



**Public Knowledge**

**Breaking the Logjam:  
Some Modest Proposals for Enhancing Transparency,  
Efficiency and Innovation in Public Spectrum  
Management**

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## I. INTRODUCTION

The dramatic rise in demand for wireless capacity has once again focused discussion on the management of federal spectrum. Mobile wireless providers hope to find additional federal spectrum to clear and auction. Technology companies and advocates of open spectrum policies hope to identify ways in which non-federal users can access federal spectrum in non-interfering ways via “opportunistic sharing.” But a lack of clarity surrounding how federal agencies allocate spectrum access and utilize wireless technologies hampers the effort to move forward with any policy.

This lack of clarity flows from a variety of sources. Chief among them is a legal framework that places the National Telecommunications Information Administration (NTIA) in the nominal position of manager of federal spectrum, while making spectrum utilization a matter of individual agency discretion. The result is that while we speak of “federal spectrum” as a single managed resource, it is instead managed in isolated and discrete bits with relatively little overall coordination beyond interference avoidance. Concerns over national security further complicate efforts to enhance overall transparency.

At the same time, the current system creates perverse incentives for federal spectrum managers to limit transparency and oversight. Historically, the only reward for operating with greater transparency and efficiency is to have spectrum reallocated for auction. Indeed, industry stakeholders and federal officials have repeatedly stated that the driving purpose for enhancing transparency is to facilitate transfer of spectrum from federal use to commercial use, preferably by clearing large bands of paired spectrum in the range most desirable for cellular providers. The resistance of federal spectrum managers is further compounded by proposals that emphasize punishing and compelling agencies to give up spectrum through such mechanisms as spectrum fees, and which appear utterly indifferent to the growing need for federal wireless capacity for the delivery of services.

The result is a logjam in federal spectrum policy that goes beyond the impact on the private sector. Federal spectrum management remains frozen, unable to take advantage of changes in technology or leverage economies of scale. Basic planning for serving expanding federal needs is hampered, agencies lack modern equipment, and agencies are locked into antiquated systems, unable to take advantage of the flexibility that has become the hallmark of private sector wireless use, from the iPhone to unlicensed mesh networks.

In an effort to break the policy logjam, we make a number of recommendations for enhancing transparency and coordination among federal users who work within the existing framework of federal law.<sup>1</sup> The recommendations begin with simple reform of the NTIA’s processes and its relationship with the FCC. As a next step, we propose that the Administration use existing legislative authority to “zero base” the federal “spectrum budget” by requiring every agency to reapply for its spectrum allocation, including specific details with regard to spectrum utilization. The President should also, by Executive Order, require all agencies to execute five-year “spectrum plans” that would set forth projected need and allow for coordinated planning

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<sup>1</sup> We recognize that national security issues will need to be addressed in the context of all of these proposals.

among agencies. The NTIA, working with the Chief Technology Officer (CTO), would provide coordination and support to agencies.

While this imposes significant burdens on federal agencies, such action constitutes a critical first step toward developing a coherent federal spectrum policy that will ultimately enhance federal use and result in significant cost savings. With this information in hand, the NTIA, working with the CTO, the Office of Management and Budget (OMB) and the General Services Administration, can commence long-term spectrum planning on a government-wide basis that would transition the federal government (to the extent possible) from relying on discrete quasi-license-like assignments to dynamic assignment of flexible wireless capacity on an as needed basis. In addition, the NTIA and the FCC would convene state and local governments to determine how to promote interoperability and develop a set of best practices for management of wireless at all levels of government.

We stress that for these proposals to succeed ***the political leadership must embrace enhancing transparency and public involvement in spectrum policy as a value for its own sake***, not merely as a means of moving spectrum from federal use to commercial use. While enhanced transparency and public oversight of federal spectrum will almost certainly result in an increase in the wireless capacity available to the private sector, the federal government and Congress must commit that a primary goal of federal spectrum management reform is to ensure that all federal agencies will have access to the wireless tools critical to success in the 21<sup>st</sup> Century.

Specifically, we propose:

- The NTIA and the Federal Communications Commission (FCC) should expand the cooperation required between the agencies by statute. In particular, the agencies should publish an annual joint spectrum plan based on the mandatory consultation between the Chairman of the FCC and the Administrator of the NTIA,<sup>2</sup> and should clarify the “expedited” process mandated by statute for processing applications for mixed federal and non-federal use.<sup>3</sup>
- The NTIA should take steps to improve opportunities for public involvement in its spectrum management decisions, and should launch its own e-government initiative, similar to the Reboot.FCC.Gov.
- The 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.

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<sup>2</sup> 47 U.S.C. § 922.

<sup>3</sup> 47 U.S.C. §§ 903(b)(5), 927(2).

- The President should require all agencies to prepare a “spectrum budget” in the same manner they prepare a federal budget, assessing existing and future needs. The NTIA would serve as coordinator for these agencies and would provide technical support, assisted by the federal Chief Technology Officer (CTO) and the Office of Management and Budget (OMB).
- Based on these exercises, the CTO, with support from the NTIA, would assist agencies in upgrading wireless equipment and enhancing the use of spectrum resources for individual agencies, in order to enhance their overall missions.
- The Federal CTO, working with the NTIA and other federal agencies, should develop policies enabling and encouraging federal agencies to move from the current system of assigned spectrum allocations to a system leveraging new technologies to permit dynamic assignment to agencies on an “as needed” basis. In essence, the federal government would transition from a system in which agencies hold the equivalent of a spectrum license to one where the federal government manages a vast pool of wireless capacity from which agencies may “draw” as needed.
- The NTIA and the OMB should conduct a comprehensive review of existing federal statutes to determine how private entities can make contributions to federal agencies to enhance federal spectrum efficiency and promote innovative use of wireless resources by the federal government. The review should also seek to establish ways to further enhance public transparency and accountability with regard to spectrum use.
- The NTIA and the FCC should work with state and local governments, and their trade associations, to find ways in which federal, state and local governments can enhance emergency communications and spectrum efficiency, and promote innovative uses of wireless technology at all levels of government.

## **II. THE INTEREST OF THE PUBLIC IN FEDERAL SPECTRUM MANAGEMENT**

Interest in federal spectrum has generally focused on how to enhance non-federal access to spectrum allocated on a primary basis to federal users. In particular, wireless service providers have urged the federal government to clear additional bands, in order to auction more licensed spectrum to meet the ever-increasing demand from consumers and businesses. In recent years, advocates of increasing unlicensed spectrum access have also sought greater transparency and efficiency in federal spectrum management.

But the value of enhancing transparency and efficiency in federal spectrum management goes well beyond making more spectrum available for non-federal users. Every citizen of the United States has the same interest in seeing the federal government use wireless to enhance the delivery of federal services as we do in seeing federal money wisely spent and natural resources properly developed. Federal agencies use wireless for a wide variety of purposes ranging from

national security to internal communications to tracking the weather. Modernizing federal use of wireless can vastly improve public welfare by allowing federal agencies to deliver new services, improve the overall efficiency of old services, and generally stimulate the development of new wireless technologies and economic growth. For example, the development by the Department of Defense of the Global Positioning System (GPS), and the decision to make GPS available freely to the public, not only enhanced the efficiency of federal operations, it created an entire civilian industry.

In addition, although “spectrum” is an artificial construct used to describe the right to transmit on specified electronic frequencies at specified power levels, we continue to view spectrum as a “national resource.” We have therefore made it a cornerstone of federal policy that use of “the public airwaves” must serve the broader public interest. This broader public interest includes a wide range of identified interests from protecting public safety, to ensuring that federal services are delivered in innovative and cost effective ways, to reducing costs for federal operations by reducing the need to pay private sector providers.

Any effort to enhance the efficiency of federal spectrum management must start with an understanding of how the federal government uses spectrum today. In theory, the National Telecommunications Information Administration (NTIA) manages federal spectrum under a set of procedures contained in the *Manual of Regulations and Procedures for Federal Radio Frequency Management*.<sup>4</sup> But while we speak of “federal spectrum” as if it were one centrally managed resource, “federal spectrum” consists of hundreds of allocations for use by nearly all federal departments or agencies, with no mechanism for tracking use. This fragmentation of management costs the federal government billions of dollars in inefficiency and opportunity cost. Agencies struggle with antiquated and inefficient equipment because they lack the funds to upgrade and because the reward for efficient use of spectrum is to have spectrum capacity reallocated elsewhere. The arcane nature of the federal spectrum allocation process contributes to a culture within the federal system where a handful of spectrum managers in each agency make decisions without any form of effective oversight, subject to the specific demands of their own agencies, and resistant to efforts to impose any kind of overall federal policy.

The persistence of this state of affairs for many years, despite strong consensus around the need to enhance transparency among industry stakeholders, academics and advocates, members of Congress, and political appointees demonstrates that the problem admits to no easy solution. The effort by leaders in both houses of Congress to pass bills that would enhance transparency of federal spectrum management and ease the ability of future auction winners to migrate federal users to clear bands post auction has been met with difficulty, despite broad stakeholder and bipartisan support. Even if the pending bill mandating an inventory of federal spectrum and the creation of a publicly accessible database passes, the NTIA will still need to resolve the problem of compelling federal agencies over which it has no authority to cooperate.

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<sup>4</sup> Also called the “Red Book” because of its red cover. Available at: <http://www.ntia.doc.gov/osmhome/redbook/redbook.html>

### III. REASONS WHY TRANSPARENCY REMAINS ELUSIVE

Given all the positive reasons for transparency, why has it remained so elusive? The answer lies in the peculiar combination of legal circumstances and institutional incentives at play.

Although the Communications Act centralizes authority for federal assignment in the President,<sup>5</sup> delegated to the Assistant Secretary for the NTIA,<sup>6</sup> management of federal spectrum requires a complex balancing between the current needs of federal agencies, and their possible future needs. Further, although the NTIA has a general coordination responsibility, generally exercised by its hosting of the Interdepartmental Radio Advisory Committee (IRAC), the NTIA does not have direct authority over the agencies it authorizes to use particular allocated frequencies. National security concerns, and the difficulty involved in anticipating the range of agency uses, further complicates efforts to promote transparency.

At the same time, one cannot ignore the institutional incentives for agencies to maintain the current lack of transparency as a means of protecting institutional goals. Historically, greater transparency and efficiency by federal users has been rewarded with the transfer of spectrum from federal users to the private sector. Lack of transparency facilitates an insular and defensive approach to spectrum management, where federal agencies seek to preserve their spectrum from private sector “poaching.” Given this choice of rewards, it should come as no surprise that rational federal spectrum managers would seek to maintain the status quo rather than seek to promote greater transparency and public input.

This element in the culture of federal spectrum management is perhaps best illustrated by the agency response when Congress explicitly instructed the NTIA to take steps to increase transparency in federal decisions on spectrum management in the Telecommunications Authorization Act of 1992.<sup>7</sup> The statute directed the NTIA to modify the Red Book as follows:

- (1) provide for a period at the beginning of each meeting of the Interdepartmental Radio Advisory Committee to be open to the public to make presentations and receive advice, and provide the public with other meaningful opportunities to make presentations and receive advice;
- (2) include provisions that will require (A) publication in the Federal Register of major policy proposals that are not classified and that involve spectrum management, and (B) adequate opportunity for public review and comment on those proposals;
- (3) include provisions that will require publication in the Federal Register of major policy decisions that are not classified and that involve spectrum management;
- (4) include provisions that will require that nonclassified spectrum management information be

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<sup>5</sup> 47 U.S.C. § 305(a).

<sup>6</sup> 47 U.S.C. § 902(b).

<sup>7</sup> Pub. L. 102-538 §104, *codified at* 47 U.S.C. §903(a)-(b).

made available to the public, including access to electronic databases; and

(5) establish procedures that provide for the prompt and impartial consideration of requests for access to Government spectrum by the public, which procedures shall include provisions that will require the disclosure of the status and ultimate disposition of any such request.

The NTIA's response to this statutory directive can be found in Chapter 11 of the Red Book.<sup>8</sup> It can be summarized as follows:

- (1) Most information can be obtained on the NTIA website.
- (2) Parties in need of additional information should file a Freedom of Information Act Request.
- (3) Parties wishing to make a presentation to the IRAC should use the website to find appropriate contact information, then submit a formal request.
- (4) Applications for access to federal spectrum will be forwarded to the FCC. The NTIA may or may not include written comments or recommendations to the FCC as part of this process.

This minimalist response to Congress' effort to enhance transparency and public input cannot be explained as a function of national security or by a lack of authority by the NTIA over other federal agencies. It is also interesting to note that since the beginning of the Obama Administration, other federal agencies, including the FCC, have launched significant transparency and civic engagement initiatives. But the NTIA has not. With the exception of opening meetings of the spectrum federal advisory committee to the public, the NTIA has made no significant changes in its processes, or announced any initiatives to promote greater transparency or facilitate public input in its spectrum management.

While one should not impute too much to the failure of an agency to allocate scarce resources to reforming its own processes and accountability, it is also understandable why critics of federal spectrum management have become frustrated and accuse the agency (and federal spectrum managers generally) of doing their best to obstruct efforts to enhance transparency and accountability.

#### **IV. CONSEQUENCES OF THE GRIDLOCK: FEDERAL SPECTRUM MANAGEMENT REMAINS FROZEN, MISSING OUT ON NEW SPECTRUM TECHNOLOGIES AND OPPORTUNITIES FOR COST SAVINGS**

As a result of the current system, the process by which agencies apply for spectrum allocation and use wireless capacity has remained virtually unchanged. This appears to have stifled innovation in federal wireless services. Federal agencies lack the necessary flexibility to

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<sup>8</sup> Available at <http://www.ntia.doc.gov/osmhome/redbook/11.pdf>

experiment with new “business models” for delivering service or meeting their needs. Even if they had this flexibility, however, a culture of innovation around wireless delivery does not exist (excluding those agencies, such as the Department of Defense, that have an explicit research component as part of their mission). For the vast majority of federal agencies, spectrum is an input for the purpose of fulfilling a specific function such as secure two-way radio communication, weather radar, or satellite uplink. There is no effort on an interagency level to consider how changes in wireless technology could revolutionize the delivery of federal services. To the extent individual agencies may be engaged in such thinking for themselves, it is done on an isolated and sporadic basis. There is no obvious effort, either at NTIA or elsewhere in the federal government, to facilitate such thinking.

The result is that the federal government is largely missing out on the wireless revolution. While demand for machine-to-machine wireless capacity and other industrial uses continues to rise, the federal government remains essentially static. Whatever opportunities the federal government could realize for economies of scale and other efficiencies are currently lost, with no mechanism for capturing them.

In addition, the lack of transparency has produced paralysis in the effort to make more spectrum available to non-federal users. Whether one favors clearing bands for auction or increasing opportunities for “mixed use” with federal users, the inability of stakeholders, advocates and decision makers to say with any certainty what the characteristics are for any band primarily allocated for federal use has made it impossible to determine how to proceed. Although parties can usually agree with generalities and overall goals, any set of recommendations can, and is, met with objections that cannot be evaluated because the information needed to adequately evaluate them does not exist.

## **V. MOVING FORWARD WITHIN THE EXISTING STATUTORY FRAMEWORK: NEW PERSPECTIVES AND NEW TECHNOLOGIES REQUIRE NEW APPROACHES**

Moving forward to enhance federal spectrum management requires addressing the situation that has developed over the last several decades. Federal spectrum managers face increasing demand on their spectrum. They have every incentive to fight enhanced transparency, which generally “rewards” these efforts with loss of spectrum and the concomitant costs of leasing access from the private sector. Further, the current system, which fragments spectrum use across all federal agencies, remains an impediment to implementing new, interoperable technologies and achieving the efficiencies and cost savings that come from leveraging the vast size of the federal government.

Changing the federal culture requires leadership from the political branch. It also requires cooperation from non-federal stakeholders. An approach to federal spectrum reform geared solely to finding new spectrum to clear and auction will not only re-enforce the overall resistance by federal spectrum managers to change, it will result in policies that ill-serve the nation as a whole. New technologies permit the federal government to treat “federal spectrum” as a coordinated resource, assigning spectrum to agencies on an “as needed” basis without cumbersome application processes. This would undoubtedly require public investment in

upgrading available federal technology, but the benefits to the public in enabling more efficient delivery of federal services via wireless and the cost savings from improving overall efficiency appear likely to offset these expenditures – although one cannot say for certain until the federal government takes sufficient steps forward to make a proper assessment.

To begin moving forward, we recommend a number of initial steps to improve those processes under the direct control of the FCC and the NTIA. Not only are these steps the easiest to achieve, they also send a strong statement that the primary spectrum management agencies believe in transparency and public participation. Further, through facilitating the application process for commercial users to access federal spectrum consistent with existing federal use, the proposed reforms will also begin to address the overall issue of making more spectrum available for non-federal users.

As a second step, we recommend using the statutory powers conferred upon the President, the Secretary of Commerce, the Asst. Secretary for the NTIA, and the Director of the OMB, to “zero base” federal spectrum allocations and to require agencies to engage in spectrum planning in the same way they assess other resource needs. The NTIA and the CTO would assist agencies in these planning efforts and begin the process of encouraging cross-agency coordination and cooperation to achieve efficiencies and economies of scale.

Critically, this would provide a clear database for the public with regard to the use of federal spectrum and the projection of federal need. This would permit the debate to move to the third and final stage, the formulation of a coherent federal spectrum policy designed to maximize federal goals across all agencies, while providing non-federal users with accurate information with regard to access to spectrum.

## **VI. INTERNAL REFORMS AT THE NTIA AND THE FCC**

The NTIA was directed by Congress in 1992 to make its spectrum management practices more transparent. As noted above, the NTIA has not invested significant resources into this effort, nor have any initiatives been announced since the change of Administration similar to the FCC’s efforts to increase accessibility. The NTIA website is both difficult to navigate and largely impenetrable to the layperson – the *Manual of Regulations and Procedures for Federal Radio Frequency Management* even more so. The times and agendas for IRAC meetings are not readily available. Indeed, public participation in IRAC deliberations is only permitted to the extent mandated by Congress, embodied in the ability to make presentations.

Even for the practitioner attempting to determine how federal frequency bands are used and managed, the NTIA website and Red Book are difficult to navigate. The most recent comprehensive report on federal spectrum use, the 2008 Federal Strategic Spectrum Plan,<sup>9</sup> provides a description by agency of frequency bands used for specific purposes. To assemble a picture of a band primarily allocated for federal use, one would need to review the entire report and reconstruct it. Even this would not provide any technical details on how the agencies in question actually use the spectrum.

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<sup>9</sup> Available at <http://www.ntia.doc.gov/reports/2008/FederalStrategicSpectrumPlan2008.pdf>.

As an initial matter, therefore, NTIA could demonstrate a commitment to transparency and public input through the simple expediency of making its existing website more accessible. Indeed, the NTIA BTOP program provides a reasonable model for NTIA to replicate on the spectrum side. Even better would be a full commitment to implement social media and e-government tools, as has been done with the FCC's Reboot.FCC.Gov.

#### **A. Specific Reforms**

Beyond the general need to make existing NTIA information more accessible, the NTIA can enact several specific reforms to improve its processes.

***Facilitate participation in IRAC.*** The NTIA should facilitate participation by the public in the deliberations of the Interdepartment Radio Advisory Committee (IRAC). It is safe to say that unless one knew precisely what the IRAC was, and why one wished to find it, a member of the public would be extremely unlikely to find the relevant webpage on the NTIA website. The rather minimal information provided invites members of the public to send, by email, a written request to brief the IRAC, or to attend a scheduled public briefing. No other access to the IRAC's deliberations is provided.

***Provide Minutes or a Report on the Biannual Meeting Between the Assistant Secretary and the Chairman of the FCC to Conduct Spectrum Planning.*** Section 112 of the National Telecommunications Information Administration Organization Act<sup>10</sup> requires the Assistant Secretary for the NTIA and the Chairman of the FCC to meet "at least Biannually" to conduct joint spectrum planning on how to make more spectrum available for non-federal users. The FCC and NTIA could jointly publish a report on or minutes from this exercise.

***Provide a clear process for expedited consideration of mixed use applications.*** Section 117 of the NTIA Organization Act<sup>11</sup> permits the Secretary of Commerce to allow non-federal users to access bands "allocated on a primary basis for Federal Government use." The FCC is required to process such requests within one year. The NTIA and the FCC should work jointly to make this process accessible by non-federal users, and to decide on the applications within the time limit set by Congress.

These specific reforms, in addition to general reforms designed to encourage public participation and the accessibility of information, are entirely within the control of the NTIA and the FCC. The agencies can begin implementation immediately. This would both improve overall transparency and demonstrate an agency commitment to enhancing transparency and public participation.

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<sup>10</sup> 47 U.S.C. § 921.

<sup>11</sup> 47 U.S.C. § 927.

## **VII. ZERO BASE FEDERAL SPECTRUM ALLOCATIONS**

In accounting, “zero based” budgeting is a planning technique used to re-examine traditional expenditures. Rather than simply continuing expenditures from previous years, zero based budgeting requires those seeking money to justify each request as if it were a new request for funds. Federal agencies have employed zero based budgeting to re-examine traditional modes of operation and to enhance public oversight by requiring a justification for each expense.

We propose that the federal government “zero base” federal spectrum allocations, and require every agency to reapply for a spectrum allocation. The Secretary of Commerce is explicitly authorized to “withhold or refuse to assign” spectrum allocations to federal users “to further the goal of making efficient and cost effective use of the spectrum.” 47 U.S.C. §903(d)(2). In addition, the NTIA may alter or eliminate an existing allocation to a federal user, subject to an appeal to the Office of Management and Budget. 47 U.S.C. §103(b)(2)(A); §104(d)(2). Finally, we note that Section 305(a) of the Communications Act centralizes authority over federal spectrum in the President. Although the President has delegated this authority to the Assistant Secretary for the NTIA, the President remains the ultimate source of authority over the ability of federal users to access spectrum.

To zero base federal spectrum, the President, the Secretary of Commerce, and the Assistant Secretary for the NTIA would jointly announce that all existing federal spectrum assignments are hereby cancelled on a specific date. All federal agencies would therefore be required to reapply for federal spectrum allocations, subject to approval by the Secretary of Commerce, the Assistant Secretary of the NTIA, and the Chief Technology Officer as the designee of the Director of the Office of Management and Budget. This one-time special process would completely bypass the IRAC and other standard procedures described in the Red Book. The same order would also require federal agencies to generate a “spectrum budget” similar to their annual budget requests.

This exercise would allow the NTIA and the Chief Technology Officer to achieve two goals. First, it would provide a comprehensive database of all federal users, at whatever level of granular detail desired, though the simple expediency of declaring any spectrum allocation not included in the database null and void. Federal agencies refusing to comply could not subsequently be heard to complain if “their” spectrum were reallocated.

More importantly, however, this exercise would transform federal spectrum management by allowing for a more active role for the NTIA and the Chief Technology Officer. As an initial matter, the NTIA and the CTO would need to provide technical assistance to other federal agencies for the application and initial “spectrum budgeting” process. Afterwards, the database would provide the necessary information for genuine federal spectrum planning.

## **VIII. AFFIRMATIVE SPECTRUM PLANNING BY THE NTIA AND THE CTO**

The final set of recommendations concerns what should be the ultimate goal of federal spectrum management: moving from the existing system to one where federal agencies can enjoy flexibility and are encouraged to be innovative in their uses of wireless capacity, while still using

spectrum in an efficient manner.

As an initial matter, the CTO, with the assistance of the NTIA, should identify those federal agencies in need of wireless equipment upgrades and recommend ways of enhancing use of spectrum resources for individual agencies, in order to enhance their overall missions. Longer term, the Federal CTO, working with the NTIA and other federal agencies, should develop policies enabling and encouraging federal agencies to move from the current system of assigned spectrum allocations to a system leveraging new technologies to permit dynamic assignment to agencies on an “as needed” basis. In essence, the federal government would transition from a system in which agencies hold the equivalent of a spectrum license to one where the federal government manages a vast pool of wireless capacity from which agencies may “draw” as needed.

Contemporaneous with this, the NTIA and the OMB should conduct a comprehensive review of existing federal statutes to determine how private entities can make contributions to federal agencies to enhance federal spectrum efficiency and promote innovative use of wireless by the federal government. This review should also seek to establish ways to further enhance public transparency and accountability with regard to spectrum use. In particular, the NTIA and the FCC should work with state and local governments, and their trade associations, to find ways in which federal, state and local governments can enhance emergency communications, spectrum efficiency, and promote innovative uses of wireless technology at all levels of government.

## **IX. CONCLUSION**

The continued logjam in federal spectrum management, caused largely by a lack of transparency, imposes huge costs. In addition to the obvious cost discussed in spectrum policy circles of limiting non-federal access to federal spectrum, the current lack of transparency preempts any ability of the federal government as a whole to enjoy those advances in wireless technology that have improved productivity and our quality of life outside of the federal sector. But enhancing transparency will require more than just implementation of the changes proposed here. It will require leaders who are willing to push aggressively to change the culture of federal spectrum management from one that punishes transparency and efficiency to one that welcomes transparency as a means of achieving federal policy goals beyond transferring spectrum to the private sector.