

Testimony of Lawrence J. White\*  
before the  
Committee on Commerce, Science, and Transportation  
U.S. Senate  
March 14, 2006

I am pleased and honored to have this opportunity to appear before this Committee on the important topic of today's hearing: "Spectrum Management Reform". Spectrum management reform is an area that, if policy moves in a sensible direction, could yield great benefits for the U.S. economy.

I am currently the co-chair (along with Dr. Thomas M. Lenard) of a Working Group convened by the Progress & Freedom Foundation (PFF) to propose a "New Spectrum Policy" for the U.S., as part of PFF's multi-faceted effort to provide a "Digital Age Communications Act" (DACA) that would guide the reform of U.S. telecommunications policy. Our Working Group recently unveiled "Release 1.0" of its Report, which I would like to submit for the record of this hearing.

As the "Release 1.0" characterization indicates, the New Spectrum Policy Report is still a work in progress and will likely go through some refinements in the coming months, as well as being accompanied by specific legislative language. Though no member of our Group -- composed of one or more economists, lawyers, and electrical engineers -- may agree with every single word in the current Release, we all agree on the major thrust of the Report: *that the current system of "command-and-control" regulation of the electromagnetic spectrum has yielded and will continue to yield large and growing inefficiencies in spectrum use, and that a "propertization" of the spectrum -- a system that would rely primarily on a framework of fully developed property rights and markets in spectrum -- would yield great benefits for the U.S. economy.*

---

\* Professor of Economics, Stern School of Business, New York University

In the rest of this written testimony I will summarize the "Release 1.0" of our Report. (Since "Release 1.0" is being submitted for the record together with this written testimony, the interested reader of this testimony who wants more detail, support, and citations can find them in that Report.)

### I. The Problem.

The widely recognized problem with uninhibited radio transmissions is "interference": one party's transmissions interfering with those of another party in the same (or a neighboring) geographic area and/or spectrum band. Another way of describing this problem is that it is one of negative externalities or spillover effects.

### II. Potential Ways of Managing the Problem.

There are three potential ways of managing the use of the spectrum, so as to deal with interference: a) the traditional command-and-control regulation and licensing approach; b) a commons/unlicensed approach; and c) a propertization and markets approach. The first is the approach that has been prevalent in the U.S. since 1927 -- first under the auspices of the Federal Radio Commission and then, from 1934 onward, under the auspices of Federal Communications Commission (FCC). The second has recently been advocated by a group of technologists and legal scholars. The third is the approach favored by the Report, taking as its origin a seminal 1959 article by Nobel Prize winner Ronald Coase.

### III. Traditional Command-and-Control Regulation and Licensing.

Since 1927, federal law has declared the spectrum to be a national resource, to be managed by the federal government for the benefit of the American people. In practice, this has meant a regime of detailed command-and-control regulation and licensing by (since 1934) the FCC: The FCC has traditionally allocated specific spectrum bands and geographic areas to specific uses,

mandated specific service parameters, and selected specific users (through "beauty contests") to hold the licenses for these bands, geographic areas, uses, and service parameters.

This approach broke down in the 1980s, when the FCC was swamped by applicants for the licenses for the newly opening (and clearly seen to be highly profitable) cellular services. The Congress came to the FCC's rescue by authorizing lotteries among the large numbers of otherwise qualified applicants. After the lotteries were revealed to yield rapid "flips" and large windfall gains, the Congress authorized auctions in 1993, which have been held for cellular and similar services since 1995.

Despite the widely acknowledged success of these spectrum auctions, and the FCC's recent efforts to grant greater flexibility to auctioned spectrum and to encourage a secondary market in spectrum, the overwhelming bulk of spectrum in the U.S. remains subject to the FCC's command-and-control regulation and licensing.

The costs to the U.S. economy of this rigid management approach have been documented and are now widely appreciated. Spectrum is utilized inefficiently. New products come to market later and at higher costs. Competition and innovation is impeded. For example, the rollout of cellular service in the U.S. was delayed for over a decade, while the FCC tried to figure out how to integrate this new service into its existing allocation scheme. Even today, after over a decade of auctions that have authorized larger swaths of spectrum for cellular service, it's clear that even greater allocations would be worthwhile and could lead to lower prices and improved services.

#### IV. The Commons/Unlicensed Approach.

The success of the FCC's experiments in allocating some spectrum bands to "unlicensed" low-power uses -- e.g., garage-door openers, WiFi, and Bluetooth -- and the advent of newer technologies, such as cognitive radio and mesh networks, has led some technologists and legal scholars to advocate the expansion of such unlicensed bands. At the limit, with sufficiently good

technologies, limits on power emissions of transmission devices, and adherence to courtesy protocols (the advocates argue), the spectrum could become a vast "commons", where formal management of the spectrum -- either in the FCC tradition or using the property rights approach discussed below -- would not be needed (and indeed, would introduce transactions costs and would impede full development of the spectrum). In essence, there would be an abundance of usable spectrum, so formal allocations would not be necessary.

The Report is highly skeptical of such claims. The demand for spectrum use is likely to be so price elastic that effective boundless abundance (i.e., effective supply would exceed demand, even at a zero price) is unlikely to appear. Further, the power limits and courtesy protocols necessary for a commons are just an alternative form of government command-and-control regulation. And the haziness of property rights and enforcement rights in a commons world would likely discourage the large-scale investments that would be needed in some areas for efficient spectrum utilization. The Report expresses the fear also that the continued governmental regulatory presence would mean that political considerations would trump efficiency in regulatory decisions. And, finally, the Report explains that propertization and markets can handle the kinds of uses -- e.g., garage-door openers and WiFi -- that are currently extolled as successful unlicensed uses. For example, an equipment manufacturer could buy the rights to use a specific spectrum frequency band (say, for garage-door openers) and then sell equipment designed to operate on that frequency to consumers.

In any event, the Report advocates "grandfathering" existing unlicensed spectrum bands for continued use along current lines. If in the future, governments want to create and set aside additional "spectrum commons", they should be required to buy the spectrum in the open market (as would everyone else in a propertization and markets framework), and careful benefit-cost analyses should be expected for any such purchases and uses.

## V. Propertization and Markets.

The third way to manage the spectrum so as to deal with interference -- the direction that the Report endorses -- is the approach of creating property rights in spectrum. The property rights would consist of a right to transmit within a specified geographic area and a specified spectrum frequency band, with limits on the power of the transmissions at the geographic and frequency band borders, and limits on in-band power as well. Another way of thinking about the property rights is that they constitute the right to exclude -- exclude others' transmissions within the property owner's geographic and spectrum band territory.

Within these limits, the spectrum owner could employ the spectrum for any use/service, so long as she didn't "trespass" with excessively powerful signals on the property of her neighbors. A spectrum property holder could add to her holdings, sell some of them off, divide, lease -- and even just not use her spectrum if she so chose.

Indeed, a convenient metaphor for these property rights in spectrum is that of real estate: The property owner of a bundle of spectrum rights could think of those rights as roughly equivalent to those enjoyed by the owner of a piece of real estate. The rights and activities enjoyed by the spectrum owner could equally well describe those enjoyed by a real estate owner. The Report envisions spectrum markets for transactions developing, just as real estate markets have developed for commercial and residential real estate. Also, of course, the antitrust laws would apply to any agglomerations of spectrum, so as to prevent such agglomerations from creating positions of market power.

Any initial specification of these spectrum property rights -- the geographic boundaries, the spectrum band boundaries, the power limits -- ought to be capable of being renegotiated by owners among themselves in subsequent transactions, as market conditions and technologies of transmission and reception change. But because such negotiations are costly, the initial allocations should be structured -- initially by the FCC -- with an eye toward minimizing such subsequent

transactions. The FCC's Evan Kwerel and John Williams have suggested that the parameters that apply currently to auctioned personal communications services (PCS) spectrum would be a useful starting place for much, if not most spectrum in a propertized framework. Also, the Report notes that cognitive radio, whose development is seen by commons advocates as a boon to the commons approach, may well help reduce transactions costs in a propertization approach, since the need to amass adjacent spectrum bands for a particular service would be reduced.

#### VI. How to Get from Here (Command-and-Control Regulation and Licensing) to There (Propertization and Markets).

If U.S. were starting with a clean slate -- i.e., if there were no current users of spectrum with implicit rights to the spectrum that they use -- there could be an initial laying out of spectrum property "plots" and then an all-inclusive auction to get those plots into the hands of those who could use them most effectively. With well-defined property rights applied to these spectrum plots, secondary markets in spectrum would quickly develop.

However, the U.S. starts instead with the existing "legacy" system of "encumbered" spectrum, based on the FCC's command-and-control regulatory and licensing system described above. Some spectrum holders have recently purchased their spectrum in the auctions of the past dozen years. Others received their spectrum gratis through a beauty contest. Yet others purchased their spectrum indirectly by buying a company (e.g., a radio or TV broadcaster) that had spectrum rights. Virtually all are likely to have made substantial investments in equipment and other complementary inputs to the use of their spectrum. In addition, there are some spectrum bands that are currently unassigned or that are lightly used and encumbered. And various governmental bodies have a claim to approximately a third of the available spectrum.

Consequently a major challenge to implementing a propertized spectrum framework is designing the transition from the current legacy system to a propertized system. The Report

identifies five distinct options for a transition to a propertized system for spectrum. Under any of the options, a "National Spectrum Registry" should be established (much like land registries), so as to facilitate spectrum transactions and negotiations. The Registry could be maintained by the FCC, by the National Telecommunications and Information Administration (NTIA), or by a private entity.

The five potential options discussed in the Report are as follows:

1) **Auction spectrum with the rights to clear incumbents immediately without compensation.** In essence, current spectrum users would retain no residual rights and could be removed by the purchasers at will.

2) **Auction spectrum with rights to clear incumbents with compensation.** Clearing would entail paying either relocation costs or, if the value of the incumbent's operations is less than relocation costs, paying the incumbent to cease operations. If the clearing costs are readily known or quickly adjudicated, this option will usually yield efficient outcomes.

3) **Auction spectrum without rights to clear incumbents from the auction spectrum.** Buyers of the spectrum would be required to negotiate with incumbents to change the configuration of the latter's rights. This option is similar to one recently proposed by the British telecommunications regulator, Ofcom, as well as to a proposal by Senator Larry Pressler in 1996.

4) **A "Big Bang" auction with unassigned and encumbered spectrum.** Incumbents would be encouraged to bring their spectrum voluntarily to auction. Incumbents could either be permitted to repurchase their existing rights at no net cost to themselves, or they could be given transferable vouchers to compensate them for mandatory clearing.

5) **Give incumbents full property rights to the spectrum that they already use.** Current spectrum users would thereby gain immediate flexibility in terms of adjusting inputs and altering uses, so long as they did not thereby generate interference with an adjacent spectrum owner's property rights.

The Report rejects options 1 and 5 as, at best, likely to lead to great delays in implementation. The Report does, however, endorse options 2-4 as all reasonable choices and, if properly implemented, could provide an efficient and timely transition to a propertized and market-oriented spectrum regime.

#### VII. Government-held spectrum.

Government at all levels (federal, state, and local) now hold about a third of all available spectrum. Even in a propertized framework, so long as spectrum is a "free" resource to a government agency, there is no clear incentive for the agency to do other than to hoard its spectrum against the possibility that it may be useful sometime in the future. The Report does recommend, however, a number of measures that can encourage greater efficiency in the use of publicly held spectrum:

- 1) Include government-held spectrum in the National Registry.
- 2) Require that NTIA prepare and submit annual reports to Congress on spectrum usage by government.
- 3) Establish reward structures that encourage government employees to economize on their agencies' uses and holdings of spectrum.
- 4) Government entities at all levels should be expected to purchase any additional spectrum rights that they want to use.
- 5) Try innovative ways to promote efficient use of government spectrum, such as contracts let by government public safety agencies that would allow contractors to provide public safety spectrum services in return for rights to use that spectrum when not needed for public safety.
- 6) Generally encourage purchase of communications services in place of grants of spectrum.

#### VIII. The Legal Standard for Enforcement of Spectrum Property Rights.

Spectrum property owners need to be able to have legal recourse in the event that someone breaches their property right -- in essence, if someone trespasses on their spectrum property. It is also critical that the property rights be as clearly defined and unambiguous -- and that the adjudication process be as simple -- as possible.

The Report endorses the concept of using the law of trespass as the appropriate legal framework. Detection of trespass could be based on measurements at the (geographic or spectrum band) boundary or could be based on measurements at the transmitter combined with a radiation propagation model that indicates the consequent emission levels at the boundaries. The latter approach currently works well for the quasi-property-rights regime that applies to the PCS bands. Also, some allowance may be necessary for the stochastic properties of transmission power strengths that are due to environmental conditions.

Enforcement could be through the federal court system or through adjudicatory proceedings in a reformed FCC (as described in the DACA Institutional Reform Working Group's report).

#### IX. International Obligations.

The Report recognizes that the U.S. has international obligations with respect to spectrum usage and interference and advocates that all spectrum rights that are created in a propertized framework should be consistent with those obligations.

#### X. The Role of the FCC.

The FCC would have at least one and possibly two additional important roles in the propertized framework advocated in the Report. First, the FCC would be responsible for the initial implementation of the property rights regime -- the auctions, the initial specifications of geographic and spectrum band boundaries, the specification of power limits at the boundaries, etc. Second, the FCC could be the agency that maintains the National Spectrum Registry. Third, the FCC could be

the initial forum for the adjudication of spectrum property disputes.

## XI. Conclusion.

A relatively new approach to spectrum management -- based on property rights and markets -- holds great promise for improving the efficiency with which the spectrum is utilized in the U.S. economy and for encouraging innovation and competition. The Report describes and explains this new approach and identifies three sensible options for a transition from the current command-and-control regulatory and licensing regime to a propertization and markets framework for spectrum. A rapid commitment to one of these options would surely be in the best interests of our country.