

**Prepared Remarks by Dr. Preston Marshall for the House Energy and Commerce
Subcommittee on Communications and Technology hearing:**

“Creating Opportunities through Improved Government Spectrum Efficiency.”

Thursday, September 13th

Summary of Points to be made:

1. Spectrum Sharing is not new, and we know how to do it. The PCAST advance is to propose it become transparent and systematic so it can support innovation and new services without the disruption and cost of relocating Federal or Commercial users.
2. Industry has invested and innovated in shared spectrum, such as WiFi for enhanced cellular carrier offload, despite its shared and less predictable nature. The recommendations PCAST made will create enormously more opportunities for innovation and investment in technologies that would not be viable, given the delay, risk, and cost of long-term, licensed spectrum.
3. Lower power technologies, such as femtocells make sharing spectrum with Federal users more viable, and can exploit spectrum that is unsuitable for higher power uses.
4. Spectrum policy should consider that we do not know what the next big innovation will be. Flexible spectrum policy is likely to be critical to the viability of many innovations, and America’s ability to lead in innovation.
5. PCAST report is not dependent on any new technology. Its technology assumptions are highly conservative, and available now.
6. While the NTIA report may not be “perfect”, it is unlikely to be fundamentally incorrect in its premise that it is increasingly difficult, expensive, and disruptive to relocate Federal users. Some new mechanism is required to make use of this unused spectrum.
7. In summary, the PCAST recommendations do not remove any current access from either Federal or commercial users, and provide the opportunity for at least doubling the spectrum available for innovation throughout our economy.

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Thank you Chairman Walden, and Ranking member Eshoo. I appreciate the opportunity the Committee has provided to comment on spectrum policy, and some of the technology implications. I welcome this opportunity to continue the informal dialog we had with many of the members and staff of this committee.

My Name is Preston Marshall, and I am Deputy Director of the Information Sciences Institute at University of Southern California’s Viterbi School of Engineering. I am also a Research Professor in the Ming Hsieh Department of Electrical Engineering. I am the author of two books on the subject of wireless networks, the latest of which is due to be released by Cambridge University Press in the fall. I was Program Manager for seven years of the Defense Advanced Research Projects Agency managing projects in wireless and networking, including the dynamic spectrum access program. I also participated as a technical advisor to the President’s Council of Advisors on Science and Technology (PCAST) study titled “Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth.” However, the opinions expressed here are my own, and not that of PCAST.

Spectrum sharing is not new. Cell towers share with cell towers, Federal users share with other Federal users, and often Federal users share with specific civil users, as well. Just recently, the FCC approved a Special Temporary authorization for T-Mobile to experiment with sharing one of the most contentious bands, 1755 MHZ. What makes the PCAST recommendation new and exciting is that it makes Federal spectrum sharing systematic and transparent. This will be based on a fundamental principle that underutilized Federal

spectrum should be shared to the greatest possible extent. Sharing opportunities would be visible to all potential users. No special connections or knowledge of Federal agencies or regulators would be required for potential innovators, or current spectrum users to determine the availability of sharable spectrum. A marketplace for sharing spectrum rights would operate to monetize these opportunities for the Federal Government, and to ensure protection for investors and innovators in these bands.

I have heard it said that industry would not invest in shared spectrum. Clearly this is not correct. Industry finds shared spectrum quite acceptable for investment, as we see more and more investment in large scale WiFi networks in unlicensed, shared spectrum. It is true that these investments have a very different cost and obsolescence structure than the large cellular towers, but this is exactly the innovation that is needed to bridge the gap between these two extreme models of wireless, and meet the need for exponential, not linear, growth in wireless capacity. In my opinion, the PCAST report recommendations will lead to any number of technology and service opportunities that can leverage the unique opportunities provided by different characteristics of spectrum, licensing, and exclusive operation.

The success of WiFi has another lesson for us. One of the major carriers has stated that it has shifted over half of its smartphone traffic to WiFi offload. The WiFi 2.4 GHz spectrum is significantly less than that exclusively licensed by that carrier. Just their usage of WiFi (a small fraction of all WiFi usage) is providing more capacity per MHz than the dedicated cellular spectrum.

I am not arguing for WiFi, but this does demonstrate that low power, localized communications is the solution to the bandwidth needs in our dense usage areas. Whether supplied by carrier, or private, femtocells, microcells or WiFi, the fact is that these low power systems essentially replicate their bandwidth hundreds of times in the same area that a tower has only one unit of capacity. This is the only way to meet bandwidth demands. Even if Federal usage was reduced to zero, the additional spectrum would only double the available spectrum, clearly not enough to meet demands for 50 or more times user bandwidth!

The use of smaller and smaller, low power cell sites is central to the ability to leverage Federal spectrum by commercial wireless. While sharing Federal spectrum with high power towers might have severe challenges, sharing with these emerging, low power, often indoor technologies provides a practical and effective application of spectrum that otherwise would serve no one. For example, the NTIA report shows that exclusion zones for the 3600 MHz band would essentially preclude access to most of the US population when sharing with high power LTE, but could be highly useful when used for lower power applications, such as femtocells.

It is true that the proposed sharing regime is not the same as the current exclusive regimes. Different does not mean inferior. The introduction of unlicensed spectrum was different, but it led to the explosion of unlicensed innovation, and an industry largely dominated by US Corporations. I believe the PCAST proposal provides for many more such opportunities for US firms to innovate and develop new products for the home market, and be in a position to dominate this technology as these principles are adopted worldwide. And, this opportunity does not require reallocating spectrum from any existing or future application,

just sharing the spectrum currently allocated to, and needed by, Federal users, and therefore not available for reallocation.

We should not assume that spectrum policy must consider only cellular. Innovation had been rampant when we have made spectrum available. Again, WiFi is a good example for this. However, it is hard to see that the current spectrum policy alternatives, which are completely shared, or auctioned and exclusively licensed, can support the emergence of new technologies. The National Broadband Plan shows the average delay from spectrum being identified to being used is over eight years. Issues with incumbent users, and band clearing can add years to this, as well as risk to the investment, as we all saw in the LightSquared issues. This is a poor environment to foster the innovation needed in this highly dynamic space. It fails to support the innovation cycle that has been so successful in creating domination in Internet, applications, devices, and Smartphones, as examples. For US companies to dominate these future environments, we must have a spectrum policy that enables them to predictably, rapidly, and affordably obtain access to spectrum to develop and promote these applications.

Some have commented that the PCAST report depends on high-risk technologies. If anything the opposite is true. There are exciting technologies that could have been included in the recommendations, An example of this is the Dynamic Spectrum Access technology I worked on at DARPA. However, the recommendations initiate spectrum sharing using very conservative and available technology that extends the current analytic approach to spectrum sharing. It builds on systems that have already been approved by the FCC for the TV Whitespaces. It is a pragmatic solution using today's technology.

I believe the PCAST report was correct in not challenging the fundamental conclusions of the NTIA report. While it is possible that specific Federal usages, relocation costs, or required timelines could be challenged, such system-by-system adjustments would not be likely to change the overall dynamic. Relocation of Federal users will be increasingly more expensive, technically challenging, operationally disruptive, and costly. A metaphor for this might be that when a plow first pushes against snow, it moves easily, but with increased movement, the snow compresses and becomes an intractable block of ice. With each reallocation, Federal users are, and will become more compressed into the remaining Federal spectrum, and reallocation will be increasingly difficult.

Further, the report recognizes that Federal usage is no more static than civil, and faces the same growth in information access seen in civil users. The PCAST report approach enables Federal usage to evolve, and avoids locking Federal users into a new, but equally rigid and inflexible set of spectrum assignments.

Another comment I have heard is that the PCAST recommendations abandon the successful model of exclusive licensing. I did not read that anywhere in the report! Spectrum that can be freed up through mechanisms such as incentive auctions, clearing, or other repurposing could still be provided for exclusive use auctions. What it does say is that the current toolkit to deploy spectrum for use by the civil community is inadequate, and can not make best use of spectrum that would otherwise lie fallow. Would industry prefer to let this spectrum remain unusable, rather than be provided for use under potentially restrictive terms. If so, the marketplace will respond that way. However, our experience shows otherwise. The investment by industry in WiFi and carrier offload into the non-exclusive,

and massively congested unlicensed bands is proof that exclusive control is not a prerequisite for investment.

Spectrum sharing is not in opposition to license or auction processes. Instead, it is an alternative to letting spectrum lay fallow due to allocation policies that are not flexible enough to accommodate a wide range of applications and usage. Additionally, spectrum sharing offers the opportunity for revenue from spectrum that would otherwise not be eligible for auction. It eliminates the delay for clearing and auction, we enable a much wider range of bidders. I read the PCAST report as clearly embracing market solutions, and applying them to a whole new class of spectrum.

Lastly, I believe the PCAST recommendations are very friendly to, and enabling for innovation: Current spectrum allocation processes take ten years through the clearing and auction process, have high levels of uncertainty due to the political and regulatory process, and carry risk due to unknown impact on incumbent users. This is hardly conducive to the investment ecosystem that has spawned US domination in many areas of technology.

In summary, why should anyone oppose this approach? It takes nothing off the plate for commercial spectrum users. If bands can be cleared and auctioned with exclusive licensing, and I believe the PCAST recommendations in no way preclude that. If Federal spectrum is as underutilized as some say, then that spectrum will be almost immediately available for use. If federal users could more effectively utilize commercial services, then there is a model for that spectrum to placed into a secondary sharing rights market, generate revenue, and have that revenue defray the costs of the commercial services, and provide revenue.

Yes, the PCAST recommendations represent change, but it is change that takes nothing from current users; either commercial or Federal, and provides both category of participant the flexibility to fully exploit the full extent of the national spectrum resource. What more desirable accomplishment could any recommendation provide?

Thank you very much for your time and attention.