum Relocation Fund, a broader and ongoing Spectrum Innovation Fund (SIF) should be largely revenue neutral with respect to the general budget. Just as the CSEA Fund was created with a set-aside from the 2006 auction of federal bands, we recommend that the initial increment of funding be provided by earmarking a portion of the revenue from the next auction of spectrum, which could occur as soon as 2011.

Subsequently, the Spectrum Innovation Fund could be replenished through any number of options, although this Subcommittee has not come to any conclusion or single view on whether any of these options are a good approach. One general option could be for funding from spectrum user fees on entities or devices that benefit directly from the use of federal spectrum allocations.[21] Even where band-sharing is made available on an unlicensed or opportunistic basis, it would be feasible to collect a one-time certification fee on unlicensed devices that currently do not make any contributions for access to the limited spectrum resource.[22] Alternatively, revenue derived from leasing excess capacity available to the private sector could be designated in full or in part to replenish the SIF. The Committee is not recommending how the SIF should be financed, however, or at what level.

In sum, we recommend that the allowable purposes of the CSEA's Spectrum Relocation Fund should be broadened, creating a Spectrum Innovation Fund to reimburse approved federal spectrum users for the upfront research, planning and possibly other costs related to modernizing federal systems not only to migrate off bands designated for auction, but also to facilitate the shared or more efficient use of other federal bands. The SIF should be revenue-neutral to the general Treasury. We expect that enhancing agency budgets to improve spectrum efficiency and open spectrum capacity to the private sector would prove to be a strong incentive focused directly on the desired outcome.

[21] For example, if annual spectrum user fees were to be imposed on federal entities, this revenue could be recycled back to these same agencies as an incentive to improve the efficiency of their use of the spectrum resource and/or to open more capacity to the private sector.

[22] Such a fee could be assessed on devices capable of operating on frequency bands that in the future are opened for private sector sharing or access as a result of investments financed from the SIF. For example, the FCC's recent TV White Space order contemplates a modest one-time user fee on unlicensed devices to offset the cost of the private geolocation database service providers that will deliver an online query service to provide users with permissable channels depending on their location.