outweigh tlie costs of windfalls to incumbents[157] For instance, MSS providers stated that efficiency gains would follow froin a policy that allowed them to coiiduct terrestrial mobile operations in spectruin that MSS would otherwise render useless for traditional terrestrial mobile purposes.[158] They asserted that granting regulatory tlcxihility may lower costs and eliminate inefficiencies by allowing MSS operators to extend their addressable markets to urban and suburban areas, increase the nuinber of subscribers by offering a ubiquitous and previously unavailable niohile service, and lower costs by increasing the number of handsets produced.

To tlic extent that the Commission determined that the appropriate avenue would be to clear a band of incuinbents and reallocate it to inore flexible use, several parties recommended that the Coininission create a "trust fund" froin auction proceeds iii order to pay for relocation costs involved in the band clearing.[159] In addition, some commenters advocated using incentives, such as user lees, to encourage licensees to iiiore efficiently use spectrum that was undcrutilized.[160]

As also discussed above, various parties focused on the need for longterm planning on the part of the Commission.[161] For instance, parties suggested that the Commission should devise a coiiiprehensive spectruin management plan for the next several years hy anticipating future rulemakings. As noted above, a three- and ten-year plan were suggested.[162] Another commenter proposed that the Coininission take a 20-year view to assist investment, spur innovation, and focus on ways to transition hands to digital technologies. Among the other ideas suggested was that of using the expiration of licenses as a tiiiie to transition to new spectrum management approaches.[163]

A. General Transition Considerations

In deierinining whether and how to transition legacy command-and-control hands to iiiore flexible rights models, the Commission should focus first on initiating transition in those bands where additional flexibility will provide the greatest benefits at the least cost. In general, the greatest benefits will be realized in those bands in which the current regulatory regime has led to significant underutilization or inefficient use of the spectrum However, the Commission must also weigh the potential cost of transition, both in terms of its impact on incumbents and on tlie public. Assessing these potential costs and benefits, the Working Group concludes that there are soine spectrum bands in which introducing fundamental regulatory changes in the near terin inay not be necessary, appropriate, or practical. These include

- Bands licensed under flexible use rules or currently allocated for such use:
- Bands dedicated for use by unlicensed devices;

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[157] *See, e.g.*, Mobile Satellite Ventures Comments at 8.
[158] *See, e.g.*, Mobile Satellite Ventures Comments at 14.
[159] *See, e.g.*, TIA Comments at 7; Nokia Comments at 3.
[160] *See, e.g.*, Comscarch Comments at 6.
[161] *See generally* Nokia Comments at 2; TIA Comments at 4-6
[162] *See* CTIA Comments at 15-16.
[163] *See* Consumer Federation of America Comments at 30-31.

- Public safety spectrum;
- Broadcast spectrum, including DTV spectruin that is subject to ongoing rulemakings;
- Spectrum bands curl-ently shared with the Federal Govrrninent; and
- Bands licensed on a shared or non-exclusive basis.

In bands that fall outside these categories, however, the Working Group recommends that the Cuininission initiate proceedings to begin the transition of its spectrum regulations to allow inore flexible uses. Moreover, in the long tertii, the Commission sliould consider transitioning to a flexible rights inodel in all bands throughout the spectrum where such action would further the Coininission's spectruni policy goals.

B. Available Transition Mechanisms

Oiice the Commission identifies particular hands that are suitable for transition, it will iieed to identify appropriate transition mechanisms. Historically, the Commission has used a number of different transitional mechanisms to inove spectrum from narrowly-defined legacy uses to inore tlexible new uses. In addition, other mechanisms that have nor previously been used are also available. Generally, the core issue for all of these transition mechanisms is the treatment of incumbents: Do they reinain in the band or are they cleared or relocated? If incumbents are cleared or relocated out of the band, what mechanisms are used'? If incuinbents remain in the band, does the Commission grant them expanded riglits outright or does it use a iiew licensing vehicle to award expanded rights?

Transition options generally fall into the lollowing categories, though variations and combinations of each are also possible: (I) reallocating a particular band to the flexible rights inodel, with assignment of the expanded rights to new licensees and the mandatory relocation of incuinhents to other bands; (2) allowing incumbents to remain as licensees for those portions in a band tliat they currently occupy. while assigning "overlay" licenses for additional rights and/or unoccupied "white space" not assigned to incumbents, (3) reallocating and assigning spectruin to iiew licensees under the flexible rights model, anti using voluntary market-based band-restructuring incentives, such as a two-sided auction. to encourage incumbents to clear or restructure the hand; or (4) granting cxpanded. flexible rights to the incuinbent licensees already occupying the band. Each of these options is discussed in general below.

1. Expanded rights "overlay" licenses combined with mandatory relocation of incumbents

Under this optioii, tlie Commission reallocates a particular band of spectruin to allow for iiiore tlexible uses, grants the expanded usage riglits under new licenses (*generally via* auctions) and requires iricumbent licensees and the services they provide to clear the band and either cease operating or relocate to other bands. The Commission has used this option in several instances, including broadband PCS.

There arc several variations of this option, depending on the conditions that must be met in order for mandatory relocation of incumbents to occur. Under one approach (which was used for broadband PCS), new spectrum licenses are issued under flexible rules while iiicuinbents are required to clear, relocate, or retune to alternative bands by a specified date. In addition. the new licensees may bc required to pay the costs of relocating incuinbents. Uiider a more conditional approach (which was adopted for 700 MHz DTV spectruiii). incumbents are required to clcar or relocate only if and when certain external conditions are met, such that there is no fixed time frame for clearing and relocation. Under this approach, while new licensees are not required to pay the costs of clearing and relocating incuinbents, they may pay for voluntary early clearing by iincumbents.

2. Expanded rights "overlay" licenses with grandfathering of incumbents

Uiider this option, tlie Commission grants expanded usage rights under new licenses, which are "overlaid" on rop of the incumbent licenses. Incumbents retain their existing rights (including interference and renewal rights) on a grandfathered **basis,** and are not subject to mandatory hand-clearing or relocation.

This overlay option has been used in services such as paging and SMR where the Commission is converting from site-based to geographic-area licensing, there is unlicensed "white space" (geographic areas where incumbents are not currently authorized). and incumbent and potential new uses are generally coinpatible. Under this option, incumbent\ can only acquire expanded rights, including the ability to expand their systems beyond their existing sitebased contours, by obtaining overlay licenses. Alternatively, new overlay licensees must protect incumbents' existing systeins unless they buy the incumbents out.

3. Expanded rights "overlay" licenses combined with voluntary band-clearing/restructuring incentives *for* incumbents

Under this option, the Commission reallocates restricted spectrum to iiiore flexible use, grants the expanded usage rights under new licenses, and establishes a *simultaneous* inarket-based exchange mechanism to encourage voluntary band-clearing or restructuring of the band by incumbents. This inechanisin is designed to create incentives for incumbents either to relinquish their licenses and clear the band for new

users or to exchange their restricted-use licenses fur the expanded rights available under the new license.

The Commission has not employed this option to date, but a number of potential mechanisms have been proposed that could facilitate this type of exchange. For instance, one mechanism that has been suggested is a "two-sided" auction, in which the *Commission would auction* expanded *usage* rights *to spectrum* under new *licenses, and* incumbents would voluntarily inake their spectruiii rights in the band available for auction at the same time.[164] Under ihis approach, incumbents would be eligible to participate in the auction for expanded rights only if they offered their own spectrum licenses for sale in the same auction. Moreover, incumbents would be allowed to "bid" on thcir own spectrum in addition to spectruni offered by other incumbents and by the FCC. Incumbents who chose not to offer their licenses would retain their incumbent rights, but would not be grantcd expanded rights. This mechanism provides several incentives to incumbents to offer thcir spectrum rights for possible exchange. First, if *incumbents* voluntarily participate, they would immediately have their licenses converted to expanded llexible rights licenses, thus incrcasiiig the value of their spcctruin usage riglits. In addition. incumbents would iiot be forced to sell their spectrum usage rights to others, although they would face the opportunity cost of not doing so. Finally, incumbents would be able to keep any proceeds from the sale of their rights to others. and could, as well, potentially obtain rights to relocate to other parts of the auctioned band (or other hands altogether) that might he iiiore advantageous to them

4. Expanded rights granted to incumbent licensees under existing licenses

Under this option, the Commission grants expanded tlexiblr rights directly to incumbents through modification of their existing licenses. Potential new entrants are not able to bid for or otherwise obtain these expanded rights, except hy acquiring the licenses from incumbents through the secondary market. This option has been used by the Commission in several bands. For example, in the CMRS Flexibility proceeding, the Commission grantcd CMRS providers the right to provide fixed in addition to mobile services under their existing licenses.

C. Factors Affecting the Choice of Transition Mechanism

The Commission must consider a number of factors when deciding which transition mechanisms to implement. These factors may vary significantly from band to band, suggesting possible advantages to taking different approaches in different bands.

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[164] *See* Evan Kwerel and John Williams, "A Proposal For a Rapid Transition to Market Allocation of Spectrum," OPP Working Paper 38 (November 2002).

Major factors in the Commission's evaluation of options include:

- The restrictive nature of licensee rights currently afforded incumbents in the band when compared with the flexibility that would be gained by transitioning to an expanded llexible rights model;
- The types of services currently offered in the band and the potential consumer impact of transitioning to an expanded llexible rights model of licensing;
- The number of incumbents in the band;
- The likelihood that cxpanded flexibility would lead to rapid changes in the use of the band or instead would have only a gradual impact on existing systems and uacs;
- Tlic practical effect on incumbent systems of providing expanded flexibility under a new licensing model (e.g., tlic potential for new users to coexist in tlie band with incuinbents);
- Tlic nature and extent of investments made by incumbents in their acquisition of licenses and llie building of systems, including whether incumbents have liad the opportunity to recoup their investments; and
- Tlic tiiiie and transaction costs associated with developing and iniplementing any panicular transition inechanism in a particular hand or hands. coinpared to other transition mechanisms.

New licensing with mandatory relocation. **As** a preliminary matter, consideration of tliis option depends on the availability of alternative spectrum that would be suitable for use by incumbent licensees required to relocate. Assuming that alternative spectrum is available, this option inay be preferred in cases where band-clearing is likely to be critical because of the technical incompatibility between existing uses by incumbents and prospective uses. However. it is iinportant that the benefits to be obtained through mandatory hand-clearing outweigh the costs and time required to complete *the* relocation of incumbents, aiid that the relocation be consistent with the Commission's broader spectrum goals for tlic relocation band.

In order to ensure maximum efficiency gains in the near term and avoid holdout problems, it is preferable *under* this *option* for there to be ***a*** fixed timetable for mandatory relocation. Furthermore, this optioii is likely to work best when there are niarket incentives for iiew licensees and incumbents to negotiate voluntary relocatioii agreements, although it may also be appropriate to develop mandatory compensation mechanisms in the event that tlic voluntary ones prove inadequate

New licensing with incumbent overlay. The "overlay option" generally requires the presence of a significant amount of unlicensed "white space" that would lend itself to an overlay licensing scheme. This option also is likely to work best where there is a limited need to relocate incuinbents to other bands and where incumbents have incentives to acquire rights to tlie surrounding white space, e.g., in hands that are being converted from site-based to geographic area licensing and where incumbent uses and potential new uses are generally coinpatible. In considering use of this option, the Commission needs to assess the degree of risk that incuinbents will hold out against transitioning to iiiorc

flexible use, which could hinder the Commission's goal of enabling inore efficient use of the spectrum.

New licensing with voluntary **band-clearing/restructuring.** This option has potential advantages when (I) the new flexible rights regiine being implemented represents a significant increase in flexibility over the legacy rules, and (2) this expanded flexibility is likely to lead to rapid changes in the inarkct value and the actual use of the spectrum. In such cases, a simultaneous exchange mechanism may be the fastest and most efficient means of enabling incumbents and potential new spectruiii users to restructure and reassign spectrum rights within the band to facilitate new uses. In determining whether to employ this option, the Corniiiission should compare the administrative costs and efficiency of implementing a simultaneous exchange inechanisin with that of employing other transition options. particularly the option of granting expanded rights to incumbents discussed below.

Expanded rights granted to incumbents. This option has potential advantages where the practical impact of granting incumbents additional flexibility is limited or is likely to be gradual rather than immediate, in which case it is likely that h e operation of secoiidary markets over time can effectively distribute these flexible rights so that efficiency gains can be achieved. As a practical inatter, this option also requires that there be no "white space," i.e., that all spectrum in the band be previously assigned to iiicuiiibents (to avoid ambiguity as to who is entitled to additional rights). While granting incumbent licensees additional flexibility inay allow for iiiore immediate expansion of tlic availability of llexible rights licensing models, it also inay raise equity issues relating to possible windfalls or unjust eiirichinent. The larger issue is whether such a policy would encourage parries to make future bids on presumably low-cost spectruiii that is allocated for low-value uses and that has no flexibility, then petition for an expansion of those rights alter acquiring the license. Accordingly, in considering this option, these equity issues will need to bc balanced against the potential gains in administrative efficiency and the potential public benefits of providing additional llexibility to incumbents in the band.

Conclusions/recommendations. The Working Group recoinmends that the Commission undertake the following:

- Identify cncuinbered bands licensed under legacy command-and-control regiines that are suitable for trnnsitioning to expanded flexible rights licensing models within the next five years –
    - Set a goal of identifying 100 inegahcrtz of spectrum below 3 GHz for this transition phase.
    - Develop processes for determining which bands provide greatest opportunity for improving efficient use through adoption of cxpanded flexible rights licensing schemes.
    - Look for band "defragmentation" opportunities (i.e., consolidating narrowband spectrum "slices").

- Choose appropriate transition mechanisms for the different bands being transitioned –
    - Look for bands in which to test different transition mechanisms.
    - Promote policy and legislative changes to facilitate the conducting of two-sided auctions.
    - Encourage migration of compatible technologies into coininon band groupings.

Acknowledgements

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Appendix I

Bibliography (with Summaries)

1. M. Calabrese, "Battle Over the Airwaves; Principles for Spectrum Policy Reform," New America Foundation, Sept. 2001
http://www.newamerica.net/Download_Docs/pdfs/Pub_File_610_1.pdf

The locus of this article is a discussion of the principles *that Calabrese believes should* guide spectrum policy reform. Four principles Calabrese considers to be important are: (1) the airwaves are a public asset owned in coininon by all Americans; (2) all commercial licensees *should* pay *a market-based rent* for the use *of spectrum; (3)* rigid zoning of the airwaves should be replaced by more flexible. market-driven allocation process; (4) revenue from licensing spectrum should be reinvested in new public assets that benefit all Americans and be used to update our educational technology and public media for the digital age. Calabrese suggests that the immediate problem the FCC faces is the shortage of spectrum caused by the rapid diffusion of wireless communications. The short-term issue is how to reallocate spectrum fruin existing licensees (who pay nothing) to emerging technologies (particularly wireless broadband services) that promise both higher value-added services and the payment of substantial pubic auction revenue. Therefore, Calabrese suggests Ilial auctions should occur as soon as possible. Calabrese claims Ilial the longer-term challenge is to modernize spectrum policy in a way that combines more flexible and market-oriented allocation rules with a level playing field that requires all commercial users to pay a market rate to rent space on the public airwaves. Charging all commercial licensees would result in more efficient use of spectrum as well as in the formation of a private secondary market. *Calabrese also believes that the* public should *maintain control of* spectrum and that licenses shuuld be for strictly-defined periods He suggests a transition method which (1) sets a date when incumbent licenses will be auctioned rather than automatically *renewed*; (2) *imposes an* airway "right *of way"* fee *similar* to a franchise fee typically paid by cable companies to local governments for terrestrial rights of way; (3) combines Ilie future auction date with escalating interim fees Calabrese also suggests that lease Tees cuuld be an option where auctions are not practical (e.g. for small business users **and** public sector users).

2. R. Carlberg, "The Persistence **of** the ***Dirigiste*** Model: Wireless **Spectrum** Allocation **in** Europe, ***a la Francaise,***" 54 Fed. Comm. L.J. I29 (2001).
http://www.law.indiana.edu/fclj/pubs/v54/no1/Carlberg.pdf

Carlberg examines spectrum allocation for 3G inohilc wireless networks in Ilie European Union. He claims thdt Ilie EC committed itself to a schizophrenic policy when it allowed member states to devise their own methods of allocating frequency spectrum. In particular, Carlberg criticizes Ilic French *drrigiste* policies where *dirigisme* refers to the central government's role in directing **ilie** French economy. He claims that the EC lias erred in two crucial aspects of its spectrum policy It imposed short-term deadlines and pushed lur the speedy creation of a 3G market. This may have the effect of an over-commitment of resources by telecom firms and financial institutions to a market where demand is only speculative. In addition, the *EC* yielded to countries like France Ihal wanted to maintain substantial control over Ihe selection of Ihe license and near-managerial control over the future market. Therefore, the EC did not require free market auctions for 3G licenses, thus *undercutting the EC's* policy of inarkel liberalization and of greater competition among Eurupcan firms.

3. R.H. Coase, **"The Federal Communications Commission,"** 2 J.L. & Econ. I (1959).

Coase begins this article with an overview of the development of government regulation of spectrum in tlie United States He then discusses ilie debate over whether ilie FCC's consideration of programming content when granting licenses is in violation of the First Amendment to the Constitution which protects the freeduin of the press. Finally, Coase discusses Ilic system used by Ilie FCC (prior to 1960) to allocate speclrum and whether or iiot spectrum should he treated as private property. Coase argues that licensees should have to pay for spectrum use and states that ilie aim of regulation should be to maximize output as opposed io minimizing interference. Coase argues that it is nut necessarily optimal io coinpletdy eliminate interference, but that any gain resulting in interference sliuuld more than offset the harm it produces. Ile also makes an argument for the use ol'properly riglils but also notes that when large numbers of people are involved, the argument for the institution of property rights becomes weaker and that for general regulations becomes stronger. He suggests ihai only practical experience can answer the question of how far delimitation of riglils should come ahout as a result of strict regulation and how far as a result of transactions on Llie market.

4. R.H. Coase, **"The Nature of the Firm,"** 4 Economica 398 (1937).

Coase was responsible for the initial development of the Lheory of the Iirin which he describes in this very influential paper. A firm can he defined as a group of people who have organized themselves for tlie purpose of transforming inputs into outputs. Coase develops a theory explaining **why** these firms exist. Thal is, why do people organize in this fashion'? Why, if the inarkel is the inosl efficient way of allocating resources, do producers of different inputs (e.g. owners of capital and workers with various skills) allow decision-making to he centralized? If a market is better at allocating resources than a central planner then why is the creation of a firm necessary? Within tlir firm, individual bargains between the various co-operating factors of production are eliminated and Ior a market transaction is substituted an administrative decision. Coase notes that production could possbly be carrird out in a completely decentralized way by means of contracts between individuals. But, if the costs of these transactions are very high or if short term contracts would hc unsatisfactory, firms will emerge to organize what would otherwise have been market transactions The limit to the size of the Iirin is sei where its costs of organizing a transaction become equal to Ilie cost of carrying it out ilirough Ilie rnarkrl These transaction costs determine what thr firm buys, produces, aiid sells. Coase notes Ihal a firm will tend to be larger: (1) the less the costs of organizing and the slower these costs rise with an increase in the transactions organized; (2) the less likely the entrepreneur is to inahr mistakes and the smaller the increase in mistakes with an increase in the transactions organized; (3) the greater the lowering in the supply price of factors of production io firms of larger size; **(4)** the smaller ihc spatial distribution of the transactions organized and Ilie dissimilarities of these transactions; (5) when inventions such as Ilie telephone reduce the costs of organizing spatially.

5. R.H. Coase, **"The Problem of Social Cost,"** 3 J.L. & Econ. I (1960).

This very influential paper laid **Ilir** groundwork for the development of tlie Coase Theorem (for which ilie economist, Joseph E Stiglitz, coined tlic term). The Coase theorem asserts that an optimal allocation of resources caii always be achieved through markei forces, irrespective of the

legal liability assignment, if information is perfect and transactions are costless.[165] Coase first advanced the proposition on which this theorem is based in "The Federal Communications Commission"[166] aiid develops it in more depth here. In this article. Coase examines the actions of businesses that have harmful effects on others and examines how the assignment of properly rights can potentially mitigate these harmful effects. He also discusses the merits of and costs to government regulation. Coase shows that if an initial delineation of propcrty rights is established. Ilic ultimate allocation of resources which maximizes the value of production is independent of the legal position if the pricing system is assumed to work without cost. In reality the pricing system does not work without cost. There arc transaction costs to carrying out markcl transactions which may prevent many transactions that otherwise would have been carried out These costs include the costs of negotiating, drawing up contracts, and enforcing these contracts. When transaction costs are taken into consideration, tlic initial delimitation of rights does have an effect on efficiency and Ilie allocation of resources In a situation in which there exist high transaction costs, direct government regulation may be necessary. Instead of instituting a legal system of rights wliicli caii be modified by transactions on Ilic inarket, tlie government inay *impose regulations* which *state what people must or must* no1 do and which *must* be obeyed. But there are costs to government regulation as well which include: (1) had decisions made regarding restrictive and zoning regulations: (2) political pressures; (3) operating without any competitive check. Government regulation is useful when a large number of people would iieed to he involved with the bargaining in a market syslein because ilie costs of handling the problem through the market or a firm would be high in this situation. Coase argues that when considering regulation, Ilic government must decide whether the gain from preventing the harm is greater than **Ilir** loss which could be suffered elsewhere as a result of stopping the action which produced the harm

6. P. Cramton, E. Kwerel, and J. Williams, **"Efficient Relocation of Spectrum Incumbents,"** 41 J.L. & Ccon. 647 (1998). http://www.market-design.com/files/98jle-efficient-relocation.pdf

Tlic authors examine the relative efficiencies of alternative rules for relocating speclruin incumbents They compare two alternative types of property rights, **ilie "right to stay"** and the "right to move." Under ilie righi to stay rule, an incumbent is free to use Ilie spccrruin according to the terms of the existing license. Uiider the right to inove rule, tlie entrant can unilaterally *move the incumbent*. There are two versions of the righi to move rule: the right to move with compensation to the incumbent aiid the righi to move without compensation. The authors find that giving the new entrant the right to inove tlic incumbent with compensation caii reduce negotiation costs and promote efficiency when there is private information about spectrum values but good public information about the cost of relocating Ilie incumbent. They also note that adopting an efficient relocation rule is especially imporrant *in a setting like PCS, where the* reallocation brings much needed competition.

7. **R.** Crandall, **J.** Eisenach, J. Gattuso, T. Hazlett, P.W. Huber, **G.A.** Keyworth II, T.M. Lenard, W.C. Myers, P. Pitsch, **K.** Robinson, G. Sidak. and **A.** Thierer, **"Privatizing the Electromagnetic Spectrum,"** *Future Insight* 3.1, May 1996.

The authors giv c some very specific recommendations *for* managing spectrum policy so a somewhat longer summary is presented hcre. The authors state that the overarching goal should

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[165] Jean Tirole, The Theory of Industrial Organization, The MIT Press, 1995, p. 113.
[166] R.H. Coase, "The Federal Communications Commission." 2 J.L.& Econ. 1 (1959).

be to maximize tlir value of spectrum io the American people. The current system is government-run and centrally managed but tlie authors believe that the best means of achieving efficient use of the spectrum is to rely principally on market forces They slate three problems with the current system: (1) tlic FCC lacks llie information necessary Io make efficient decisions; (2) tlie process has heeii used by special interests to delay competition and innovation; (3) the current system lias held fallow or underutilized a substantial portion of the spectrum for government purposes

The authors recommend that within its explicit or implied service area and spectrum block. a licensee should bc given: (1) service and technical flexibility; (2) freedom to resell or sublease; (3) freedom to pick regulatory classification Specilically, the authors recommend that llie FCC prepare an overlay system of licenses ihai would permit the exhaustive assignment of the 402 MHz of spectrum allocated for television broadcasting services. In order to do thisthe FCC should create licenses of 20 MHz and no smaller than tlic relevant ADI aiid assign overlay licenses using simultaneous multiple round auctions. Tlic authors believe that the FCC should permit aggregation of overlay licenses, subject only to competitive considerations and that existing TV broadcast licensees be given flexibility in use. Tlie authors rrcommend that currently unassigned spcctrum he made available in an efficient manner and that the new assignments should bc: (1)exclusive; (2) have the same marketplace freedoms as existing licensees: (3) assigned through simultaneous multiple round auctions where there are mutually exclusive applicants Existing licensees in these bands would be protected and would gain flexibility in use and the FCC would define interference radiation limits between new licensees. The FCC should maximize the value of the spectrum licenses hy auctioning hroad, low-frequency bands of contiguous spectrum thal are not fully assigned.

Similar incentive-based reforms are recommended For tlie spectrum used by tlie federal government and public safely community. The authors recommend that: (1) any state may assume responsibility for managing ilie spectrum currently allocated to public safely uses within its state boundaries provided it notifies llie FCC of its plans; (2) any state government assuming spectrum management for public safely frequencies inay grant licensees the same flexibility in use available to private FCC licensees; (3) interference disputes between states be resolved at the FCC; (4) within oiic year tlie federal government inake an additional 20% of its exclusive or shared spectrum below 5 GHz available to tlie FCC for allocation to private sector licensees using auctions. After two years, the FCC should prepare a cost-benefit report on the effects of implementing proposed legislation which would include: (1) an estimate of the change in costs of accessing spectrum, (2) the net economic and social benefits accruing fruin inore flexible use of spectrum; (3) tlir impact on low power users, (4)a discussion of how reforms affected llie international allocation of spectrum, tlie setting of technical standards, tlie development of new uses of the spectrum, the availability of advertiser-supported programming, and rhe use of spectrum by the federal government and public safety community.

8. *A. De* Vany. "Implementing *a* Market-Based Spectrum *Policy*," 41 J.L. & Econ. *627* (1998).

Dr Vany contends that the block allocation method results in a great portion ofthe spectrum going unused and, since it fixes technical standards for each block, technological innovation is prevrnied. De Vany believes thal spectrum should be unbundled from broadcast and transmission facilities and that the "commoditization" of spectrum will facilitate standardization, price discovery, and open access Io diverse users. He believes that a liquid secondary spectrum market will lower transactions and entry cost, making telecommunications

markets contestable. De Vany contends that unbundled spectruin properly rights, commoditization, and open markets will give the public access lo this public resource lie suggests that llie government hold 2-sided simultaneous auctions with package bidding Tor interdependent licenses wliicli differ in frequency and scope This, De Vany believes, would result in voluntary spectrum clearing and reallocation De Vany notes that if the government wants to raise revenue as well, the government could retain the difference between the bid and offer prices. The present broadcast standard of licenses should he restated in terms of the spectrum dimensions as they were in the WCS licenses and rights should bc defined with respect to transmitters.

9. A De Vany, R.D. Eckert, C.J. Meyers, D.J.O'Hara, and R.C. Scott, **"A Property System for Market Allocation of the Electromagnetic Spectrum: A Legal-Economic-Engineering Study,"** 21 Stan. L. Rev. 1499(1969)

Tlic authors give some very specific recommendations for managing spectrum policy. defining property rights, and defining the statutory rules so a somewhat longer summary is presented here. The authors believe tliat the goal for spectrum policy should he to maximize the social value of production fruin llie use of spectrum. In order to do lhal they believe that property rights need to be established and tliat the rule tor choosing among definitions of property rights should he to rrducc the costs of exchange aiid enforcement relative to the value of the rights. The authors recommend that rights should he defined with respect tu transmitter owners (because the authors believe that if rights urre given tu owners of receivers there would be high exchange and enforcement cots) and Tor frequencies between 50 and 1000 MHz. Rights ahould be specified in terms of time, area, and frequencies

The time rights should be defined as rights to use spectrum for 24 hours per day in perpetuity and these rights shuuld be transferable and divisible The area rights should be defined in terms of the following three properties: (1) the exclusive riglil lo originate radation subject lo the constraint that the field strength achieved by this radialion does not exceed a specified limit expressed in volts per nieter outside his area; (2) llie right tu he free, above llie same field strength, from radiation originating in any other area, (3) straight-line boundaries. Note that there will be an area (low quality service strip) between two licensees' areas where interference will be a problem. The width of this strip is greater for transmissions at lower frequencies. Therefore. the lower frequencies could be used Tor transmitters serving large areas, while higher frequencies could serve smaller areas. The frequency rights should be defined in terms of the following lhree properties (1) lliz rights apply to a band of frequencies bounded by upper and lower limits; (2) the exclusive right io originate radiation, subject tu the constraint that the field strength achieved in any other unit band of frequencies not exceed a certain limit; (3) the right io be free, above the same limit, from radiation originated by other sources assigned to a different band of frequencies. Note that there would he protection fruin multipath propagation from other users. Since there would hr economic incentives to limit tlic height of the antenna, there should be no explicit restrictions on antenna height.

The authors give detailed recommendations with respect tu formulation of the statutory rules regarding spectrum rights The rules should state that llie general purpose of the pruperly system is to create pioperty interests in a designated portion of the speclrum in urder to promote market allocation of this resource. The rules should include a definition of the basic properly interest in the spectruin and authority should be delegated to a federal agency to create licenses for sale io the public. The statute should state that licenses arc private property aiid fully transferable aiid specifically state: (1) license owners inay agree to changes in the boundaries of

the license areas; (2) license owners may transfer their rights to radiate on a Lime basis. hy tlic hour, day, mouth, or year or by aiiy other denomination of tiiiie; (3) license owners may agree to an increase or decrease of signal field-strength limits, (4) license owners may transfer all or any part of the hand assigned to them; (5) liceiise owners inay transfer all or any portion of their geographical areas of operation; (6) there shall be no restrictions, either in the license owner's certificate of ownership or by regulatory order. on transmitter power. or on antenna location and height The authors believe that there should be a strict liability standard and that any unauthorized operator of radiation within an assigned license is guilty of a breach of duty and can bc shut down. Injunctions should be granted as a matter of right lo aiiy complainant who establishes that liis rights have been violated. The statute should specifically berthr acquisition of prescriptive rights in Ilie spcclruin and there should iiot be criminal penalties.

The authors also recommend Ilial Ilie statute stipulate tlic time duration of the rights created (tlie authors recommend creation of perpetual rights). If the rights arc not defined as perpetual, Ilic auction for re-lease u f tlic license at Ilie end of the lease term shuuld beset for a time somewhat earlier than Ilie expiration ofthe terin. The lease arrangement night be accompanied by a system of rental payments instead of a lump sum payment but the government should be able to terminate the lease and re-lease the license if payments are not met. When transfers create multiple subdivisions of license areas a strict priority rule coupled with an expanded third-party-beneficiary doctrine will serve to allocate liability efficiently. The liability of transferees for rental payments could be dealt with by tlie adoption of rules similar to landlord and tenant law The authors recommend that thr statute require all agreements by license owners relating to the use of the spectrum be recorded iii a central regisrry Penalties should be assessed for noncompliance with the registration requirement, and unrecorded transfers should br voidable at tlie instance of subsequent purchasers The authors believe that enforcement should be left lo the federal and state courts. Other questions not addressed here could be resolved under stale law.

Tlic government could experiment with small portions of the speclruin Lo allow tlie opportunity to evaluate tlie above proposals. The authors recommend the following experiments: (1) in spectrum in which VHF and UHF television operates, auction off the unassigned channels to other radio services; (2) clear voice and UHF-television channels; (3) vest FM lights (fully *transferable and divisible* license rights would *replace input specifications*); (4) pack FM stations into tlie 94- to 108-MHz bands to Tree up spectrum for auction.

10. A. De Vany, **"Property Rights in the Electromagnetic Spectrum,"** Palgrave Dictionary of Economics and Law p. 167.

This article argues that Ilie decades old systems of spectrum management in use around the world must be replaced by inore open access to and flexible use of tlie spectruin resource. The author originally proposed a detailed model for privatization of speclruin iii 1969. The article posits that ilie concept of property rights is h e central issue in spectrum management. Propertization of spectrum would require a well-defined physical space broken down into time, area and spectrum bandwidth. Owners would be free to do with their spectrum as they desired. This type of system would drastically reduce transaction costs and get spectruiii out to tlie public much faster

11. H. Demsetz, **"Toward a Theory of Property Rights,"** *American Economic Review*, 1967, pp. 347-359.

Demsetz's goal was to fashion some of the elements of an economic theory of properly rights Demsetz explains that properly rights specify how persons may be benefited and harmed, and, therefore, who must pay whom to modify the actions taken by persons. He believes that the disadvantage of communal property is that the effects of a person's activities on his neighbors and on subsequent generations are iiot fully taken into account. The advantage of private property is that ilie concentration of benefits and costs on owners creates incentives to utilize resources more efficiently and io achieve a greater internalization of externalities. Demsetz mentions three broad pi inciples governing development o f property rights in communities oriented to private properly: (1) an increase in Ilic number of owners is an increase in Ilie communality of property and leads. generally, to an increase in Ilie cost of internalizing; (2) if there arc many externalities, a buy-out may be cheaper than contractual agreements; (3) Ilie greater the diseconomics of scale to land ownership the inore will contractual arrangement be used by Ilic interacting neighbors lo settle differences. Demsetz also notes that the emergence of property rights caii best he understood by their association with the emergence of new or different beneficial and harmful effects (e g. new technologies).

12. W.L. Fishman, **"Property Nights, Reliance, and Nelroactivity Under the Communications Act of 1934,"** 50 Fed. Comm. L.J. I (1997). http://www.law.indiana.edu/fclj/pubs/v50/no1/fishman.html

Fishman focuses on legal *interpretations* of the rights of spectrum licensees and explores the question of what is meant when we say that government preserves its (aasuinedj right to regulate spectrum by law. Fishman notes that although FCC approval is required for the transfer of control of the licensee or assignment of the license, it is reasonably clear (and the courts **have** recognized) that FCC licenses have some, albeit limited, attributes otproperiy. **Also,** although the FCC *discourages* speculation in unbuilt facilities, ilic sale of bare licenses resulting in a profit has been allowed in Llie past Fishman believes Ilial a contractual provision For reversion but subject lo FCC approval would be consistent with law. In addition, the creation of a security interest, albeit limited to the proceeds of an FCC-approved sale, should be deemed valid and enforceable Fishman notes that detrimental reliance in some circumstances is a workable substitute lor property rights aiid that considerations of justifiable reliance appear to liave had at least some force in past court cases. Past court cases demonstrate that FCC licensees have Ilic right to he treated equitably **hy** the FCC (even though proprrly rights are limited) aiid that the FCC can't disregard a licensee's reliance on prior policy. The courts won't automatically defer Lo FCC conclusions when there are claims of detrimental reliance. Fishman suggests proposing that property rights as normally understood are not a necessary precondition **Io** careful judicial review of agency policy changes. Ile believes thal detrimental reliance inay represent a recognizable aiid legitimate basis on which to seek relief even when. in Ilie classical sense, there are no property rights as such.

13. R.C. Fritts, **"Private Property, Economic Efficiency, and Spectrum Policy in the Wake of the C Block Auction,"** 51 Fed. Comm. *L.J.* **849** (1999). http://law.indiana.edu/fclj/pubs/v51/no3/FritMac9.PDF

Fritts examines the C block auction, which look place in 1995, discusses what went wrong, and suggests remedies He mentions six factors which contributed to the failure of the C block auctions to *efficiently distribute* specirum: (1) the C block *licensees were mostly*

newcomers to the industry and they didn't have the infrastructure necessary to make efficient use of tlic spectrum; (2) the lenient terms of the license drove up the bids (higher than their market value); (3) newcomers and new technology made it difficult to determine the optimal bid; (4) most C block bidders failed to arrange adequate financing before the auction took place; (5) special payment plans for small businesses contributed lo inefficient allocation; (6) too many goals were given to tlic FCC and efficiency was not primary. Fritts notes that the auction rules were clear and objective and were nor the cause of the probleins discussed above. Instead. the problems stemmed from the policy underlying tlie tules of the auction.

Frills believes that llie primary focus of the FCC should be the efficient distribution of property righls in specltum. These properly rights should include the righi to use the rpectrum in whatever manner tlic owner deems to be in liis or her best interest. Fritts believes that spectrum should he distributed to those that value it most aiid lhal there should be sufficient competition in the market to ensure accurate prices. The FCC should avoid dramatic changes in rules so thal companies can count on regulatory law to br predictable. Tlic only goals oftlie FCC should he to conduct auctions in an efficient manner and grant winners an ownership iiiterest equivalent to private property that will then be enforced by the FCC Fritts thinks lhal the best and most efficient means of distributing spectrum is to hold an auction where payment is required shortly after the winning hid is selected The design of spectrum auctions should. (1) allow lor license aggregation and the prevention of collusion in llie bidding process, (2) not allow bidding credits; (3) not allow installment plans. In addition, diversity aiid increasing reveiiue for the government should not he significant goals.

14. T.W. Harlctt, **"Assigning Property Rights to Radio Spectrum Users: Why Did FCC License Auctions Take 67 Years?"** 41(2) J.L. & Econ. 529 (1998).
http_ 'www.journals.uchicago.edu/JLE/abstracts/412haz.html

Hazlett discusses tlie development of the system tor broadcast licenseassignments in lhe United Slates. According to him, the system for license assignment lhal developed was neither irrational nor a "accident of history." Hazlett argues that political motivations resulted in the "giveaway" of licenses for a long time in tlie United States. Zero-priced licenses gave regulators much power to influence broadcast content which would not havr heeii feasible or legal under a market-based allocation scheme aiid Hazlett argues thal there is a clear link between method of assignment and licensee performance. Hazlett believes that the special interest of regulators in influencing broadcasting content, the limits placed on explicit program regulalion by the U.S. Constitution, and the agency problem embedded in central planning explain the political stability of economically inefficient licensing methods. Hazlett also illustrates how the increase in tlie relative economic performance of nonbroadcast wireless services explains recent reforms in spectrum policy.

15. T.W. Harlett, **"The Rationality of U.S. Regulation of the Broadcast Spectrum,"** 33 Journal of Law and Economics 133 (1990).
http://www.aei.org/ra/rahazl10.pdf

This paper reviews Hazlett's interpretation of the early history of the use and regulalion of the spectrum in the 1910s, 1920s and 1930s including passage of the Radio Act of 1912. actions by Commerce Secreiary Herbert Hoover, the establishment of the Federal Radio Commission in 1927 and the Communications Act establishing the FCC in 1934. According to Hazlett, early problems with interference aiid "chaos of the ether" imply that there was a need lo define spectrum rights but do not imply that thzre is (or was) a need for tlir government io assign

spectrum rights In ilie 1920s it would have heeii possible to develop a system of exclusive, transferable property rights in ilie spectrum and it could have been done under ihe common law rather than through a Federal regulatory agency. Hazlett asserts that in the 1920s major existing broadcasters desired federal regulation as a method of restraining competition and preserving their existing economic rents.

16. T.W. Hazlett, **"The Wireless Craze, The Unlimited Bandwidth Myth, The Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's 'Big Joke:' an Essay on Airwave Allocation Policy,"** *15 Harvard Journal* of Law and Technology (Spring 2001) http://www.aei.brookings.org/publications/working/working_01_02.pdf

In this long article (205 pages in ilie working paper format), Hazlett argue strongly lor establishing spectrum private properly righls. Harlett asserts that FCC top down regulation (i.e. block allocations), involves a variety of non-market failures because the FCC lacks the information that competitive markets can pruvide. receives its information from interested parties and not from ilie general public, and because incumbents have incentives to favor underutilization of spectrum in order to minimize interference io them aiid to exclude competitive entry (He points out that it is not economically efficient lo minimize interference, but rather we should want an optimal level of interference). In his review of FCC history, he provides examples of how incumbent licenses blocked or tried to block the introduction of FM radio broadcasting, CATV, DARS, LPTV, ultra-widehand systems, software defined radio, etc. Radio license auctions work well because they reduce delays in licensing, increase the efficiency of license distribution, inake it easier to aggregate licenses, reduce rent seeking behavior of applicants and help build the intellectual case for liberalization of the licensing process. However, high license auction prices and revenue can he a sign of policy failure, not success. because they suggest ihat access lo lliz spectrum has been artificially restricted in order to maximize revenues or rents.

There are, potentially, serious probleins with spectrum commons, because there is likely to be congestion and thus a tragedy of the commons, just as there is on the Internet. In both cases llic problem is that a price should be put on congestion. In the unlicensed hands, the *FCC* is likely to impose either loo strict or iiot strict enough restrictions (e.g. power limits that are too low or too high). An advantage of unlicensed operations is that cnlry by spectrum users is not constrained by the barriers lo entry of the FCC allocation and licensing process. It inay he possible io consider three classes of unlicensed hands: (a) bands generally allocated lo unlicensed use and controlled by a band manager; *(b)* localized *unlicensed low power use* bands; and *(c)* long distance low power unlicensed use bands.

With regard to the future of spectrum regulatuii. Hazlett offers small, medium and large reform proposals. Small reforms include: (1) establishment o l a apectruin registry which would indicate occupied aiid unoccupied spccirum, intensity of traffic, etc.; (2) privatization of public safety communications so that public safety agencies would liave title to llie speclrum they own: (3) creation of a federal spectrum budget io show costs and benefits of spectrum used by each government agency Medium reforms include: (4) establishment of exhaustive overlayrights in the TV bands so thar every channel in every inarkel would be used. Also, grant existing wireless licensees complete flexibility (5) Granting of underlay rights and allow UWB and don't allow incumbent operators lo block UWB by claiming interference problems. Large reforms Include: (6) Abolishing the FCC and replacing it with a Spectrum Court; (7) granting de novo entrants a presumptive right to use unoccupied frequencies; (8) allowing unregulated low power local area wireless devices; (Y) Granting complete flexibility to existing licensees; (10) abandoning administrative license authorizations and replacing them with pure interference adjudications

through a Spectrum Court; (11) Recasting competition or antitrust policy to lake into account spectrum ownership in evaluating market concentration; and (12) making clear that Congress, rather than a regulatory agency. should impose taxes and subsidies related to specirum utilization.

17. T.W. Harlctt and B.C.L. Boliek, **"Use of Designated Entity Procedures in Assigning Wireless Licenses," 51** Federal Communications Law Journal 639 (1999) http: www.aei.org/ra/rahazl9905.pdf

There was a significant loss in consumer surplus, i.e so called "deadweightlosa." due io the use of subsidies to designated entities in the PCS C block auction and the Regional narrowband PCS auction. The use of the designated entities led to a delay in the provision of service to consumers, slowed the entry of viable competitors and reduced the amount of money initially payable lo tlie Treasury for the auction by allowing payment spread over a number of years with a below market rate of interest on the future payments On the other hand. Hazlett and Bolick also suggest that because of tile subsidies available to designated entities, they may well have bid up auction prices to higher levels than would have happened without their designated entity status.

18. T.W. Hazlett, **"Spectrum Flash Dance: Eli Noam's Proposal for 'Open Access' to Radio Waves,"** 41 **J.L.**& Econ. 805 (1998).

This article challenges Eli Noam's property riglils article, "Spectrum Auctions: Yesterday's Hearsay, Today's Orthodox, Tomorrow's Anachronism," published concurrently in The Journal of Law and Economics (Oct. 1998). The article does so on the grounds that the Noam article (i.e., analogizing spread spectrum technology or an "open spectrum access" model for overall spectrum allocation to llie Internet packet switching) confuses defects in tlie auction allocation regime with the innovative mechanism of auctioning assignment, by failing to appreciate the efficiencies gained by auctions and not defining useful remedies for the problems The author argues that tlie specirum was originally regulated, starting in 1921 under the Radio Act, not because of chaos aiid lawlessness. as is the popular belief, but that the general application of the common law "right of user" or "trespassing" solution to the commons problem was to preempt development of such a general legal regime in favor of political control in the form of a statutory solution promoting llie "public interest." The arlicle challenges Noain's assertion that auctions were favored as a method for raising revenues, auctions as barriers to entry and property rights as lree speech iiilriiiyeinent. The article suggests that Noam analogy to Internet packet switching is misguided and that a better analogy would be competing tollways, where access provider.?charge competitive rates fur the use ol'the road The article concludes by criticizing Noam's opposition to large spectrum auctions in favor of micro-auctions and contends that Noam overstates llie current state of technologic development and its ablity lo arrange frictionless traffic. Ihc arlicle states that Noain's clearinghouse approach would likely overdivide the spectrum creating significant transaction cosls to reassemble longterm rights

19. J.A. Hausman, **"Valuing the Effect of Regulation on New Services in Telecommunications,"** *Brookings papers on Economic Activity, Microeconomics*, 1997, pp. 1-38. http://www.nextera.com/pdf/ValuingTheEffectOfRegulation.pdf

This article estimates that cost of regulatory delay in the provision of new services, including voice messaging, and cellular telephone Using assumptions and estimates aboui consumer demand, pricing and welfare loss, they estimate losses of about $1.27 billion peryear in

consumer welfare for voice messaging aiid ahout $50 billion per year in consumer welfare loss for cellular telephone due to regulatory delay in authorizing these new services.

20. R.E. Hundt aiid G.L. Rosston, **"Spectrum Flerihility Will Promote Competition and the Public Interest,"** IEEE Communications Magazine, December 1995, pp. 2-5.

Tlic true significance 01 the PCS auctions was not that they raised $7.7 billion for the treasury but that they led to ilic creation of 3 large wireless communication firms. What led to the large wireless investment boom was that Ilie Commission allowed flexibility in the use of that spectrum Spectrum flexibility includes both service and technical flexibility. We need to stop over-regulating commercial uses of licenses. Interference restrictions arc similar to land zoning restrictions. The FCC' should set initial interference restrictions and then allow licenses to negotiate interference agreements between themselves. Restrictions on allowable uses inhibit competition, and cause delay in providing innovative services. Allowing flexibility means that license will have incentives to invest in lechnology to increase competition, to take advantage of any innovations they d'velop and they will not need lo reveal their ideas in advance lo ilir FCC and thus to competitors.

However, full flexibility may allow some inarkct failures and thus inay not always be appropriate. The FCC should intervene to constrain technical flexibility so many unlicensed low power devices can operate without causing interference, to ensure sufficient educational children's television programming, to courdinatc cross-bordei satellite operations, and io decide whether too much or too little over-the-air television broadcasting is available in specific markets compared tu other uses of the spectrum. There may be other social goals where flexibility will either help or hinder the accomplishment of those goals such as minority and female ownership of businesses, provision of rural telephone services, public interest obligations of broadcasters.

With respect to transitional issues, some believe that efficiency must be balanced against equity However, if a company obtains a windfall due lo flexibility, it is because it has provided a more attractive service lo consumers. Also, the Coininisston's public iiiterest mandate should be to maximize competition, iiot protect incumbents from competition. Flexibility may cause some customers to be stranded without a service provider. but overall it is likely to increase choices for consumers.

All future spectrum allocations should provide service and technology flexibility All remaining speclruin should be exhaustively licensed using overlays. In general, users should be given exclusive rights. Spectrum rights should be transferable. Finally. service and technical restrictions on existing licensees should he reduced

21. H.J. Krent and N.S. Zeppos, **"Monitoring Government Disposition of Assets: Fashioning Regulatory Substitutes for Market Controls,"** 52 Vanderblt Law Review 1705 (1999). http://law.vanderbilt.edu/lawreview/vol526/zeppos.pdf

Most of this article discusses the sale or lease of Government assets other than Ilic frequency spectrum or radio licenses. Government sales and leases of public assets such as oil rights, public land and mineral rights, and even rights to use ilie electromagnetic speclrum, timber sales. iiiitl the disposition of real estate have generally been deplorable and sold at a fraction of the market price. Methods should be used, with legislative changes where necessary. to allow the government to maximize its return on assets sold or leased However, the disposition of assets

can serve other goals such as helping to ensure that the public receives the best service from the private use of the asset, or programmatic goals such as giving licenses to broadcasting stations that best service the public interest, or it can serve distributional goals such as helping disadvantaged individuals, or social goals such as preserving a valued way of life, etc. The Administrative Procedure Act excludes from its provisions federal agency decisions involving the distribution of public property.

The author's recommendations for reform include: all public property disposition processes should be subject to notice and comment rulemaking. Judicial review should continue to play an important role. Greater OMB review and/or Congressional review may be appropriate. The process of selling, leasing and giving away public property should be more open and transparent.

22. E.R. Kwerel and J.R. Williams, **"Changing channels: Voluntary Reallocation of UHF Television Spectrum,"** Office of Plans and Policy Working Paper No. 27 (November 1992). http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp27.pdf

Kwerel and Williams argue that the voluntary reallocation of a single UHF channel in Los Angeles from television broadcasting to use as a third cellular system would increase social welfare by $1.0 billion. Because the social value of a broadcasting service may exceed its private value, the FCC may need to estimate whether it is desirable to allow such a shift. However, subject to such a benefit-cost analysis, one voluntary reallocation should be allowed in every TV market and perhaps with respect to other spectrum uses as well. In their calculation, they estimate the amount of spectrum that could be freed up by such a move, the social cost of reducing the number of TV signals by one in LA, and then compare that with the social benefit from the reduced cellular prices that would likely take place from allowing a third cellular competitor in LA. Much of the paper is devoted to alternative calculations of the costs and benefits of such a voluntary relocation. As the value of over-the-air broadcasting diminishes compared to additional forms of personal communications, a properly supervised voluntary reallocation policy for other non-TV uses might have substantial benefits. Licenses for new services could be issued in a band before the incumbent users left the band and new licensees could negotiate with incumbents for access to additional spectrum.

23. J.R. Minasian, **"Property Rights in Radiation: An Alternative Approach to Radio Frequency Allocation,"** 18(1) J.L. & Econ. 221 (1975).

This article is based on a 1963 paper co-authored by Minasian, R.H. Coase and W. Meckling. While consistent with Coase's economics papers, it also addresses technological aspects of defining auctionable spectrum licenses.

The current institutional arrangement for spectrum allocation (1975, pre-auction) cannot provide the information needed to guide resources into their highest valued use, and gives users no incentive to economize on scarce resources. However, property rights can be defined in such a way as to bring about technically efficient use and form the basis for exchange in a market setting. A set of property rights in spectrum would incorporate the following:

1. Emission rights – The right to operate on a particular bandwidth at a specific time and place, at a power level specified at its boundaries. In addition, the amount of spurious radiation emitted would be limited.
2. Admission rights – The rightholder has the right to exclude others from using that spectrum.
3. Use – The rightholder is free to choose among legal uses.

4. Transferability – Emission and admission rights would hc transferable at the discretion of the rightholder

Minasian also considers whether the inherent variability in radiation outputs and the techniques used for enforcement are consistent with a system of private property rights and a market mechanism, and concludes that such a system would actually result in greeter technical efficiency.

Regardless of the initial distribution method, the market will eventually reallocate the rights to their most valuable use. Initial distribution should take political expediency into account, and to the extent possible, minimize the transactions costs of further redistribution.

When increases in value accrue to ilie owner of the spectruin. there are incentives to innovate and update technology. "Like" services will tend to cluster together because tlic value of their rights will be greater. The public sector can exercise rights of eminent domain to repurchase spectrum if there is a strong iced. Monopoly will be discouraged if the monopolist is not given ilie resource free of charge.

Any freedom to relax the current system of rigid input controls will improve technical efficiency.

24. E. Noam, **"Beyond Spectrum Auctions: Taking the Next Step to Open Spectrum Access."** Telecommunications Policy, Vol. 21, No. 5, Elsevier Science 1997, pp. 461-475.

Noam advocates a new post-auction paradigm for spectrum wliicli lie calls "open access," which will soon he made possible by iiew technologies. Users can enter spectrum without an exclusive use license by buying access tokens, the price of which varies witli congestion

Licensing imposes restrictions on free speech, and to the extent technology makes a less restrictive regime possible, the government is obliged to move toward allowing greater freedoms.

Auctions of exclusive use licenses have other drawbacks. 'They are primarily a revenue tool of the federal government, and therefore, revenue needs will determine auction policy. They are used to fund current consumption at the expense of long run asset management. Social values are not reflected in auction bids. Auctions are a barrier to entry aid encourage bidding consortia and an oligopolistic inarkel structure

The proposed open access system is nul currently possible, although some parts are feasible. Packets of transmitted information would carry with them electronic tokens, wliicli would be transferred (i.e., paid) at various tollgates and access points. Spot and futures markets in access tokens would exist. Such a system would convert upiront fixed costs to marginal costs, reduce barriers lo enlry and encourage competition. The current unlicensed system is similar in terms of non-exclusive access, hui because it relies on etiquette to manage congestion. it cannot guarantee access when demand is high.

25. E. Noam, **"Taking the Next Step Beyond Spectrum Auctions: Open Spectrum Access,"** *IEEE Communications Magazine* (December 1995), pp. 66-73. http://www columbia edu/dlc/wp/citi/citinoam21.html

Auctions arc preferable to llic speclrum allocation systems of the past. hul they inay not be the best system for the future. This paper makes essentially the same arguments tor an open access system as #23, above In addition. Noain makes the lollowing points:

- Some argue that without exclusive spectrum licensing, there may be less investment, but the certainty of licensing should be balanced with tlic enhanced competitive environment of an open access system.
- Investment takes place in other industries without ownership of all ofthc inputs. Certainty of supply can be addressed through the development of futures markets.
- Couching tlic discussion in terms of property riglils is not helpful, since transferable frequency access is just as inucli a property right as is fee simple ownership.
- Auction winners are unlikely to hecoine good managers of an open system because they will have interest in deterring competitors. The relatively small pieces ihcy uwn will limit lliz benefils of frequency agility.
- Noain makes clear that lie departs from Paul Baran and George Gilder in advocating llie use of a price mechanism to manage scarciiy. Thry would rely on lechnology alone.

26. **G.** Robinson, **"Spectrum Property Law 101,"** 41 J.L. & Econ. 609 (1998). http: /www.journals.uchicago.edu/JLE/abstracts/412rob.html

Robinson expands on a paper by Shelanski aiid Huber (#32, below) wlio show ihat. in practical terms if not iii theory. spectrum licensees already arc in possession of most of the essential characteristics of property: the righis Lo exclude. transfer, and use. and a renewal expectancy, which protects "investment-backed expectations." Robinson poinls uut that as long as public interest obligations are upheld, licenses cannot fully be treated as properly and, therefore, cannot Freely he traded. This prevents efficiency enhancing reallocations. Significant public interest obligations are still maintained only in broadcasting, although even there ihey are largely symbolic. Broadcasters liave a strong interest in maintaining their public interest obligations, which although trivial iii practice, liave allowed them io make lucrative deals fir spectrum access.

27. G.L. Rosnton. **"The Long and Winding Road: The FCC Paves the Path with Good Intentions,"** Stanford Inst. For Econ. Policy Research (2001). http://www.calit2.net/events/2002/Spectrum/presentations/Long_Winding_Road4-20-02.pdf

Although the FCC has indicated its intention to move to a more inarkel-based system of spectrum allocation, a number of recent examples indicate that market failure exceptions are inure frequently the rule. The Commission should immediately make ilie move to a true market system by selling flexible license riglits to spectrum wliicli has been held hack fur various reasons. Incumbent interests and political interests are two major roadblocks to Increasing the usable amount of spectrum. Rosston illustrates liis point with the following case studies:

- **700 MHz Guard Band** -- Many politically motivated restrictions on use and technology may result iii managers being unable ɒ use the hand profitably and efficiently, which will likely prompt them to petition the FCC for inure flexible use.

- Satellite **and Terrestrial Uses** - Rossion points to the DBS/Northpoint case, and petitions for terrestrial rights in Ilic 2 GHz Band and For terrestrial repeaters by XM Radio as situations in wliicli the FCC failed to define liceiise righls fully ahead of time.
- **DBS** Satellites – **A** prohibition against allowing Canadian DBS providers Lo serve US customers exacerbates an already concentrated US DBS inarkei.
- **CARS Band– A** very narrow definition of who may operate in the 12 GHz **CARS** band has prompted a proposal to expand the definition slightly. It would he more efficient to open the band **Io** more flexible use.

In order Io facilitate getting unused speclrum riglils out into the market, Rosston proposes a licensing "nomination" process Parties identifying rights they are interested in would submit a nomination to ilie FCC. Nominations would be kepi secret during tlie filing window. If no oilier party submitted a mutually exclusive nomination, llie applicant would he granted a license for that right. An auction would be held to resolve competing applications.

In addition, the interference responsibilities of licensees should he clarified and defined in terms of emissions rather than inputs. Secondary trades should be allowed to take place efficiently Spread spectrum technologies should be allowed to operate "under" other licensees, if possible.

28. G L. Rosston and J. Steinberg, **"Using Market-Based Spectrum Policy to Promote the Public Interest,"** 50 Fed. Comm. L.J. 1 (1997).

Rosston and Steinberg propose a set of principles to guide tlie FCC in its mission to maximize ilie public interest value of the spectruin. Because the Commission cannot fully know or predict how inucli consumers value different services or what teclinobgies are practical or possible, it must leave these decisions on how best to use tlie spectrum to a decentralized marketplace. It should inake available to the inarket tlie righis to as much spectrum as possible with as few restrictions as possible on how it can be used. In order to minimize transactions costs, the FCC sliould initially configure licenses optimally for the services they will most likely be used Tor, but it should permit aggregations and disaggregations as necessary. It should weigh the benefits of unlicensed uses of spectrum with the cost of keeping those bands out of exclusive use The FCC should promote a competitive industry, and be prepared to intervene when there is market power.

The Commission should permit maximum flexibility of four lypes: in service use, in technology and equipment, iii bandwidth and geographic scope, and in implementation (when and where licensees build out) In general, technical and use flexibility should he limited only by interference concerns.

When tlic market fails, such as in providing the socially optimal amount of public goods, the FCC may need to dcdicarc spectrum to those uses. In many cases, however, Ihe government can provide subsidies to facilitate spectrum license purchases by rlie providers of those public services. Public interest considerations inay also prompt soine restrictions on services, such as requiring broadcasters io provide children's TV programming, but llie requirements should be as flexible as possible.

In most cases, competitive bidding is the fastest means of putting the spcclruin into llie hands of those who will put it to its most valuable use. In other caws, the Commission should

seek to use fees approximating opportunity costs as a means of allocating scarce spccirum among competing users.

The Commission should proinotc certainty aboui the conditions of specirum use licenses by providing flexibility upfroiii. so thal licensers do not need tu petition Tor changes. A reasonable expectation of renewal will encourage investment. If public interest considerations require that the FCC reallocate spectrum. incumbents sliould be fairly aiid efficiently compensated

The U.S. should help promote global networks by cooperating and coordinating with international interests.

29. H Shelanski, **"Competition and Deployment of New Technology in U.S. Telecommunications,"** 2000 U. Chi. Legal F. 85 (2000).

Shelanski examines how ilie introduction of iiew lechnology in U.S telecommunications has historically been related to inarkel structure. Theoretical aiid einpirical evidence on the relationship between lirin size aiid innovation in the general economy is ambiguous. With respect to industry concentration, there is suggestive evidence firms in neither very competitive nor very concentrated industries are more innovative. He examines ten cases of iiew lechnology development in the telecommunications sector.

While innovation occurred under varying market structures, the deployment limes were fastest when firms were in the most competitive environments. Shelanski draws the policy implication that while there may **be cases** in which there are tradeoffs between innovation aiid competition, the presumption should be in favor ofpreserving competition.

30. H. Shelanski, **"Regulating at the Technological Edge: New Challenges lor the FCC,"** 2000 L. Rev. **Mich.** St. U. Det. C.L. 3 (2000). http /www.dcl.edu/lawrev/2000-1/Shelanski Revision.htm

This speech makes geiieral points about liow the FCC 's regulatory policy should facilitate competition and foster innovation, and promote access to new technology.

31. H. Shelanski, **"The Bending Line Between Conventional 'Broadcast' and Wireless 'Carriage',"** 97 Colum. L. Rev. 1048 (1997).

By permitting Direct Broadcast Satellite (DBS) operators to deliver wireless services and programming, without requiring the public interest obligations traditionally carried by broadcasters, the FCC lias blurred Ilie traditional distinction between broadcasiers and wireless carriers

32. H. Shelanski, **"The Speed Gap: Broadband Infrastructure and Electronic Commerce,"** 14 Berkeley Tech. **L.J.** 721 (1999).

The growth of electronic commerce will depend in large parion Ilie capability of broadband and its availability to residential consumers. However, regulation of advanced services may slow the deployment of broadband **and** adversely affect prices raced by consumers.

33. H Shelanski and P Huber, **"Administrative Creation of Property Rights to Radio Spectrum,"** 41 J.L.& Econ. **581** (1998).
http://www.journals.uchicago.edu/JLE/abstracts/41 2she.html

Although tlie Communications Act of 1Y34 expressly prohibits private ownership of spectrum, ilic FCC since llic 1970's effectively lias been increasing the properly rights that spectrum licensees hold. This has heeii accomplished through substantive and procedural regulatory reform of both the transmission and reception ends of licensee rights. The FCC has increased llic renewal expectancy and lowered ilic cost of renewing licenses. It has reduced the ban on trafficking from 3 years to oiic year, and reduced llie criteria that must be considered in allowing transfers. Broadcasters are allowed more leeway over public interest concerns in leasing or subdividing their airtime. The FCC has given providers inure freedom **over** what use is made of their spectrum, especially in exempting DBS and other subscription servicesfrom broadcaster public interest responsibilities. **Ai** least in part, this deregulation represents an ideological shift that occurred during tlie 1980's. Limited degrees of use flexibility are now permitted. The FCC has moved away froin strict content regulalion of broadcasters, although it retains some influence.

While these reforms generally involve giving licensees inure control over the transmission side of spectrum communications, a complete bundle of rights would involve licensees controlling how their sigiials are received, as well. Broadcasters traditionally have liad little power to protect their programs from unauthorized commercial retransmission, but in recent years the courts. llie FCC and Congress have moved in the direction of granting broadcasters more rights in that area

34. H. Shelanski and P. Klein, **"Empirical Research in Transaction Cost Economics: A Review and Assessment,"** 11 J.L. Econ. & Org. *335 (1995).*

Transactions costs economics (TCE)deals with how trading partners utilize contracts or governance arrangements to protect their interests in exchange relationships. For example, partners investing in a specific asset inay want lo merge in order to align their interests iii using the asset – i e . through vertical or horizontal integration. Implicit iii TCE is the idea that observed institutional arrangements have come abour as the result of minimizing some set of transactions costs among parties. Shelanrki and Klein examine some of the theoretical implications of TCE and empirical studies which attempt lo validate them.

In general, these studies attempt lo explain a governance structure for a particular industry as a function olsuch features as asset spcciticity, uncertainty about the relationship, the complexity of the transaction and the frequency of trade. The authors look at a large nuinber nf studies which focus on both formal and informal contracting arrangements aiid conclude that overall, there is quite strong evidence that transactions cosls arguments are important in explaining the nature olthese relationships.

35. J.H. Snider. **"Who Owns the Airwaves? Four Theories of Spectrum Property Rights,"** New America Foundation, April 2002.

Snider emphasizes that policy analysts should lay out all valid policy cunsiderations, regardless of political considerations. He believes that policy analysts should clearly distinguish between what are political and public policy issues relating to the allocation of spectrum. Towards this goal, Snider discusses four theories of spectrum properly rights as they would apply to local TV broadcasters. The License Theory suggests lhal since license terms are currently

limited (eight-year term for broadcasters), all broadcast spectrum could eventually be returned to the public and reallocated with no special compensation to the broadcasters. The Service Theory would allow broadcasters to provide tlir same service (e.g. the provision of one standard definition analog TV signal) as technology changes but would force tlie broadcasters to return excess spectrum resulting from improvements in technology. The Spectrum Theory holds that incumbents have full rights in perpetuity to their spectrum, including all residual rights, where h e term residual means all rights to provide services not explicitly granted in the license. The Lebensraum Theory holds that incumbents have full rights not only io their licensed spectrum. but to the guard bands surrounding Llie spccrruin that protects their signals froin interference.

36. P. Spiller and C. Cardillo, **"Towards a Property Rights Approach to Communications Spectrum,"** 16 Yale J. of Reg. I (1999).

Spiller advocates a properly rights approach to specrruin usage and advocates the development of a markrl for unrestricted rradahlc permits in speclrum. To implement this policy. Spiller believes that Congress should enact legislation mandating that the FCC grant full property rights for spectrum usage Subsequently, the judicial branch would be responsible for enforcement with regard to potential interference problems. Spiller describes the structural foundation which he believes wuuld allow for a inarket in tradable spectrum permits. The licensee would he granted ilie right to use the spectrum for anyservice that he chooses and llic right would be defined in terms of usage or outputs. That is, the licensee would be granted ilie right to transmit over a particular band and over a particular geographic location. This property right would assume a maximum field strength at tlic boundary of the coverage area and maximum levels of out-of-band emissions. Included is a right to a minimal acceptable signal to noise ratio as long as the right holder maintains a minimum field strength. Additionally, tlie right would he transferable as well as partitionable.

Spiller's paper also includes a review of New Zealand's and Guatemala's experiences with spectrum property rights. New Zealand's IYBY Radiocommunications **Act** authorized llie Ministry of Commerce to introduce tradable specrrum rights New Zealand's experience thus far does not appear to be very successful **as** only a small amount of spectrum lias been sold to individuals and much of the spectrum is iiot being used. Spiller believes that New Zealand's lack of success has three possible explanations. There may be a lack of demand for specrruin due to New Zealand's low population density. Additionally, the system was only implemented in certain limited hands. Finally, there were problems with rhe second-price auctioii process that was implemented. Unlike New Zealand, Guatemala was able to successfully implement a total property rights approach to speclruin utilization. Spiller believes that the Situation in Guatemala more closely reflects rhe potential success that the **U.S.** would experience if a ptoperty rights approach were to be implemented

37. T M Valletti, **"Spectrum Trading,"** *Telecommunications Policy*, 2001
http://www.ms.ic.ac.uk/tommaso/spectrumtrading.pdf

Valletti's paper is based partly on work done for OFTEL, the UK radiocommunications regulator, and focuses on UK and other European spectrum management regimes. His primary point is that it is inefficient to rigidly define spectrum allocations, even if spectrum is efficiently assigned within those allocations. He recommends a system of spectrum trading in which fully flexible transferable rights are given or sold to licensees, who may then trade them. The regulator will have a role in correcting market failures, but the presumption should be that the market will resolve problems unless it is demonstrated otherwise. The government role may include arbitrating interference disputes, enforcing antitrust laws (although concentration should be less of a problem when inputs of spectrum for an industry are not fixed by rigid allocation), and licensing low power equipment for open access spectrum. Social objectives should be dealt with using bidding credits, including for their military, broadcasting and public service.

38. **J.M.** Ward, **"Secondary Markets In Spectrum,"** 10 CommLaw Conspectus 103 (2001).

The author concludes that there is a spectrum drought that will impact the market. The author explains that auctions only ensure that spectrum is put to its highest valued use at the time of the initial assignment and that post-auction efficiencies are being evaluated in the Commission's secondary markets proceeding. He says that spectrum leasing has been a tremendous success, but that it is hampered by cumbersome regulations resulting in uncertainty. He hopes that eventually secondary markets will evolve into spot markets or exchanges where spectrum is bought and sold. The article analyzes the current Commission rulemaking on secondary markets and predicts the Commission's likely course of action and suggests regulatory and statutory changes to prepare for new technologies and markets. The author concludes that the Commission's secondary market proposal clings too closely to its administrative control over spectrum by requiring licensees to retain control over their spectrum, even though they may not have operational control. The author believes that this model is a disincentive to leasing and that, instead, the Commission should forebear from enforcing the traditional control standards and assign responsibility for leased spectrum to the entity operating in it.

39. D.W. Webbink, **"Frequency Spectrum Deregulation Alternatives,"** OPP Working Paper No. 2 (Oct. 1980).
http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp2.pdf

The author describes the concepts of "spectrum deregulation" or "spectrum economics" as terms that encompass not only auctions and fees but also less reliance on government decision making and greater freedom for the licensee. The paper also describes the frequency management system, problems associated with the existing system, deregulatory proposals, and objections that have been raised. The paper concludes by the author listing the most important proposals (1) free license transferability, (2) limiting petitions to deny, (3) allowance of license sharing and resale, (4) allowance of greater technical flexibility, (5) greater service flexibility, (6) clear but limited property rights, and (7) reduction in the number of classes of allocations. The paper also concludes by listing the most important but controversial changes use of auctions and lotteries instead of comparative hearings and repeal of distinctions between broadcasting, common carrier and private radio systems. The author notes that the most difficult proposal to implement would be the institution of spectrum fees.

40. J.A. Eisenach and R.J. May, eds. **" 'Propertyzing' The Electromagnetic Spectrum: Why It's Important, and How to Begin,"** Cominunications Deregulation and FCC Reform: What Conics Next? The Progress & Freedom Foundation (2001) (reprinted in 9 Media Law & Policy 19 (2000)).

The paper advocates changing tlic stewardship model of government regulation of spectrum use to one of full ownership of spectrum by the government and the private sector. The paper describes and critiques government regulation of spectrum, the property rights approach and its advantages and possible transition techniques. It also addresses potential objections to the property rights model, and provides a parable imagining Federal Government control of all real estate use. The author concludes by urging the FCC to continue auctioning spectrum and easing restrictions on auctioned spectrum, to inove aggressively towards establishing land-like properly right in spectrum, and for Congress lo codify these changes in Title III oftlie Communications Act

41. J. M. Peha, **"Spectrum Management Policy Options,"** *IEEE Communications Surveys*, 1998.

This article examines spcctruin management issues and policy options for how spectiuin can he used, determining which commercial entities can use speclrum and any associated fees, and providing spectrum for government use. Tlie article explores the trade offs between policy decisions for unlicensed, licensed spectrum, assignment mechanisms (comparative hearings, lotteries and auctions), and government allocation and assignment of spcctruin. Tlie article concludes by calling for additional allocations for unlicensed spectrum, the introduction of more market-based mechanisms for assignment of spectrum to commercial and government (i.e., using spectrum fees paid through commercial auction revenues based on commercial spectrum auction values lor government users) spectrum users. Finally. the article cautions against the use of one-time spectrum auction revenue for annual expenditures by charging auction winners annual fees

42. H. Salgado. M. Sirbu. and **J.M.** Peha, **"Spectrum Sharing Throueh Dvnamic Channel Assignment For Open Access To Personal Communications Services,"** *IEEE ICC-95* (June 1995).

This arlicle *focuses* on a *narrow* hand technical solution that uses decentralized spectrum sharing to facilitate open access among competing PCS operarors. Specilically. the articles proposes using a system of dynamic channel assignment (commonsapproach) with anonymous reuse partitioning among multiple PCS operators with partially overlapping networks and unequal traffic shares by limiting the maxiinum nuinber of channels assigned to one cell site as an incentive for operators to build more cells rather than appropriating channels from competitors. Tlic article concludes that allowing a dynamic channel assignment approach (through licensee sub-letting) could introduce an open access inarket cnlry mechanism for potential PCS providers eliminating wasted capacity without adjusting fixed spectrum assignments.

43. D.P. Kecd, **"When Less is More,"** *Future Positive*, May 21, 2002.

This article argues that by cooperating we can find more speclruin capacity. Tlie article posits that cooperative networks, rather than uncoordinated point-to-point channels, can he scaled so as to increase the capacity ofspectrum wiih increases in the number of spectrum users eliminating ilic iieed for properly-like rights in spectrum management. The author suggests that

we need a regime that allows spectrum based networks to interoperate and cooperate in an open and experimental way, just as the Internet did.

44. **A.D.** Thierer, **"A Policy Maker's Guide to Deregulating Telecommunications Part 6: A Free-Market Future for Spectrum,"** Heritage Talking Points No. 11 Washington, **D.C.:**Heritage Foundation, March 19, 1996.

This paper argues that wireless spectrum is over-regulated and tliat Congress should take the following steps: (1) grant a permanent and absolute property right to current licensees with full flexibility, (2) auction as much speclrum as possible, (3) provide First Amendment parity between wireline and wireless spectrum use, **aiid** (4) transfer all remaining spectruin authority from the FCC and NTIA to the courts, private entities, aiid an independent body. The paper concludes by arguing that seven decades of quasi-socialized federal speclruin management have diminished efficient and innovative use and that the creation of full property rights and ownership will result in a dramatic transformation of spectrum.

45. D.W. Webbink, **"Property Rights, Flexible Spectrum Use and Satellite v. Terrestrial Uses and Users,"** Chapter 11 in Communications Policy and Information Technology: Promises, Problems, and Prospects, edited hy L.F. Cramer and S. Greenstein, MIT Press (2002), pp. 277-295. **(Also** can be found at Federal Communications Commission, International Bureau, 29th TPRC Conference, 2001 http://arxiv.org/ftp/cs/papers/0109/0109016.pdf)

This paper discusses policy questions raised by the proposals to provide terrestrial services in satellite spectrum aiid **Ilir** ORBIT Act wliicli forbids auctions to select among mutually exclusive applications to provide international or global satellite services. The paper explores tlie questions of the extent to which a government ageiicy or speclruin users should be permitted to make the determination of when speclruin sharing is feasible and under what conditions and. on a related issue, whether sharing should be analyzed differently depending on if the satellite and terrestrial systems are under the control or a single or separate parties. The paper also explores the possibility that the ORBIT Act's prohibition on auctions for international or global satellite service use may prejudice the allocation of spectrum away From international satellite services in Savor or auction revenue-generating services. The author concludes by saying that wherever feasible, it would bc desirable to give companies maximum exclusive property-like rights to inake spectrum sharing decisions and ihai the anti-auction provision ofthe ORBIT Act should be repealed because in the long run it will harm satellite companies more lhan providing them with benefits.

46. D.W. Webbink, **"Radio Licenses and Frequency Spectrum Use Property Rights,"** *Communications and the Low,* vol. 9, no. 3, (lune, 1987), pp. *329.*

This article argues for exclusive properly riglils in specrruin positing that private property rights will lead to more efficient production aiid use of the rcsourcc. It explains that private property rights rrquire three conditions: (1) the right to exclusive use, (2) the right to receive income from tlic use of the resource, and (3) the right to transfer the exclusive use right in whole or in parr to others. The article contends that common property rights. including for spectrum, weaken llie incentive to use **Ilir** resource efficiently and to conserve resources since use6 cannot capture the benefits of conservation. The article describes changes thal the Commissioii made to broadcast and other spectrum service rules duriiig the 1980s lo allow for inore tlexible services offerings, sharing an leasing, longer license terms for non-broadcasting licenses, and relaxation of

trafficking rules to permit freer transferability of licenses. The arlicle coiicludes by suggesting that ilie Commission change its rules to increase property rights by: (1) allowing secondary use on all private, broadcasting, and common carrier frequencies, (2) allowing all system users the ability to earn profit from the sharing, leasing or sale of their spectrum use rights, (3) the Congress repeal section 310(d) (transferability of licenses) of the Communications Act, (4) increasing the length of license terms to 15 or 20 years or in perpetuity, (5) the grant of exclusive licenses, (5) full flexibility of use, (6) auctions fur spectrum licenses, and (7) repeal of sections 301 and 303 of the Communications Act (limits on transferability of radio licenses).