USE AND REGULATION OF THE RADIO SPECTRUM: REPORT ON A CONFERENCE*

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This paper begins by briefly outlining the present mode of determining access to the radio spectrum. The second section reviews the attack upon this method by some of the academic economists, and states their proposal for establishing a market in transferable spectrum rights. The next two sections consider the problems presented by such a market system and a number of alternative proposals for revision of spectrum management practices. The impact on spectrum use of a number of recent technological developments is briefly reviewed in Section V. A few concluding observations are appended in Section VI.[1]

I. Background to the Conference: The Radio Spectrum and its Management

Radio waves are a species of electromagnetic waves. Produced by the acceleration or oscillation of an electric charge, they transmit energy, by

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1. This discussion does not encompass all the topics covered at the conference. However, as to the topics discussed, an effort is made—in Sections II through V—to report the various points of view expressed and to give some indication of the major difficulties encountered. Sections I and VI are the contributions of the author, who also has interjected comments in the other sections where they appeared necessary for organizational or analytical purposes.

Four papers provided focal points for discussion at the conference: H. J. Barnett and E. Greenberg, *A Proposal for Wired City Television* (printed in 1968 Wash. U.L.Q. 1); L. J. Johnson, *New Technology: Its Effect on Use and Management of the Radio Spectrum* (printed in 1967 Wash. U.L.Q. 521); H. J. Levin, *The Radio Spectrum; Economic-Physical Character and Regulatory Framework* (to be printed in the October 1968 issue of the Journal of Law & Economics); and W. H. Meckling, *Management of the Frequency Spectrum* (printed in 1968 Wash. U.L.Q. 26). Two other papers, delivered at the conference but not covered in this summary, are: S. S. Alexander, *The Public Interest In Public Television* (printed as *Public Television and the "Ought" of Public Policy*, 1968 Wash. U.L.Q. 35); and J. J. McGowan, *The Economics of Competition and Regulation in Commercial Television Broadcasting* (printed as *Competition, Regulation, and Performance in Television Broadcasting*, 1967 Wash. U.L.Q. 499).

wave-like disturbances of electromagnetic fields, as they pass through space or air or some other medium. Radio waves have frequencies ranging from 10 kilohertz (KHz) (10,000 cycles per second) to 300,000 Gigahertz (GHz) (300,000,000,000,000 cycles per second). However, the higher frequencies are not of any practical use at the present time, and the internationally recognized radio spectrum does not extend beyond 40 Gigahertz.

The radio spectrum is used for a wide variety of purposes, most of them involving some form of communications: military and defense facilities; space technology; air and maritime navigation; radio and television broadcasting; communications common carriers; business and industrial radio; police, fire and other local emergency services; air, maritime, rail, taxi and other transportation services; atmospheric and geodetic exploration; and citizens and amateur radio. As these uses have expanded in volume, and as new applications of radio technology have been developed, questions have arisen as to the capacity of the radio spectrum to accommodate the substantial increase in radio wave propagation.

A major limitation on the ability to make effective use of the radio spectrum is the phenomenon of electronic interference. In general, if two or more radio signals are transmitted to the same area at the same time on the same frequency, they will so interfere with one another as to render some or all of the signals unintelligible. Several outcomes are possible: (1) a very powerful signal might override a weaker one so that the latter is excluded for all practical purposes; (2) the several signals may be so similar in intensity as to cancel one another out in a confusion of "noise"; or (3) an intermediate condition might prevail in which the weaker signal is rendered unintelligible and the stronger one is not, but the quality of the stronger signal is appreciably reduced by the presence of the weaker one. To eliminate or minimize electronic interference, it is necessary to separate the multiple signals by one or a combination of three techniques: (1) separating the signals in space, *i.e.*, altering the location or direction of one or more signals so that they do not present multiple strong signals in the areas where reception is desired; (2) separating the signals in time, which may include the transmission of one signal during silent intervals in the transmission of another; and (3) separating the signals in frequency so that the same, adjacent or related frequencies are not employed in transmitting multiple signals to the same area at the same time. The interference phenomenon, and the modes of eliminating or minimizing interference, are more complex than this, but the main dimensions of the problem can be stated in these terms.[2]

2. The tendency of radio signals to interfere with one another is affected, *inter alia,*

Another aspect of the radio spectrum which affects its use is the variation in the propagation characteristics of different frequencies. At some frequencies, radio waves carry for long distances, either because they bend and follow the curvature of the earth or because they reach distant points via reflections from the ionosphere. At other frequencies, these characteristics are lacking and transmission is limited by the horizon or other physical impediments. Some frequencies are influenced more by the weather, or by physical obstructions, than are others; and, apart from these external factors, the tendency of signals to fade varies from one frequency to another. Thus, the range and reliability of signals is partly an attribute of the frequency. In a large variety of ways, the different parts of the radio spectrum manifest distinctive properties, making various of the frequencies more suitable for some purposes than for others.[3]

Over the years, radio spectrum utilization has moved progressively from the lower frequencies to higher and higher ranges. About 1918, the useful portion of the spectrum appeared to extend only to 1.5 Megahertz (MHz) (1,500 KHz); the upper limit of effective utilization was extended to 25 MHz by 1927, to 300 MHz by 1938, and to 40 GHz during World War II.[4] Thus, the capacity of the radio spectrum has expanded substantially over time as advances in technology have opened higher frequencies to exploitation. Another, and equally important, expansion in capacity has occurred as a result of more intensive use of radio frequencies. By limiting more narrowly the geographical area covered by a given radio signal, by improving the capacity of receiving devices to distinguish desired signals from those on adjacent frequencies, and by other advances in the art (particularly as regards modulation), it has been possible to transmit a larger number of usable signals within a limited band of radio frequencies.

Nothwithstanding these increases in the capacity of the radio spectrum, at any given time there are likely to be more persons desiring to use the spectrum, or particular portions of it, than the spectrum (or those particular portions) can accommodate. In the absence of some mechanism for limiting access, multiple users would create levels of electronic interference that would substantially reduce the utility of all radio wave propagation in the frequencies affected. And since radio waves do not respect national

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by modulation techniques; by weather; by temporal, seasonal and solar variations; and by receiver sensitivity.

3. For further discussion of the physical properties of the spectrum, see JOINT TECHNICAL ADVISORY COMMITTEE, RADIO SPECTRUM UTILIZATION (1964); JOINT TECHNICAL ADVISORY COMMITTEE, RADIO SPECTRUM CONSERVATION (1952).

4. However, the upper ranges of the spectrum are not extensively utilized. Even today, most activities employ frequencies of less than 15 GHz.

borders, and some of them travel long distances, there is an obvious need for international coordination so that the radio signals emanating from different countries will not produce intolerable levels of electronic interference.

What are the means by which access to the radio spectrum is controlled? The basic institutional framework for radio spectrum utilization was shaped in 1927. The international Washington Radio Conference undertook to allocate among the various classes of radio service all of the radio spectrum then in use, and establish a procedure for recording frequency uses by individual stations in different countries with the International Telecommunication Union (ITU).[5] Contemporaneously, Congress enacted the Radio Act of 1927 establishing a Federal Radio Commission to regulate radio transmissions by most classes of stations within the United States;[6] radio transmissions of agencies of the United States government continued to be regulated by the President and subordinates in the executive department. In 1934, the Radio Act's provisions were incorporated into a more comprehensive Communications Act and the Federal Communications Commission (FCC) succeeded to the functions of the Federal Radio Commission.[7] The President's responsibilities over federal government stations were subsequently delegated to the Director of Telecommunications Management (DTM), who is assisted by the Interdepartment Radio Advisory Committee(IRAC).[8]

The outer limits on use of the radio spectrum are fixed by international agreements to which the United States is a party. Under the Radio Regulations of the ITU,[9] frequencies from 10 KHz to 40 GHz are allocated to radio services of different kinds. However, the services are stated in very broad terms, and frequently multiple uses are permitted. Moreover, the Radio Regulations are limited in two important respects: they do not apply to services which do not cause harmful interference to the stations of another country;[10] and they have only a limited application to the radio installations of military forces.[11] On the other hand, the broader outlines of the Radio Regulations are supplemented by regional and bilateral treaties,

5. In 1947, the recording procedure was considerably expanded, for administration by a new body, the International Frequency Registration Board of the ITU. *See generally* G. CODDING, THE INTERNATIONAL TELECOMMUNICATION UNION (1952).

6. 44 Stat. 1162 (1927), *repealed,* 48 Stat. 1102 (1934).

7. 48 Stat. 1064 (1934), 47 U.S.C. § 151 (1962).

8. 47 U.S.C. § 305 (1962); Exec. Order No. 10,995, 27 Fed. Reg. 1519 (1962), *as amended,* Exec. Order No. 11,084, 28 Fed. Reg. 1531 (1963).

9. T.I.A.S. 4892 & 4893 (1961), 5603 (1964).

10. T.I.A.S. 4892 & 4893 (1961); *cf.* T.I.A.S. 5603 (1964).

11. T.I.A.S. 4892 (1961).

and compliance with those to which the United States is a party is a prerequisite to radio frequency usage in this country.[12]

Within the limits fixed by these international arrangements, access to the radio spectrum is controlled by the DTM in the case of federal government stations, and by the FCC in all other instances. The division of the spectrum between the federal government and other uses is determined jointly by the DTM and the FCC: some frequencies are reserved for government use; others are reserved for nongovernment use; and some frequencies are shared between the two types of service. Any conflicts between the two classes of use, and claims for adjustment of the boundary lines, are resolved by negotiations between the two agencies.[13]

With respect to frequencies reserved for federal government use, the DTM authorizes operations by particular agencies and installations and establishes standards for such operations. Applications for new operating authority are processed initially by the Interdepartment Radio Advisory Committee, consisting of representatives of the government agencies making major use of the spectrum (and an FCC official serving in a liaison capacity); prospective interference problems are attempted to be resolved by negotiations among the affected agencies. However, the DTM has the authority to grant or withhold authorizations, and to establish the conditions under which these authorizations must be exercised. The processes by which the DTM and IRAC consider applications for government frequency use are not open to public inspection; only the interested government agencies are privy to those proceedings.[14]

With respect to frequency users other than the federal government, the FCC controls access to the spectrum. It exercises this control in three stages.

First, within the limits prescribed by international treaties and its arrangements with DTM, the FCC allocates the spectrum among different broad classes of use—television broadcasting, fixed common carrier communications, maritime navigation, police mobile radio, etc.[15] Any pro-

12. *See, e.g.,* the North American Regional Broadcasting Agreement, T.I.A.S. 4460 (1950).

13. *See, e.g.,* Bendix Aviation Corp. v. FCC, 272 F.2d 533 (D.C. Cir. 1959), *cert. denied,* 361 U.S. 965 (1960).

14. On the procedures employed by the DTM, see MAC QUIVEY, FREQUENCY ASSIGNMENT ADMINISTRATIVE CONTROL (1956); Coase, *The Interdepartment Radio Advisory Committee,* 5 J. LAW & ECON. 17 (1962); Metzger & Burrus, *Radio Frequency Allocation in the Public Interest: Federal Government and Civilian Use,* 4 DUQUESNE U.L. REV. 1 (1965); Rosenblum, *Low Visibility Decision-Making by Administrative Agencies: The Problem of Radio Spectrum Allocation,* 18 ADMIN. L. REV. 19 (1965). *See also* Schiller, *The Increasing Military Influence in the Governmental Sector of Communications in the United States,* 19 ADMIN. L. REV. 303 (1967).

15. 47 C.F.R. § 2.106 (1968).

spective user of the spectrum must select a frequency which conforms to this allocation. However, several diverse uses are permitted in the case of some frequency bands, and in exceptional cases the Commission may authorize ad hoc departures from the general allocation pattern.

Second, the Commission by general rule establishes standards for operation of different classes of service, specifying allowable power, antenna height, equipment and the like.[16] In the case of some services, the FCC also establishes a geographical distribution of stations by general rule. Thus, a Table of Assignments governs the distribution of television and FM outlets, specifying the channels available in each of a large number of communities.[17] Once again, the Commission must proceed within the boundaries marked by international treaties and its arrangements with DTM.

Finally, the Commission authorizes particular persons to use the spectrum in individual licensing proceedings. For most classes of users, little more is required than compliance with the general standards established in the first two stages. However, the license which is granted in such a case is not an exclusive one and the licensee may find that it is sharing a frequency with a great many other licensees and experiencing difficulties in obtaining access to the congested airwaves. This is true, for example, of the land mobile services, where licensees operate on a party line basis and must wait for an opening in the traffic of other licensees in order to transmit their messages.[18] In the case of other services, such as common carrier communications and broadcasting, the Commission's authorization carries with it the *exclusive* right to use the frequency in the designated area. But this creates a problem if the number of applicants in an area exceeds the number of available frequencies. The Commission must then hold a comparative proceeding in order to select the applicant best qualified.[19] Licenses are issued for limited periods—three or five years depending on the nature of the license—but they are renewable over an indefinite number of limited license terms.

Authorizations which create a potentiality of interference with stations of other nations are registered with the International Frequency Registration Board. Registration is conditioned on conformity with international requirements, including the avoidance of harmful interference with other

16. *E.g.*, 47 C.F.R. §§ 73.39-.50, .188 (1968).

17. 47 C.F.R. §§ 73.202, .205-.207 (FM), 73.606 (television) (1968).

18. Industry coordinating committees seek to facilitate improved usage of the channels available for land mobile services.

19. On the need for a comparative proceeding, see Ashbacker Radio Corp. v. FCC, 326 U.S. 327 (1945); Johnston Broadcasting Co. v. FCC, 175 F.2d 351 (D.C. Cir. 1949). On the standards employed, see W. JONES, CASES AND MATERIALS ON REGULATED INDUSTRIES 1080-90, 1121-25 (1967).

stations having a prior claim on use of the frequency. There is a procedure for adjudicating disputes among diverse claimants to the same frequency rights, and in such controversies weight is given to priority in registration and use of the frequency, continuity of frequency usage, and, to some extent, the importance of the use.[20]

The proceedings of the FCC are open to the public. Determinations relating to allocation of spectrum among different uses, technical standards, and most geographical assignments, are made in rule-making proceedings. A proposed rule is publicly promulgated, interested parties are permitted to comment, and a decision is reached on the basis of the comments submitted and the recommendations of the Commission's staff. Individual licenses issued in accordance with the rules normally involve no more than routine administrative processing. But if an issue of fact is presented, or if a comparative proceeding must be held, then an adjudicatory proceeding is required. This involves notice of issues, opportunity for affected parties to participate, presentation of evidence on a formal record with the right of confrontation and cross examination, and an agency decision based upon that record.[21]

In making its decisions, the FCC is guided by the most general statutory directions. Thus, the general standard applicable to issuance of licenses is "whether the public interest, convenience and necessity will be served."[22] On the geographical distribution of authorizations, the FCC is instructed "to provide a fair, efficient, and equitable distribution of radio service to each of the several States and communities."[23] And the Commission is directed to "generally encourage the larger and more effective use of radio in the public interest."[24] While the legislation contains many detailed provisions concerned with specific problems, these are almost the only standards which bear on the allocation of the spectrum among different classes of use.

20. For further discussion of international frequency control, see G. CODDING, *supra* note 5. *See also* Glazer, *The Law-Making Treaties of the International Telecommunications Union Through Time and Space,* 60 MICH. L. REV. 269 (1962); *Miles, International Radiofrequency Management,* 31 TELECOMMUNICATION J. 170 (1954); Nicotera, *The Structure of the ITU,* TELECOMMUNICATION J. 160 (1964); Plosz, *The International Telecommunications Union,* 31 SASK. BAR REV. 41 (1966); Note, *The Master Radio Frequency Record,* TELECOMMUNICATION J. 216 (1955).

21. For a more detailed discussion of FCC procedures see W. JONES, LICENSING OF MAJOR BROADCAST FACILITIES BY THE FEDERAL COMMUNICATIONS COMMISSION (1962), reprinted in *Hearings on Federal Communication Commission, Part I, Before Subcomm. No. 6 of House Select Comm. on Small Business,* 89th Cong., 2d Sess. (1966); Metzger & Burrus, *supra* note 14.

22. 47 U.S.C. § 309 (1962).

23. 47 U.S.C. § 307(b) (1962).

24. 47 U.S.C. § 303(g) (1962)

The DTM operates without statutory standards of any kind. And the executive order delegating authority to the DTM is as vague and general as the Communications Act.[25]

In making decisions on radio spectrum allocation, the FCC and DTM are not concerned exclusively, or even primarily, with technical considerations. To be sure, the end result is a determination assigning a service to a particular portion of the spectrum, with prescriptions as to bandwidth, antenna height, operating power, and the like. But among the policy considerations underlying the decision are such factors as the scope of the economically feasible service area; the expense of the equipment and how such costs should be divided among transmitting and receiving units; the importance of the service to the economy or to the functioning of society (*e.g.*, public safety); and the availability of alternative means of providing the same service. These factors must be weighed in conjunction with the technical characteristics of the proposed spectrum use.

In recent years, the problem of radio spectrum congestion has become increasingly acute.[26] While advances in technology have greatly expanded the capacity of the spectrum, demand for spectrum space has increased at an even faster rate. Among the major problem areas are the following.

(1) Land mobile services. Business firms have been making increasing use of mobile radio facilities to communicate with trains, taxis, repair services, delivery trucks, automated machinery, and other mobile facilities. State and local governments also have been making more use of mobile radio in the conduct of police, fire and other emergency and governmental functions. The frequencies allocated to the land mobile services are being sorely taxed in the major urban areas, as more and more licensees are added to the limited channels assigned to these services. The consequent congestion in their party lines leads to delays in gaining access to the airwaves and diminishes the usefulness of the radio facilities involved. Land mobile users have been pressing for the allocation of additional frequencies to their service, with particular attention to the possibility of obtaining frequencies from the relatively lavish authorizations of television broadcasting and the federal government.[27]

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25. See note 8 *supra.*

26. *See generally* TELECOMMUNICATIONS SCIENCE PANEL OF THE COMMERCE TECHNICAL ADVISORY BOARD, ELECTROMAGNETIC SPECTRUM UTILIZATION—THE SILENT CRISIS (1966); OFFICE OF TELECOMMUNICATIONS MANAGEMENT, A REPORT OF FREQUENCY MANAGEMENT WITHIN THE EXECUTIVE BRANCH OF THE GOVERNMENT (1966).

27. On the land mobile problem, see FCC, REPORT OF THE ADVISORY COMMITTEE FOR THE LAND MOBILE RADIO SERVICES (1967); Courtney, *The Double Standard,* 20 FED. COM. B.J. 152 (1966); Courtney & Blooston, *Development of Mobile Radio Com-*

(2) Communications common carriers. Following World War II, the long-distance cables employed by the Bell system were supplemented by microwave relays, narrow beams of radio waves between fixed points; microwave is now the dominant mode of intercity communcation. Microwave also has been employed extensively by many private businesses. With the advent of satellite communications, which also depend on microwave transmissions, a problem of accommodation has arisen between the terrestrial and satellite services. At the present time, the Communications Satellite Corporation (Comsat) is providing international telecommunication service on bands in the 4 and 6 GHz range which it shares with the terrestrial microwave relays of the common carriers, principally the Bell system. Proposals have been made using satellite communications for domestic as well as international traffic. The terrestrial carriers fear that their microwave transmissions will be impaired by interference resulting from extensive domestic use of satellite communications, and Comsat is concerned that the development of satellite communications may be retarded by limitations on its access to the spectrum.[28]

(3) Television. The spectrum allocated to television broadcasting is quite extensive as compared with most other services. However, because of the size of the individual television channel (6 MHz) and the problems of co-channel and adjacent channel interference among stations in different communities (requiring separations of up to 220 miles in some instances), the number of channels available in any given community is severely limited. Thus, the FCC's most recent geographical distribution involved some

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munications—The "Work Horse" Radio Services, 22 LAW & CONTEMP. PROB. 626 (1957).

28. On the potential and problems of domestic satellites, see HUGHES AIRCRAFT CO., THE POSSIBLE FUTURE OF SATELLITE COMMUNICATION (DTM Report 1967); SYSTEM SCIENCES CORP., EVALUATION OF DOMESTIC USES OF SATELLITE SYSTEMS (DTM Report 1967); HULT, SATELLITES AND FUTURE COMMUNICATIONS INCLUDING BROADCAST (RAND paper P-3477, 1967); JOHNSON, THE IMPACT OF COMMUNICATIONS SATELLITES ON THE TELEVISION INDUSTRY (RAND paper P-3572, 1967); Dirlam & Kahn, *The Merits of Reserving Cost-Savings from Domestic Communications Satellites for Support of Educational Television,* 77 YALE L.J. (1968); Pierce, *"Communication" in Toward the Year 2000,* DAEDALUS, *Summer* 1967, at 909; Schiller, *Communications Satellites: A New Institutional Setting,* BULL. OF ATOMIC SCIENTISTS, April 1967, at 4; Schiller, *New or Last Chance in Space Communications,* ILL. BUS. REV., Dec. 1966, at 6; Silberman, *The Little Bird That Casts a Big Shadow,* FORTUNE, Feb. 1967, at 108; Note, *The Future of Domestic Satellite Communications,* 19 STAN. L. REV. 1058 (1967).

Problems pertaining to domestic communications satellites were among those raised by the President in establishing a Task Force on Communication Policy on August 14, 1967. *See* PRESIDENT'S RECOMMENDATIONS RELATIVE TO WORLD COMMUNICATIONS, H.R. Doc. No. 157, 90th Cong., 1st Sess. (1967). The message also inquired: "Are we making the best use of the electromagnetic frequency spectrum?" *Id.* at 8.

1,756 television channel assignments in the contiguous United States; but only 40 of the top 100 markets have six or more commercial television assignments; 31 have five assignments; and most of the remaining markets in the top 100 have only four commercial assignments. Markets of smaller size have fewer channels on the average.[29] While not all of these channels have been occupied by stations, there is concern that a medium of expression as important as television should be so restricted by spectrum considerations as to severely limit the number of outlets in a large number of communities.[30]

(4) New uses of the spectrum. There are a number of technological developments which are expected to create additional demands upon the radio spectrum: automated equipment with requirements for remote control; expansions in computer operations and in the volume of data transmissions; radio devices to reduce the incidence of highway accidents; networks to exchange documents, data and other information among libraries, universities, and other research centers; and personal mobile telephones to permit individuals to engage in telephonic communications without regard to location. Some of these developments may be prevented or delayed if the necessary spectrum space is not available on economically practicable terms.[31]

At the same time, other technological developments suggest that it may be possible to employ communications techniques which *do not* involve

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29. *See Fifth Report on Fostering Expanded Use of UHF Television Channels,* 6 P. & F. RADIO REG. 2d 1643, 1667-68 (1966).

30. The major problems of broadcast regulation are reviewed in W. JONES, *supra* note 19, at 1050-64 (geographical distribution of stations), 1091-1105 (economic injury to existing broadcasters), 1105-35 (concentration of control of mass media), 1135-75 (network practices), 1175-1232 (station programming), 1233-73 (subscription and supplemental services, including CATV).

The impact of channel scarcity on programming practices is discussed in McGowan, *supra* note 1; Rothenberg, *Consumer Sovereignty and the Economics of Television Programming,* 4 UNIVERSITY OF CHICAGO STUDIES IN PUBLIC COMMUNICATION 45 (1962); Steiner, *Program Patterns and Preferences and the Workability of Competition in Radio Broadcasting,* 66 *Q.J.* ECON. 194 (1952); Wiles, *Pilkington and the Theory of Value,* 73 ECON. J. 183 (1963). *See also* Coase, *The Economics of Broadcasting and Government Policy,* 56 AM. ECON. REV. 440 (1966); G. STEINER, THE PEOPLE LOOK AT TELEVISION (1963).

On the alternative of noncommercial television, see CARNEGIE COMMISSION ON EDUCATIONAL TELEVISION, PUBLIC TELEVISION: PROGRAM FOR ACTION (1967); W. SCHRAMM, J. LYLE & I. POOL, THE PEOPLE LOOK AT EDUCATIONAL TELEVISION (1963); STANFORD INSTITUTE FOR COMMUNICATION RESEARCH, EDUCATIONAL TELEVISION—THE NEXT TEN YEARS (1962). *See also* Public Broadcasting Act of 1967, 76 Stat. 64 (1967), 47 U.S.C. § 396 (1968).

31. *See* TELECOMMUNICATIONS SCIENCE PANEL OF THE COMMERCE TECHNICAL ADVISORY BOARD, *supra* note 26.

atmospheric propagation of radio signals to replace methods currently making use of the spectrum. Thus, television signals might be carried by cable rather than radiated through the atmosphere; and data transmission might utilize waveguides or other enclosed conduits instead of atmospheric microwave transmissions.

This, then, is the background against which the Airlie House conference was held. The question was whether better ways might be developed to cope with growing problems of spectrum scarcity.

II. The Critique of the Academic Economists and the Proposal for a Market System

The basic problem of the present system, as identified by one group of critics, is the absence of transferable property rights in the spectrum. As one economist observed:

> Frequency spectrum is the only resource of any consequence for which:
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> 1) All use rights are defined by government and then given away;
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> 2) Recipients of rights are not permitted to sell all or any portion of their rights, hence, no rights holder has any incentive to economize on the use thereof or transfer his rights to someone who values them more highly;
>
> 3) The total amount of the resource available is subdivided, with each piece alloted to specific services ,(e.g., land mobile) and no transfer permitted among services;
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> 4) Significant portions of the resource are allocated to specific services, but the number of individuals who can use the resource is unlimited i.e., within certain service categories spectrum is treated as a free good;
>
> 5) Because the government completely controls use rights, government agencies get first consideration in their distribution—again, at no cost;
>
> 6) Potential current users have no incentive to take into account future value, i.e., of withholding use today in favor of more valuable possible future use.[32]

A number of speakers commented on the relatively inflexible nature of spectrum allocations: the tendency of the FCC and the DTM to continue existing allocations in effect despite changing circumstances, and to protect existing users from interference by newcomers.

> . . . [I]t's a lot harder to get government agencies to reallocate spectrum and to adapt to rapidly changing conditions than it would be for

32. Meckling, *supra* note 1.

people with property interests to buy and sell them back and forth between one another.

In general, users of *existing* facilities are accorded assurance that new or proposed interfering facilities will not be permitted; little if any attention is directed to the possibilities of trade-offs between cost and interference protection.

[Y]our favored incumbent is the chap who is unaware of spectrum costs and opportunity costs. He is shielded from these unpleasant facts of life. He may well use more spectrum than he would in an organized frequency market. He may stockpile much longer than he would in a market.[33]

The consequences of this pattern for research and development were elaborated by a hypothetical example:

Present-day incentives for existing users of lower frequencies to engage in research and development in the frequencies above 15 [GHz] leave much to be desired: A user "C" may feel great pressure to engage in research and development in the higher frequencies because continued expansion of C's services in the lower frequencies would lead to interference with the services provided by D and E. Yet, perhaps only at a small cost (relative to that involved in C's using the higher frequencies) D and E might be able to protect themselves from this added interference. But today there is no easy way by which C can compensate D and E for these added costs, or for C even to determine what the magnitude of costs would be. On the other hand, B might not feel under pressure because his allocations in the lower region are "adequate" for his needs. Yet F and G may be badly squeezed in their allocations; while they could not themselves employ the higher frequencies due to the very nature of their operations, they might find extremely valuable the spectrum allocation that B is now occupying if somehow B could be induced to move into the higher frequencies and vacate his existing allocation.[34]

As another speaker observed:

. . . [T]here [is] a lot of discussion of the extensive and intensive development of the spectrum and R & D expenditures, . . . with the general presumption that those expenditures are desirable, as there is a tendency to think that any increased use of the spectrum—in the extensive sense for example—is obviously desirable. And, of course, this is not true. . . . The question is whether the cost of the R & D is recaptured in the gain in terms of the value of the spectrum. And no one knows that . . . until we find out what the value of the spectrum really is.[35]

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33. Johnson, *supra* note 1.

34. *Id.*

35. Levin, *supra* note 1.

The distortion of R & D expenditures was emphasized by comparing the motivations of spectrum users having ample allocations and those with inadequate assignments. "[S]ome innovations will fail to occur (in services with unusually lush assignments); whereas other congested areas may experience innovations which would never have occurred in a free market."[36] Also, there may be a need for public investment in telecommunications research because of "uncertainties, time period before return, [and] indiscriminate benefits."

Apart from the tendency of the regulatory agencies to perpetuate existing allocations, their decisions on spectrum matters were criticized for failing to articulate any meaningful criteria for spectrum allocation. A participant stated:

> . . . one of the most frustrating things about trying to function . . . in this area is what seems to me to be the total absence of any standard. And with all respect I really find the "public convenience and necessity" more a charade—somewhere between a charade and criminal fraud—more than I do a useful standard. I mean it is absolutely devoid of meaning so far as I am concerned.[37]

As a means for remedying these deficiencies, it was urged that the present system of administrative allocation be replaced by a market system for frequencies: "the one big difference between it and what we have now is simply that individual frequency rights would be transferable in whole or in part and, in terms of three dimensions of band-width, geographic locations, and time."[38] Under this proposal, it was envisaged that all holders of existing authorizations would become owners of the spectrum rights represented by those authorizations, without payment to the government, and would be free to transfer them for a consideration to any other user. "In those portions of the spectrum which are overused (congested) some users would buy out others, reducing the level of interference." Moreover, "making rights transferable would provide incentives to owners of those rights to use them economically." And it would introduce needed flexibility into the system by providing a means of taking "rights away from existing users and [giving] them to new users if it turns out that the value of the spectrum to the new user exceeds the value to the present user." Finally, research and development would be stimulated in areas where present incentives are low. "[T]he present holders of broadcast bands, for example, are not interested in suggestions that they could send their signal on a much smaller chunk of frequency unless they are allowed to somehow capture some of

36. *Id.*

37. Meckling, *supra* note 1.

the gain from that."[39] Under a market system, the broadcasters could sell off part of their rights if they so decided.

There was some discussion of the extent to which property rights in the spectrum are recognized under the present system of administrative allocation. The Communications Act states that its purpose is "to maintain the control of the United States over all the channels of . . . radio transmission; and to provide for the use of such channels, but not the ownership thereof by persons for limited periods of time, under licenses granted by Federal authority;"[40] and every licensee is required to sign "a waiver of any claim to the use of any particular frequency or of the ether as against the regulatory power of the United States because of the previous use of the same, whether by license or otherwise."[41] But the FCC rarely displaces existing licensees, so there is considerable security of tenure in fact, if not in law. And at least one kind of licensee—the broadcaster—can sell his operating authority along with his station facilities as long as FCC approval is obtained.[42] There is therefore a recognizable market in broadcast authorizations—in fact, once again, if not in law. However, it was recognized that neither of these phenomena provided the kind of flexibility and incentive implicit in a market system, which would have as its central feature the *transferability* of spectrum authorizations among *different* uses.

The basic theme of the proponents of a market system was that the radio spectrum is a scarce resource not materially different, in its economic aspects, from other scarce resources:

> The wellspring of . . . confusion has been the belief that interference is a technical problem peculiar to the use of frequency spectrum. In fact, interference is simply a manifestation of scarcity. It is not possible for all those who would like to use the spectrum to do so without affecting the amount of the resource available to others. The analogy to other resources, land, labor and capital, is so obvious as not to require elaboration.
>
> Any effort to improve frequency management must be built on a recognition that frequency spectrum is an economic resource in no significant way different from the mass of other resources available to society. . . .[43]

Much of the remaining discussion was concerned with the soundness of this premise.

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38. *Id.*
39. *Id.*
40. 47 U.S.C. § 301 (1962).
41. 47 U.S.C. § 304 (1962).
42. 47 U.S.C. § 310(b) (1962).
43. Meckling, *supra* note 1. For an earlier exposition in the same vein, see Coase,

III. Problems Raised by the Proposal for a Market System

A. *Definition of Proprietary Interests*

A market system for spectrum rights requires that there be rights which can be sold and exchanged, *i.e.*, that property interests in the spectrum can be defined with sufficient clarity to make them marketable. Proponents of the market system idea did not undertake to explain how spectrum rights would be defined.[44] For the most part, they assumed that the courts would be capable of developing the necessary standards once a decision had been made to adopt a market system, in much the same way that courts had defined various interests in land. Indeed, some of them suggested that such a system would have developed out of the unregulated electronic interference of the twenties—through the recognition of "squatters' rights" in the spectrum—if Congress had not intervened with the Federal Radio Act and the system of administrative authorization.

Others were more skeptical. They recalled the great confusion which resulted when federal regulation broke down in the twenties. One official opined that, without federal regulation, "you would simply have had squatters on top of squatters, to the end that you got ultimate chaos."[45] There was considerable doubt that the courts would move with sufficient speed and clarity in developing a body of law to deal with newly created rights in the radio spectrum. Some of the problems may be briefly summarized.

(1) Under the existing system of administrative authorization, radiation rights are defined largely in terms of inputs: the use of particular equipment at a particular location, with prescribed limits on power, antenna height, and the like. Simply confirming these rights in the present licensees would not create a market system with transferability among different uses, since the prescribed limitations on inputs would limit each right to a particular use (*i.e.*, the one for which it had been initially licensed). It would be necessary, as a minimum, to redefine radiation rights as outputs: the ability to radiate signals of defined strength over particular areas at par-

The Federal Communications Commission, 2 J. Law & Econ. 1 (1959). *See also* Note, *The Crisis in Electromagnetic Frequency Spectrum Allocation: Abatement Through Market Distribution,* 53 Iowa L. Rev. 437 (1967).

44. See, however, the related proposal to modify the method by which radiation rights are defined under regulation, note 64 *infra.*

45. On the background and legislative history of the Radio Act of 1927, see W. Jones, *supra* note 19, at 1022-28.

ticular times. There was no discussion by the proponents of a market system of the ease or difficulty of this kind of redefinition of rights.

(2) The technology of radio spectrum utilization is not static, and some cited the danger that a mode of definition rooted in contemporary technical concepts would prove to be a hindrance as technology developed. If, however, radiation rights are defined in terms of inputs—equipment, power, antenna height, and the like—it is difficult to see how a market system could be developed which would permit transferability of rights among different uses, since it would be most unusual for different types of use to involve the same inputs.

(3) One mode of specifying property rights in the spectrum would be to define them in negative terms, as the right to exclude signals of a certain strength and designated frequency from a particular area, or to exclude any signals which would interfere with a protected existing use of the spectrum. This definitional approach was implicit in a number of comments relating to the uncertainties involved in buying and selling spectrum rights.

> . . . The problem here is that many of the people who want to buy spectrum . . . are going to want to use it for a [purpose different from its present use]. Let me give you two examples.
>
> A satellite operator wants to operate a satellite on a shared frequency, and he knows ahead of time that he is going to interfere with the local landline microwave. So he says, "Okay, I'll buy you out." And he does. He operates a satellite, and, in fact, ex-post, there is some interference in other parts of the system. And it was very hard for him to predict what that level of interference was going to be. It isn't like the guy who buys a house on a piece of land where he sort of knows what he is getting and there aren't strong external effects which cannot be easily predicted.
>
> Another example. A bunch of mobile operators finally get up enough of a coalition so they buy out a local broadcasting station's right to radiate, and they use the frequency for their mobile operation. But now you have this number of mobile operations running around the countryside, and the kind of interference likely to be generated by that may be different from the kind of interference generated from the central TV station from the fixed point, and kinds of interference which are simply hard to predict.
>
> Now, this simply raises the level of uncertainty, and businessmen are used to coping with uncertainty. But to the extent that there is a high level of uncertainty this reduces the values of a market mechanism. . . .

The problem of uncertainty was raised in connection with an interference phenomenon known as intermodulation—the interference created

by the interaction of several signals, which individually do not create interference.

> I am given a right to [transmit from] a mountaintop. . . . I move up. . . . And B moves up after me with his right. And he doesn't do anything to me. Now, C comes up with his right, and he doesn't do anything to me either. But when he enters the mountaintop, B now starts doing something to me.
>
> [W]ho shall pay for the filter that has to go into B? B is now causing interference to me through no fault of his own because C comes on the scene.
>
> When I am given a right, to what extent can I be given something that I can in fact know about with a degree of certainty so that I am not surprised, if I am going to buy this right and make a judgment about its value to me?

Such interference is difficult to predict.

The proponents of a market system in spectrum rights did not attempt to respond to these problems with specific definitions of the rights proposed. They simply expressed confidence that the courts would develop a body of law to deal with property interests in the spectrum if such interests were permitted. However, others doubted that the courts would respond in a way that would produce an efficient system of spectrum rights.

> If the rights are not clearly defined, then the courts have to come in and mediate and decide. . . . And the courts do not always decide things in ways which lead to economic efficiency. Now, if we begin with the premise that efficiency is good, . . . then we would be much better off to define very clearly what these rights are. . . . [S]o that they lead to efficiency, we must be sure that the definition . . . facilitates the least cost transferability, the least cost enforcement of rights and policing of rights, and identification of who is interfering with those rights.

One participant suggested that federal legislation might be revised so that the FCC's primary function was stating what it is that is being sold, *i.e.*, defining the pertinent transferable units of spectrum space.

B. *Interference Problems of Disparate Uses: The Zoning Analogy*

Closely related to some of these definitional problems is the challenge presented by the zoning analogy: perhaps efficient use of the radio spectrum depends upon minimizing the variety of spectrum uses in a given spectral region. In the discussion, the problem was expressed in different ways. At one point, a government official observed:

> In the area of frequency utilization there are some very real technological problems, I think, in having mobile radio frequencies that use a very limited amount of frequency space in a very limited geographical area competing in the same frequency range where a television station is broadcasting a signal.

Subsequently, an economist conceded that there were "zoning problems" involved in spectrum transactions. To this, another government official responded:

> There is nothing in the area of zoning and the odors that may emanate from a mis-zoned plant that as far as I know is equal to the problems of intermodulation that you are going to get with people operating on adjacent portions of the spectrum.

A question was raised as to whether the land zoning problem was "like that of a land mobile user down in the middle of the television bandwidth," and, more specifically, "what would happen if a land mobile user bought out Channel 5 in Washington?" The response, from an engineer, was that the land mobile user probably would be restricted in its operations because of interference with stations operating on Channel 5 in other cities. "The point is the land mobile cannot just operate anywhere within a TV band just because he owns Channel 5 in Washington. He has got problems of either causing extreme interference" to TV stations on Channel 5 in other cities or of "being interfered with" by such stations. This led a lawyer to express the view that

> if you want more space for land mobile, what you are going to have to do is move land mobile as a group rather than having individual land mobile operators bid for spaces here, there, and everywhere they can get hold of them. That is, the nature of the service is such that there are efficiencies in having all the land mobile people operating near one another rather than at different spots.

An engineer agreed that "by keeping the users of a particular type together you eliminate these problems of cross-operations," and that "when you get interference between different types of users, you have a more difficult case to solve than when you have interference between similar users."

The zoning problem was not fully explored in the discussion. But its implications are significant. If it is important that similar users be kept in the same area of the spectrum, it is difficult to see how a conventional market system can provide for free transferability of spectrum from one use to another.

C. *Special Problems of Television*

Since television frequencies occupy a substantial portion of a desirable segment of the radio spectrum (about 50% of the frequencies below 1 GHz), there was considerable discussion of the impact a market system might have on television. In this connection, it was noted that the television service is characterized by two dichotomies: (1) transmitting and receiving equipment are owned by different persons, the latter being in the hands of the general public; and (2) the financial support for television programs is not furnished directly by viewers, but comes instead from advertisers.

The first point is important in relation to the idea that television broadcasters are using unnecessarily large bandwidths to transmit their programs (6MHz). With the incentives of a market system, broadcasters might economize on bandwidth (reducing channels, for example, to 3 MHz) and sell the excess to others for different spectrum uses. The question, however, is how you can do this without rendering obsolete the billions of dollars worth of receiving equipment in the hands of the public. Some suggestions were forthcoming, but they all involved regulatory action rather than the operation of market forces, *i.e.*, the announcement of mandatory conversion to transmission techniques involving narrower bandwidths at some future date, possibly coupled with the requirement that new sets be capable of receiving both the present wide bandwidth signals and the narrower bandwith signals projected for the future. There was no suggestion as to how a market system might resolve the problem of obsolescense of television receivers.

The second point is important in the context of a market system in which television would have to bid against other prospective users for access to the spectrum. Would the interests of viewers be adequately represented by the bids of the broadcasters? One economist argued that there was no necessary relation:

> . . . [T]he value [of television time], to the advertisers is reflected in what he is willing to pay for the time, and the value to the broadcaster of having that time to sell to the advertiser is reflected in what he is willing to pay for the spectrum if it were put up for bid. But it is not true . . . that the value of the viewing opportunities thereby afforded the viewer is reflected in those prices. Very indirectly this may be true in the sense that what the viewer is going to pay for advertised products may depend on how much he likes the program, but I sure wouldn't want to push that argument very far.
>
> In this circumstance [it cannot be presumed that willingness to pay more for spectrum use reflects a higher social use. The presumption] falls to the ground when there are a group of people bigger than any

other whose interests cannot be, or at least are not under present arrangements, represented in the prices anybody is willing to pay.

In response to this argument, three points were made. First, it is possible that advertisers do adequately represent viewers, since program success results in product success and the latter increases the revenues of the advertiser. This possibility was discussed, but no one was prepared to urge it strongly. Second, it was noted that "no one has suggested that because TV is supported by advertising that we ought to give them antennae. . . . That is to say, we *do* require that the TV stations buy the resources which they use even if they are supported by advertised TV." Finally, it was urged that a market mechanism would facilitate the growth of subscription television if the interests of viewers proved to be inadequately represented by advertisers.

The original spokesman observed that pay television was not necessarily the best solution because "it takes some resource use to internalize the benefits to reflect them in the prices viewers pay. And there is no presumption, although it may well be true, that that resource cost is worth incurring." In short, the allocational and other advantages of pay television may be offset by the costs incurred in establishing a system for tabulating the programs watched, computing the amounts payable, and effecting collections of those amounts.[46]

D. *Special Problems of Public Services*

A similar point was made with respect to frequencies employed by government agencies for police protection and the like: that such frequencies were not used in producing goods or services to be sold for a profit, and that the government's bids for such services might not reflect their value in augmenting police protection for the public. The opposition to this line of reasoning was summed up in the query: "Is this factor input any dif-

46. On subscription television, see Blank, *The Quest for Quality and Diversity in Television Programming,* 56 AM. ECON. REV. 448 (1965); Minasian, *Television Pricing and the Theory of Public Goods,* 7 J. LAW & ECON. 71 (1964); Suelflow, *Subscription Television,* PUB. UTIL. FORT., June 22, 1967, at 25, & July 6, 1967, at 23; Comment, *Aspects of Pay Television: Regulation, Constitutional Law, Antitrust,* 53 CALIF. L. REV. 1378 (1965). A Committee of the FCC recently advanced a proposal for a national subscription television service. 10 P. & F. Radio Reg. 2d 1617 (1967). However, the House Committee on Interstate and Foreign Commerce has expressed the view that the FCC should not approve national television for a year or until the Act is amended to affirmatively authorize such a service. 7 Television Digest, Nov. 20, 1967, at 5.

On the economics of commercially supported television, see authorities cited note 30 *supra. See also* Lees & Yang, *The Redistribution Effect of Television Advertising,* 76 ECON. J. 328 (1966).

ferent than any other that the police or land mobile user has to use and bid for?" A government official responded:

> I would think there is a very great difference. I would think when the police department in the City of Los Angeles needs spectrum, they need it. And they need cars. They can go out and buy cars [and pay for them]. Because the public never owned the cars. But the public does own the spectrum.
>
> Now, the police feel . . . that it would be a great anomaly to say to the police in Los Angeles that they should bid in competition with businessmen to get back some part of what started out in the public domain. . . .

At least some of the economists were unpersuaded:

> . . . [W]hile the police themselves and public safety . . . are a public good, spectrum is in essence no different . . .than any other factor of input. And the fact that the public happened to own the spectrum and may choose . . . to buy it from themselves and give it to the police is a matter of conscious public decision and a perfectly appropriate one.
>
> It is not at all clear that giving away frequency . . . is the sensible way to subsidize police. [It may be desirable] to give the police money instead of frequencies, since it is quite possible that there is a misallocation of resources as a consequence of the fact we do this, because if they had the money they would buy other things than frequencies.

The discussion of governmental functions focused on police operations at the local level. At the national level, government payments for spectrum use would involve, in the first instance at least, payments back into the federal treasury. While the payment here would be a transfer from one pocket to another, the process would not be pointless since presumably there would be budgetary review of spectrum expenditures as well as other expenditures. In the case of state and local governments, there would be a transfer of funds to the national government in the event of a lease or purchase of spectrum rights from a federal authority.

With respect to public service uses of the spectrum, some participants thought that the place to intervene was in the bidding process rather than through allocation of the spectrum to particular uses: "if educational TV is so important and we want to be sure we have some spectrum use for it, . . . the educational TV entity [should] bid enough to make sure that it has that spectrum."

E. *Monopoly and Concentration of Ownership*

One of the objections to a market system in spectrum rights is that monopoly in the broadcasting and communications industries might be

increased thereby. "Fear that a single firm might buy up all of the frequency spectrum is the extreme expression of this question." To this, it was said that "there is no reason to believe that a market for frequencies would be [particularly] susceptible to monopoly. . . . [W]e have anti-trust laws specifically designed to handle the problem of monopoly, and there is no reason why frequency monopoly problems can't be handled under those laws just as is the case for other resources."[47]

The problem was not discussed at any length at the conference, but the following dialogue, between a lawyer and a government official on the related problem of disposing of user rights by competitive bidding, sheds some light on the issue:

> Official: One consequence of that . . . would be just as one consequence of sale of television franchises through auction rather than through the admittedly imperfect comparative process—that the biggest, richest people would end up owning the spectrum.
>
> And unless you now put on some other constraints—and it has to be short of anti-trust, because you would have a fellow owning an awful lot of television stations but you could not prove he had such a segment of the market that he violates the anti-trust law.
>
> Lawyer: I don't object to your multiple ownership rule [restricting the number of stations a television broadcaster may control].
>
> Official: . . . [I]f you are going to say to the existing land mobile users, "Well, if you want to continue here we are going to make you bid to rent it, and not all of you can win even if you are willing to spend some money, because only those people who spend the most money will win," I think you will find that the biggest ready mixed concrete companies, the biggest trucking companies, the biggest delivery companies, the biggest manufacturing concerns would end up with the spectrum. . . .
>
> Lawyer: . . . I have the feeling that you are confusing ability to pay with willingness to pay. And the willingness to pay for something depends upon the profitability of its use to you. . . .
>
> Official: . . . I would expect that [the big company] may be in a position to realize greater efficiencies from this added use of the spectrum than the little fellow. . . .
>
> Lawyer: I should say it should go to the fellow who could get the more efficient use of the spectrum.[48]

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47. Meckling, *supra* note 1.

48. The Commission's multiple ownership rules are set forth at 47 C.F.R. §§ 73.35 (AM), 73.240 (FM), 73.636 (television) (1968). The antitrust laws also apply to the acquisition of broadcast facilities. 47 U.S.C. § 313 (1962); United States v. RCA, 358 U.S. 334 (1959); Comment, *Corporate Acquisition of Broadcast Facilities: The "Public Interest" and the Antitrust Laws*, 8 B.C. IND. & COM. L. REV. 903 (1967). Finally, the FCC has made some rather feeble efforts to limit concentration of control of mass media in comparative proceedings—preferring applicants not affiliated with

F. *Private Stockpiling of Frequencies*

A somewhat related issue is manifested by the concern that private parties would acquire frequency rights for stockpiling rather than current use.

> The radio spectrum is not consumed through use. . . . When a frequency band ceases to be used, it is just as available and it is just as fresh as it ever was. . . . I think this is a significant distinction, because it relates to this question of stockpiling. . . . Should frequency rights include the right to non-use, to non-reception?

This led to a proposal that spectrum rights should have a time dimension and be shared among users with low traffic volume "to prevent the rights from being stockpiled." For this, an effective switching and accounting system would be required. Alternatively, it was proposed that the rights could be sold or leased with a specification of the time within which they must be used.

On the other hand, an economist stated that the value of a spectrum right is

> the present value of the future services that will be rendered by that right, not just this year's services, but all of the potential useful services of that right in the future.
>
> Now, if it turns out that it pays to withhold a piece of frequency spectrum now . . . someone will . . . keep that piece of spectrum vacant for future uses. There is a rationale for not using . . . all of the frequency spectrum. . . [I]nvestments that will be made in equipment [in exploiting particular] frequencies will later become a sunk cost. Then, once [that investment has been made,] the question of the alternative uses will change.

These were the only comments directed to the economics of private stockpiling, although public stockpiling of frequencies was discussed in another context.[49]

G. *The Public Interest in Communications*

There was some suggestion that the public interest in the spectrum might be related to its distinctive usefulness for communications purposes.

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other mass media over those who are so affiliated. *See* W. JONES, *supra* note 19, at 1118-25.

See also H. LEVIN, BROADCAST REGULATION AND JOINT OWNERSHIP OF MEDIA (1960); UNITED RESEARCH, INC., THE IMPLICATIONS OF LIMITING MULTIPLE OWNERSHIP OF TELEVISION STATIONS (1966); Toohey, *Newspaper Ownership of Broadcast Facilities*, 20 FED. COM. B.J. 44 (1966). The FCC recently has terminated a proceeding that would have imposed additional restrictions on ownership of multiple television stations in the major markets. Television Multiple Ownership Rules, 12 P.&F. RADIO REG. 2d 1501 (1968).

49. See *infra Part IV*, Section A.

> . . . [T]he spectrum may not be a unique resource, but communications are a unique product for society. . . . Communications make us. . . . [I]f we can think of a different society, or people being in some sense better, or society as being somewhat better, the avenue of communication will be used in a sense that the avenue of transportation or food or clothing or other goods might not be. Communications we sense have a very great leverage for society, and in this sense it is a good that is unique, even though the spectrum might not be.

Other participants recalled the long-standing public concern with the use of the spectrum for communications purposes.

In opposition, it was urged that the utility of the spectrum for communications purposes should point in the direction of less, rather than more, government intervention.

> There are many who argue that the government should retain control of frequency spectrum in order to control the quality of broadcasting. . . . I am very uneasy about the potential for censorship implied by using government control over frequencies as a lever for enforcing higher standards on broadcasters. . . . Would anyone seriously suggest that printing presses or newsprint should be controlled by the government in order to control the quality of newspapers?[50]

This issue was not developed fully, but perhaps governmental intervention in respect of broadcasting might not take the form of censorship. Without seeking to exclude any specific material from the airwaves, the government might endeavor to spread broadcast services geographically, so that all portions of the nation receive services from a number of stations; and to achieve diversity in broadcast offerings, the government might license some stations to educational and other noncommercial institutions.[51] Because of the scarcity of the resource, the effort to include some of these broadcast offerings may lead to the exclusion of others (in terms of reducing the volume of certain types of offerings at certain locations). But neither the motivation nor the effect would resemble censorship in the classical sense.[52]

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50. Meckling, *supra* note 1.

51. *See* Sixth Report and Order, 17 Fed. Reg. 3905 (1952).

52. A sizable literature has developed on the question of government control of program content. *E.g.*, COONS, FREEDOM AND RESPONSIBILITY IN BROADCASTING (1961); N. MINNOW, EQUAL TIME: THE PRIVATE BROADCASTER AND THE PUBLIC INTEREST (1964); E. SMEAD, FREEDOM OF SPEECH BY RADIO AND TELEVISION (1959); *The Attainment of Balanced Program Service in Television*, 52 VA. L. REV. 633 (1966); Kalven, *Broadcasting, Public Policy and the First Amendment*, 10 J. LAW & ECON. 15 (1967); Loevinger, *The Issues in Program Regulation*, 20 FED. COM. B.J. 3 (1966); Pierson, *The Need for Modification of Section 326*, 18 FED. COM. B.J. 15 (1963); Robinson, *The FCC and the First Amendment: Observations on 40 Years of Radio and*

There are at least two issues: (1) What forms of government intervention are appropriate in the case of television and other electronic mass media? (2) To what extent are the appropriate forms of government intervention dependent upon administrative allocation of the spectrum (in contrast to a market system)?

H. *International Constraints*

It was recognized by all participants, proponents of a market system as well as critics of the idea, that any new system of spectrum ownership would have to be consistent with international agreements. It was not clear from the discussion, however, just how significant this constraint might be. Thus, one participant noted:

> Rights are conferred to countries in terms of protection from harmful interference and on the basis of present and prior registration for quite specific transmitting and receiving uses, combinations, within the table of allocations. . . .
>
> Now at one time the international concept of the spectrum had its greatest significance below 30 Megahertz or near borders. But the fact of satellites makes the entire spectrum technologically international. The only protection for national uses derives from international agreement and regulations. . . .

Another participant observed that "there are real property rights that have been developed through the registration of frequencies [particularly in the high-frequency band] with the International Telecommunication Union, and these rest outside this country. So if you were going to change any property rights relating to high frequency use, you would run into problems there."

But there was dissent from the idea that the radio spectrum was wholly international:

> . . . [R]adiocommunication transmitted and received wholly within this country's territorial boundaries, and posing no interferences to any other nation's communications, occupies spectrum that for all practical purposes "belongs" to us under present international arrangements. But we are also free to use frequencies beyond our boundaries (or within them) when potential conflicts with foreign countries are in fact precluded (or resolved) through priorities recorded in the IFRB's Master Frequency Register in Geneva. Such international recognition of priority rights . . . can indeed be construed as having

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Television Regulation, 52 MINN. L. REV. 67 (1967); Note, *Regulation of Program Content by the FCC,* 77 HARV. L. REV. 701 (1964). The pertinent official pronouncements are collected in W. JONES, *supra note* 19, at 1175-1232.

> established a kind of national property right system in spectrum even where national discretion is *not* unlimited initially because emissions are liable to cross national boundaries.[53]

However, after recognizing that there are these broad areas where national policy can be implemented free of international interference problems, the same commentator noted two other constraints of an international character: "(i) the economic and security advantages of internationally-standardized equipment; and (ii) the mutual advantages to all nations in using the same frequencies to do the same things domestically, not withstanding the technical interchangeability of spectrum among alternative uses."

> Many nations stand to benefit from almost any international standardization of communications equipment. The equipment producing nations may better enjoy greater economies of large-scale production. The non-producing buyer-nation benefits from the greater number of supplier options he can choose among and the greater likelihood of competitive pricing where hardware is standardized internationally. . . .
>
> Another factor which operates to limit national discretion in all frequency utilization is the so-called rule of "common use of common frequencies." This practice has emerged historically for administrative convenience in the accommodation of new services. . . .
>
> In the case of space communication, e.g., the question was whether to place it in a band then occupied by our radar (and by the Soviet Union's terrestrial microwave), or vice versa (their radar and our microwave). Both nations had placed these two *domestic* services in different bands during the wartime hiatus in the rule of common usage, between the ITU Conferences of 1938 and 1947. Furthermore, space communication could be kept compatible with domestic microwave at a small cost, but not easily with radar. Hence, depending on where space communication was lodged substantial displacement or conversion costs would have been placed on the U.S. or the USSR. . . .
>
> The rule of common usage would clearly have precluded any such eventuality and acted to distribute the displacement or conversion costs more equitably on the several parties involved, and without having to determine first whose incompatible usage had priority over whose. . . .[54]

It is important to distinguish between international constraints based upon the prospect of interference and those that are related to the considerations last mentioned. The former constraints leave ample room for transfers of spectrum rights, since most domestic uses of the radio spectrum do not produce interference beyond our borders. The latter considerations,

53. Levin, *The Radio Spectrum: Economic-Physical Character and Regulatory Framework,* to be printed in the Oct. 1968 issue of the JOURNAL OF LAW & ECONOMICS.
54. *Id.*

by contrast, are more pervasive in their impact. If accepted as controlling, they would preclude the major advantage of the proposed market system in spectrum rights—the unhampered transferability of spectrum from one use to another.[55]

I. *Political Opposition*

A principal proponent of the creation of a market in spectrum rights concluded that the "real barrier to progress is the problem of provoking political action," and that "it seems highly unlikely that the political support necessary for such a reform will be forthcoming in the near future."[56] A government official, skeptical of the virtues of a market system, observed:

> As far as I can tell, probably a majority of the people in this country who are unhappy with the absence of [a] market in the allocation of spectrum are in this room. I think the public is very happy thus far with the way spectrum has been allocated. They have a lot of free television, and they would like some more of it.
>
> [Land mobile interests are not] happy with the allocation, but [they have not] suggested that the way to help them was to create property rights and start auctioning them off. . . .
>
> If you are proposing that the market is to be made applicable, I submit to you first you are going to have to get a change in the law. And I also submit to you that you won't get the change in the law . . . [U]nless things really get desparate, you are never going to get Congressional action to make [a] market apply to this reallocation process.

The reality of political opposition to a market system appeared to be generally conceded. It was unclear, however, to what extent this opposition is simply a rational conclusion from the factors previously noted, and to what extent it is an irrational adherence to the status quo, aided and abetted by those with vested interests in present frequency arrangements.

IV. Other Proposals for Reform of the Frequency Management System

In addition to the proposal that a market system be instituted for distributing spectrum rights, other more modest suggestions were made concerning possible revisions in arrangements governing frequency allocations. Some of these are more radical than others.

A. *Market Simulation by Regulatory Agencies Through Use of Shadow Pricing*

One proposal proceeded on the assumption that there would be no change in the governmental structure for allocating frequencies, and in-

55. *See also* authorities cited note 20 *supra.*

56. Meckling, *Management of the Frequency Spectrum,* 1968 Wash. U.L.Q. 26.

quired whether the decisions of the regulatory agencies could be made to conform more closely to the kinds of allocations that would be made by a competitive market.

> Optimal allocation of spectral rights would theoretically be reached through trial and error when no further reallocation among competing claimants would increase the aggregate net value output from spectral inputs among others. If user A generates less output per dollar's worth of spectral input than alternative user B could derive were he granted the radiation rights, then it would pay A to sell and B to buy the input in question. The upshot would be greater production for B and, by substituting some lower-cost input for the frequency he sells (or more of some input of comparable cost), A would also produce more in the event of a reallocation of spectrum from A to B.[57]

In the absence of a market in which transfers from A to B can take place, a regulatory agency could seek to determine the value of spectrum rights to various claimants and award the rights to the claimant able to establish the highest value.

Thus, the value of spectrum to a terrestrial communications common carrier could be estimated by comparing the cost of microwave links (employing such spectrum) with the higher cost of substitute cable connections (not employing any spectrum); the difference would indicate the maximum value of spectrum to the carrier. The value of spectrum to a satellite communications carrier could be estimated by comparing the cost of a low power, wide bandwidth mode of transmission (employing large amounts of spectrum) with the increased cost of a high power, narrow bandwidth means accomplishing the same transmission (using smaller amounts of spectrum); the difference in costs would indicate the maximum value of the incremental spectrum to the satellite carrier.

> These imputed values of spectrum can be said to set maxima on conjectural price bids. . . . In that sense they are related to but obviously not identical with the shadow prices which would result if the spectrum were bought and sold in a competitive market. . . .
>
> The cost savings enjoyed by both microwave and satellites, over their next-best . . . alternatives, can be viewed as a first approximation of the value of spectrum to either user. Hence it is broadly indicative of what each user would in fact be willing to pay for spectrum in a competitive market. . . . These two conjectural price-bids . . . can help us infer the party for whom the spectrum has greater economic value absolutely, and at the margin.[58]

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57. Levin, *supra* note 53.

58. *Id.*

Similarly, the value of spectrum to land mobile users could be estimated by calculating the capital and labor costs incurred in doing the same job with and without mobile radio. Thus, if three trucks and drivers equipped with radio can do the work of four not equipped with radio, the maximum value of spectrum to land mobile users is the saving in costs represented by the extra truck and driver (less the costs of the radio equipment itself). And the value of spectrum to broadcasters could be estimated by comparing the costs of delivering programs to homes via cables as compared to the costs of conventional over-the-air transmission. However, before making any reallocation from one service to another on the basis of such findings, it would be necessary to determine the value of the spectrum at the margin, rather than its total value for each service. The land mobile interests have pressed for an approach analogous to market simulation, urging that the contributions of various spectrum uses to Gross National Product be considered in making allocations.

In addition to assisting in the efficient allocation of the scarce spectrum resource, market simulation also might prove valuable in furnishing data affecting decisions on R & D expenditures devoted to development of the spectrum.

Regulatory simulation of market transactions differs from the market system previously proposed in several important respects. First, since the simulation proposal functions within the framework of existing regulatory institutions, it could be implemented without new legislation. If the principal obstacle is irrational opposition on the part of Congress and the general public, this might be an important consideration.

Second, the regulatory agency need not be controlled in its ultimate decision by the market simulation data showing the value of the spectrum for different uses. If some important social consideration presented a compelling case (*e.g.*, the advancement of education through the reservation of channels for educational television) the agency could prefer the claimant showing lower economic value but greater social importance. In this case, however, the agency making the choice would have an awareness of, and presumably could be called upon to justify, the economic sacrifices implicit in its decision.

> To recognize these economic consequences is not necessarily to deny that they may be worth incurring. But to ignore them is to perpetuate a subterfuge in deciding without full knowledge and divulgence of all the facts.[59]

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59. *Id.*

Moreover, the allocation of spectrum to one user on social grounds (*e.g.*, the broadcaster or common carrier), despite the ability of another to make better economic use of the resource (*eg.*, land mobile), suggests that some attention be directed to whether the social purposes are in fact achieved.

Third, market simulation does not require any payments by users. While there were suggestions that such a system might usefully be coupled with user charges or rents for spectrum rights, the presence of payments is not intrinsic to the system. This might be of importance in the case of users like local governments, which might be able to show great value in both an economic and social sense but find it difficult to raise funds.[60]

A question was raised as to how far this approach departs from present regulatory practice. A former government official observed that the FCC "does ask for and receive testimony about the economic and social value of a proposed decision," and "that the Commission does have a conception of alternative use, although it may be very rudimentary, and it suffers from imperfect knowledge and imperfect techniques." Probably most of the participants considered that the Commission's decisional processes were far removed from market simulation.

In attempting to illustrate how the market simulation approach might work in the context of overriding public values, a proponent of the approach turned to the FCC decision reserving extensive frequencies for educational television (in a spectum area now coveted by land mobile users):

> [T]he political decision that came out on the ETV reservation . . . would have been [more] intellectually satisfying . . . if I felt that opportunity costs had been taken into account in some specific way.

A former official commented:

> [W]hen the original decision [on the ETV reservation] was made, the alternative was not mobile at all. . . . Nobody came for mobile for those frequencies. . . . The alternative was between educational and more commercial [television] applications. And that was the only argument that was raised.

A representative of the land mobile interests objected to the "stockpiling" of the ETV frequencies:

> [T]he tendency is to allow for [ETV's] possible growth in the future and to allocate or allot or stockpile substantial amounts of spectrum. [The spectrum requirements of ETV are uncertain.] I am not against educational television per se. I am only against the stockpiling of large amounts of frequencies in anticipation of something happening which may well never occur. And, therefore, because of

60. *See also* Levin, *New Technology and the Old Regulation in Radio Spectrum Management,* 56 AM. ECON. REV. 339 (1966).

> the inflexibility of the reallocation of that spectrum, it ends up being unused for long periods of time. Therein lies the crux of the problem . . . —the inflexibility of changing the allocation.

Thus the criticisms of the FCC's processes are actually twofold: (a) failure to give adequate weight to market conditions in making the initial allocation; and (b) failure to reallocate in light of changed market conditions.

There were, however, two major objections to the market simulation approach. First, an objection was raised by a number of economists: that "shadow prices" or estimates of "market value" are very hard to compute.

> If the FCC is to assign frequencies in accord with potential price, it must know how much prospective users would be willing to bid for rights. In practice, it is virtually impossible to elicit that information without actually forcing the competing claimants to incur the relevant costs. Otherwise, it takes little imagination to visualize the exaggerated nature of the claims that would be made by competitors for rights to use the frequencies, and of the painful task the judges would have in deciding whose claim was valid.[61]
>
> . . . [I]n looking at the value of the spectrum, economists can work from now till doomsday looking at shadow prices and imputed value of spectrum, and at best they will only get a very crude indication of the value of spectrum. . . . [W]hatever decisions are made are going to have to involve a large arbitrary content, although research will help to reduce that and to make a wise course of action a little clearer. But at best we aren't going to have [a] nice balancing of marginal benefits and marginal costs as economists would like to see in theory.

It was emphasized, however, by an advocate of shadow prices, that the pertinent question is: "Can I capitalize on hardware costs in a sufficiently sophisticated way to get an insight not by what the man tells me but in terms of what I see past closed transactions are with regard to what a chunk of spectrum is worth to a man—as inferred from what he in fact would have to do in terms of hardware input if he didn't have it, or, in fact, the adjustment he could make if he did have more?"

The second objection to the market simulation approach was concerned with the impact on existing spectrum rights.

> [I]ndividuals and businesses have been given rights to use spectrum—rights which are valuable, and which they would not forgo lightly. . . . Effective use of the market value criterion would, I suspect, imply wholesale changes in the frequency allocation tables. Is it reasonable to suppose that any frequency authority would take entire frequency allocations or significant portions thereof away from one service and give them to another?[62]

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61. Meckling, *supra* note 36.
62. *Id.*

Both a market system and a market simulation approach are designed to improve the allocation of frequencies. But the market system begins by confirming the rights of existing users and making them transferable. The status quo is disturbed only to the extent that existing users voluntarily transfer their rights in exchange for considerations deemed to be satisfactory by each of them. In the market simulation approach, the status quo is altered directly by government reallocations, which may rest on market value criteria but involve no compensation to the user who is excluded or displaced.

B. *User Charges*

While the idea generally was not advanced independently of other proposals, there were comments on the desirability of imposing user charges or rents on persons making use of the radio spectrum. The charges might be fixed in relation to the spectrum value found under the market simulation approach just discussed; or they might be determined by some form of competitive bidding among competing users. In either event, the user charge was thought to have four advantages:

(1) The payment would remove any element of "subsidy" inhering in the present system of granting spectrum rights without charge. Spectrum users would have to compensate the public, by payments into the treasury, for their use of the public's property.

(2) User charges also would provide an incentive to economize on use of the radio spectrum, an incentive now lacking in many circumstances. If the charges were sufficiently substantial, licensees would be induced to seek modes of operation involving no spectrum, or less spectrum than the amount presently employed; in the absence of a rental fee (or some other kind of pressure), there is no reason for a licensee to seek substitute techniques, or to incur expenses, in order to reduce its use of spectrum space.

(3) A system of user charges might make it easier to transfer spectrum from one use to another. At the present time, the regulatory agencies are extremely reluctant to require a user to give up spectrum space; and, recognizing their own reticence in this regard, they are reluctant to permit new uses of the spectrum in a spectral region if it is likely that more important demands will be made in the foreseeable future. If, however, a system of user charges were employed—one under which charges could be adjusted in relation to the demand for the particular portion of the spectrum—users could be authorized at low rentals when there was no great demand for the space and then displaced, by force of higher user charges, as and when other demands made the space more valuable for other uses.

(4) User charges might provide a means for relieving congestion in

those areas, as land mobile, where licenses have been freely granted on a nonexclusive basis. While the charges would not, in themselves, make more spectrum space available, they could function to ration the existing space by forcing out the users least willing to pay. Those that remained would then be in a position to realize the potential of the spectrum resource unhampered by the deterioration accompanying its treatment as a free good, *i.e.*, at present, "[i]ndividual users will not take into account the interference (congestion) costs which they impose on others when they use the spectrum."

Since most of the remarks about user charges were made in connection with the next proposal, they will be considered in that context. Suffice it to say that the principal objection to this suggestion relates to its impact on the status quo. Licensees who now pay nothing for spectrum rights would be compelled to pay rental fees; those not in a position to make the payments would be displaced by those who were prepared to do so. Thus, like the market simulation approach and unlike the full-fledged market system, existing licensees would be adversely affected by the change.

C. *Competitive Bidding Within Zones*

Building upon the two previous suggestions, a proposal was made late in the proceedings that spectrum rights, zoned as to use, be auctioned off at competitive bidding. It was observed, preliminarily, that some spectrum rights, such as those of the broadcasters, are exclusive—only one broadcaster is authorized to transmit on a particular channel in a particular city; in the event of competing applications, the licensee is selected by a comparative proceeding. Other spectrum rights, such as those of land mobile operators, are nonexclusive; those meeting the eligibility requirements are permitted to enter without limit no matter how badly the party-line congestion degrades the quality of service. The proposal was:

> First, that all of the non-exclusive rights be subjected to limitations at the point of saturation. Decide how many land mobiles you are going to allow in at any given service and stop . . .
>
> [Second,] you have . . . a problem of rationing. You have . . . more land mobile operators than there are channels. You have more broadcast applicants than there are broadcast spots. You have to ration the spots. . . . It seems to me that the sensible way to ration these spots is to auction them off. Sell them to the highest bidder.
>
> Now, this will do several things. [First,] it will get rid of the party-line congestion in land mobile and . . . the comparative proceeding in broadcasting. And I can't think of two things that it would be better to get rid of in FCC administration of the spectrum.

> The second thing that will happen is [that] you will have bidders for these scarce frequencies. And this ought to tell you something about the relative values [of the uses to which these frequencies are being put]. Now, it is true [that] a land mobile operator can't come in and bid for channel 2 in the VHF band, but he can bid against other land mobile operators for the scarce land mobile [slots. This] will give you some idea of the relative value of these uses of the spectrum in an economic sense and facilitate the transfer of spectrum from [uses] where the bids [are low] to [uses] where the bids are very high. . . .
>
> Now, this does two things. First, of all, it permits you to move services as a group and eliminate some of the technical problems that exist if one land mobile operator gets one frequency in one isolated part of the country and starts doing all sorts of weird things with all the other services in that area. You can move in a sort of zoned way a whole group of frequencies into the areas of short supply.
>
> Secondly, it permits you to introduce into the process those non-economic considerations which some people think are important. That is, [the agency is] not a slave to the bidding system. [It] may say, "Well, yes, it is true that land mobile is willing to pay more for these frequencies than UHF broadcasting, but we think UHF broadcasting is more important."
>
> But I would urge that the mere statement of that conclusion is not enough, that the reasons [the agency thinks] UHF broadcasting should have [these] frequencies, despite the fact that other people by bidding for land mobile slots have shown that there is a great shortage elsewhere, have to be articulated more fully than they have been articulated. . . .

It was noted that the zones would not have to be fixed any more firmly than technical considerations required, and that variances could be permitted where technical obstacles were not a problem.

There were a number of objections to the proposal, some of them reminiscent of comments made in connection with other proposals.

First, it was observed that this proposal, in its initial bidding phase, would not make more frequencies available for the congested land mobile services, but would exclude some operators from the spectrum and require the remainder to pay a fee for what formerly they had received without charge. As previously noted, there was concern that all the frequencies would go to the largest and richest bidders, and that police and public safety users would be disadvantaged. There also was concern that land mobile users would be forced to bid for spectrum space which, in the short run at least, could not be expanded:

> . . . [T]he idea of people bidding against each other when they are faced with . . . a perfectly inelastic supply curve . . . has a parallel, at least in the short run, to price ceilings, price control and rationing

during wartime, when there is a certain supply on the market and we choose not to allocate according to people's ability and willingness to pay. We do make judgments about people who ought to have a share regardless of their ability to pay, or in this case police and public safety users whose value to the community is not reflected very well in their ability to pay.

[By contrast,] police cars can be built, . . . and there is a cost of production. The supply curve for police cars is fairly horizontal, and the police at least are assured that what they are paying sort of reflects the cost of production. . . .

Second, the prospect of abolishing the comparative proceeding met with considerable approval. A frequent participant in such cases described the comparative hearing as "an absolute masterpiece in chaos and frustration . . . where there essentially are no standards for selecting between equally qualified [applicants]. So you resolve it in a long hearing in the hopes they will all buy each other out or faint of exhaustion." However, another participant felt that in some comparative cases "you can make a rational judgment" and select a winner who would not necessarily have prevailed if competitive bidding were employed. He also asked whether licenses would be subject to renewal at three-year intervals so that "every broadcaster operates subject to the fact if [he is outbid] at the end of that three years . . . he can be displaced?"[63]

Finally, on the zoning aspect, an analogy was made to the zoning of land.

[I]n land use if you want to bid on a factory site you have to bid in the area that is zoned for factories. You can't bid on land in a residential section and build a factory. . . . And the relative prices in the two areas then suggest the need for the planning board to reallocate land perhaps from one use to another.

Some, however, found the analogy to land zoning unappealing because informed "people—those who don't know communications problems—think that land zoning . . . is the world's greatest abomination of governmental activity," peculiarly susceptible to "the leverage of people with money . . . who know how to use . . . courts and lawyers." Thus, like land zoning, the proposed system "could be conceived to work decently" and yet not work out in practice.

D. *Other Proposals*

There were a number of other proposals more limited in scope.

One suggestion was that an unused portion of the spectrum be set aside for experimentation in the development of transferable spectrum rights:

63 On the comparative proceeding, see authorities cited *supra* note 19.

> . . . Why don't we take a portion of the spectrum which is at present not used by anyone, . . . and that if used in any way by the market would not create any problem internationally, . . . and attempt to define the rights and distribute them in some way. . . . Why don't we try this and see what the costs of policing are, see what the costs of transactions are . . . ?

The proposal attracted both favorable and unfavorable comments. One of the critics said:

> I . . . wonder how much you would really learn from [experimenting with some unused portion of the spectrum.] What portions of the band are unused, and why are they not used? . . . [O]ne of the answers is because they are not very useful to anybody. And if you simply said, 'Well, let's take the 20 Gigahertz band and throw it open,' the question is: . . . who would actually use it? Would we really get much information about the kind of problems that mobile users would face in a market system in the portions of the band which are not only used but very heavily used? That's where we really need the information, and that's where the experiment should be conducted.

A second suggestion concerned the FCC's method of allocating spectrum space in blocks, so that the same frequencies are used for the same purposes in all parts of the country. This means that "in Nebraska or Utah, for example, you can't use the bands which are allocated for marine use, . . . [o]r you can't use the Forestry Service band in New York City. . . . [O]ne doesn't have to have a very sophisticated notion of marginal cost and marginal benefit to know that somehow using those bands in Utah and Nebraska would be somehow contributing to the social welfare."

Several FCC officials indicated that the problem was under consideration at the Commission, and noted: (a) there is no shortage of bands in Utah and Nebraska, (b) the forestry bands in New York used by officials who run the public parks, and (c) 40 of the forestry frequencies in New York were given to the New York City police. There was a general feeling that greater flexibility in the block allocation of frequencies would be desirable.

A third suggestion was that the FCC define spectrum rights in terms of outputs (energy levels along geographic contours) rather than inputs (size and shape of antenna, power level at the transmitter). The present system of controlling inputs was said to have two disadvantages: "first, it makes it difficult for the user to make input substitutions, *e.g.,* of transmitter power for antenna size; secondly, it results in different levels of interference as a function of time of day, day of the year, sun spot cycle, etc." To overcome these disadvantages "it would be desirable to specify energy levels that [licensees] would be able to impose at various geographic points." The "rights would have to be defined in probabilistic terms, *e.g.,* power levels

cannot exceed a specified amount more than one percent of the time at specific geographic points." "From an interference standpoint there is no reason why we should be concerned about how these energy levels are created."[64]

This proposal was not discussed. However, as previously noted, it probably would be necessary to redefine spectrum rights in terms of outputs if a system permitting transfers among different users were to be instituted.

V. Technological Developments Affecting Use of the Spectrum

A number of proposals and projections at the conference concerned the use of the radio spectrum to provide specific services. Of particular significance are: use of cables to transmit television programs to the home, and developments pertaining to communications satellites.

A. *Wire Television*

Most members of the television audience receive their programming from over-the-air transmissions of stations in their immediate vicinity. There are, however, some two million homes which rely on community antenna television (CATV) systems as the sole, or a supplementary, source of television programming. CATV systems pick up signals at points remote from the community they serve, transmit them via microwave relay (or cable) to the particular community, and deliver them by wire to the homes of subscribers; these systems also may deliver local signals, either as a matter of convenience or as a means of providing improved reception for their subscribers. By and large, CATV systems do not originate programming; they perform a distributive function for those prepared to pay for it. Their phenomenal growth in recent years has raised questions as to the prospect for distributing all television signals by wire.[65]

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64. Meckling, *supra* note 56.

65. On CATV developments, see M. Seiden, An Economic Analysis of Community Antenna TV Systems and the TV Broadcasting Industry (1965); Cole, *Community Antenna Television, The Broadcaster Establishment, and the Federal Regulator*, 14 Am. U.L. Rev. 124 (1965); Fisher, *Community Antenna Television Systems and the Regulation of Television Broadcasting*, 56 Am. Econ. Rev. 320 (1965); Fisher & Ferral, *Community Antenna Systems and Local Television Station Audience*, 80 Q.J. Econ. 227 (1966); Greenberg, *Wire Television and the FCC's Second Report and Order on CATV Systems*, 10 J. Law & Econ. 181 (1967); Huntley & Phillips, *Community Antenna Television: A Regulatory Dilemma*, 18 Ala. L. Rev. 64 (1965) & 18 Ala. L. Rev. 296 (1966); Nester, *Is CATV Infringing Proprietary Rights in Television Broadcasts?*, 15 Copyright Law Symposium 153 (1967); Note, *CATV and Copyright Liability*, 80 Harv. L. Rev. 1514 (1967); Note, *The Wire Mire: The FCC and*

At the conference, several economists proposed that the present mode of transmitting television programs via the airwaves be replaced by a system of wire transmission.[66] Their thesis was that contemporary television is severely hampered by the limited number of channels in most markets (averaging about three per city); that under the present system, spectrum scarcity would preclude any substantial increase in the number of channels (the maximum would average less than five per city); and that even this increase would be impeded by the high fixed costs of over-the-air transmission. With so few channels, broadcasters tend to concentrate on mass appeal programming to the detriment of diversity; and there is difficulty in obtaining access for pay television, educational television and political programs. Under the wire system proposed each community would have 20 channels available, and the number of channels could be expanded still further if warranted by demand.

With a wire system, it would be possible to eliminate television transmitters and towers, home antennae, and the portion of the television receiver required for amplifying weak over-the-air transmissions. However, a grid of 20-channel coaxial cable, linking all television sets to the station, would have to be added. It was estimated that the capital costs of the segments eliminated would more than offset the wiring costs. It also was estimated that, with substantially complete coverage in a city, the cost of wired television would run in the neighborhood of $1.00 to $1.50 per home per month (current CATV charges for more costly operations are about $5.00 per month). With the elimination of expensive transmitting equipment, transmission costs would be greatly reduced—so much so that broadcast time could sell for $5 to $10 per hour. And with these reduced costs, it was anticipated that the volume and diversity of programming would greatly increase.

While the major purpose of the proposal was not to conserve spectrum, it is clear that considerable spectrum would be released for other purposes if the proposal were put into effect. And the spectrum space involved is in a particularly congested frequency range, adjacent to the land mobile frequencies among others. A system of wire television also would improve picture quality; would remove the need for government supervision of programming (with the threat of censorship this implies); and would pro-

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CATV, 79 HARV. L. REV. 366 (1965); Note, *Federal, State, and Local Regulations of CATV—After You, Alphonse . . .*, 29 U. PITT. L. REV. 109 (1967).

A number of important CATV cases are currently pending before the United States Supreme Court.

66. Barnett & Greenberg, *A Proposal for Wired City Television*, 1968 WASH. U.L.Q. 1.

vide extra capacity for other electronic services to the home such as data processing, facsimile reproduction, and electronic shopping and credit services.[67]

Some doubts were expressed about the political feasibility of the proposal. In particular, there was the problem of service to rural areas and the need to collect monthly charges from members of the public now receiving television programs without charge.

> . . . [W]hen you come along and suggest . . . getting service to most people, if not to the rural people, with a wire system, before you are halfway through explaining to the public . . . that as a condition to [getting 20 channels of service] you are going to have to take away the frequencies of the fellow who now gives it to them free, he closes his mind at that point. . . .
>
> Now, you can sell CATV, which is a variant of this, because that still leaves the free choice. That is, [the viewer] can either subscribe or he doesn't have to subscribe. But [under the proposed wire system] he has to subscribe. . . . There is going to be nothing to get off the air.

Another participant observed that the critical question is the extent of viewer choice to be afforded:

> . . . I see the basic drive in TV is to provide more choices in the home. . . . Once you cross this point from 7 to 10 channels, quit thinking radio. The economics just by themselves flip right over to wire. If you are going to have ten [channels] in every home now, you can pay for the wire system. . . .

This speaker also pointed out that, even with a wire system, some spectrum would still be required for broadcasting to rural audiences.

In judging the merits of the wire system, it would be illuminating to know what the cost of television reception would be if the radio spectrum were rented for the purpose at its true economic value rather than provided free of charge by the government. Is this a case where technological progress is blocked by a government subsidy to the existing mode of program distribution?

B. *Satellite Communications*

At present, Comsat is operating as middle man for the conventional communications carriers in transmitting message traffic between the United States and other nations of the world.[68] To perform this function, a number

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67. *See also* Johnson, *New Technology: Its Effect on Use and Management of the Radio Spectrum*, 1967 WASH. U.L.Q. 521; Pierce, *supra* note 28.

68. On the organization and status of Comsat, see Boskey, *Monopoly and Antitrust Aspects of Satellite Operations*, 58 Nw. U.L. REV. 266 (1963); Kirkpatrick, *Antitrust in Orbit*, 33 GEO. WASH. L. REV. 89 (1964); Levin, *Organization and Control of*

of earth stations are required in the United States—about six in all—and Comsat shares frequency bands at 4 and 6 GHz with terrestrial microwave systems. While this frequency sharing has created some potential for interference, the arrangement is generally considered to be workable. There are, however, proposals pending to extend satellite communcations to domestic traffic, including the networking of television programming, and this would greatly increase the number of earth stations required, the volume of satellite traffic, and the potential interference. These proposals pose a question of availability of spectrum space.[69]

Comsat and some other proponents of a domestic satellite system believe that such a system could be instituted at 4 and 6 GHz without creating undue interference between satellite and terrestrial services. The Bell System contends that the interference problem is so acute that the domestic service should not be instituted at 4 and 6 GHz at any substantial level, but should be transferred to frequencies above 10 GHz which are presently undeveloped. From a scientific point of view, the prospects for using the higher frequencies are encouraging, but additional expense will be required, both for the research and development needed and for the additional operating equipment required to cope with the physical characteristics of the higher frequencies.

One of the difficulties presented by the existing system of spectrum management is the lack of guidance it affords as to whether emphasis should be placed on achieving compatibility at 4 and 6 GHz or on developing frequencies above 10 GHz. In the former instance, cooperation between Comsat and the Bell System would be required; but minimization of the costs of achieving compatibility is impeded by FCC policies imposing the burden on newcomers not to interfere with existing users. One observer commented:

> Quite conceivably, the added cost to either satellite users or to terrestrial microwave users of reducing interference to a tolerably low level [at 4 and 6 GHz] would be less than the social value gained by

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Communications Satellites, 113 U. PA. L. REV. 315 (1965); Mansbach, *The "Authorized Entity"—"Authorized User" Question in the Communications Satellite Act of 1962,* 20 FED. COM. B.J. 117 (1966); Rosenblum, *Regulation in Orbit: Administrative Aspects of the Communications Satellite Act of 1962,* 58 NW. U.L. REV. 216 (1963); Schwartz, *Governmentally Appointed Directors in a Private Corporation—The Communications Satellite Act of 1962,* 79 HARV. L. REV. 350 (1965); Schwartz, *Comsat, The Carriers, and the Earth Stations: Some Problems with "Melding Variegated Interests,"* 76 YALE L.J. 441 (1967); Note, *Communications Satellite Act of 1962,* 76 HARV. L. REV. 388 (1962). *See also* the PRESIDENT'S RECOMMENDATIONS RELATIVE TO WORLD COMMUNICATIONS, *supra* note 28.

69. See authorities cited note 28 *supra.*

> conserving the spectrum through greater shared use. In such cases, society would benefit, on balance, by permitting the expanded shared use in combination with some means by which the cost of protection from interference would be appropriately borne. Unfortunately, current practice in spectrum management simply avoids this issue. In general, users of *existing* facilities are accorded assurance that new or proposed interfering facilities will not be permitted; little if any attention is directed to the possibilities of trade-offs between cost and interference protection. . . .
>
> Questions . . . arise regarding the appropriate level and timing of research and development to exploit the higher regions of the spectrum. Among the reasons why no satisfactory answer can be given is simply the fact that existing arrangements for managing the spectrum provide little clue about the social cost of employing the lower frequency bands more intensively as an alternative to expanding into higher regions.[70]

In discussing this problem, it was pointed out that incumbent users, such as the Bell System, tend to be pessimistic about the prospect of achieving compatibility and minimizing interference, while newcomers, such as Comsat, tend to be optimistic about accomplishing these objectives. It also was noted that the projected demands for satellite communications are so large that there is no possibility of accommodating the traffic in the 4 and 6 GHz bands; thus the need to exploit the higher frequencies is unavoidable, and the only question is the level and timing of the research and development program. Finally, government officials indicated that, for a large number of earth stations, the uncertainties surrounding terrestrial-satellite interference at 4 and 6 GHz are so troublesome that extensive technical experimentation is required to determine the scope of the anticipated interference.

Many of the problems relating to a domestic satellite system involve questions as to the ownership and organization of the communications satellites. Difficult problems are presented, for example, in deciding whether one or several domestic systems should be authorized: the number of orbital slots available at the equator for synchronous satellites are limited; there are economies of scale in constructing and operating satellites and earth stations of different sizes; multiple systems would make demands upon the spectrum different from the demands of a single system; and important issues of competition and monopoly are implicit in such a choice.[71] In addition, a domestic system would use international space—including orbital positions above other nations—presenting issues for international negotiations.[72]

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70. Johnson, *supra* note 67.

71 See authorities cited note 28 *supra.*

72. On the international framework of satellite operations, see Doyle, *Communication Satellites, International Organization for Development and Control,* 55 CALIF. L.

Another important possibility is the prospect that communications satellites may be employed to broadcast television programs directly to the home. The proposals previously discussed all envisage Comsat or some other owner-manager of the satellite as a middleman in the networking process, *i.e.*, distributing programs from production centers to local stations, which the latter would then broadcast to local audiences. Direct satellite broadcasting is seen as a more remote development, and one that will present serious problems pertaining to spectrum use, cost of transmitting and receiving equipment, and impact on the local broadcaster.[73]

C. *Other Developments*

Other technological developments bearing upon use of the spectrum may be briefly summarized:[74]

(1) Facsimile transmission. Use of the television bands, on a shared basis, for the transmission of printed copy into the home, raises the possibility that newspapers and mail may be transmitted electronically. Experimental operations are in progress.

(2) Spread spectrum techniques. By pooling a number of frequencies, and transmitting messages that hop rapidly from one frequency to another in accordance with predetermined time patterns, the capacity of the spectrum for some types of land mobile services may be increased substantially.

REV. 431 (1967); Doyle, *International Satellite Communications and the Law,* 11 MCGILL L. REV. 137 (1965); Estep, *International Lawmakers in a Technological World: Space Communications and Nuclear Energy,* 33 GEO. WASH. L. REV. 162 (1964); Estep, *Some International Aspects of Communications Satellite Systems,* 58 NW. U.L. REV. 237 (1963); Estep & Kearse, *Space Communications and the Law: Adequate International Control After 1963?,* 60 MICH. L. REV. 873 (1962); Glazer, *Infelix ITU—The Need for Space-Age Revisions to the International Telecommunication Convention,* 23 FED. B.J. 1 (1963); Kraus, *Legal Aspects of Space Age Communications and Space Surveillance,* 29 J. AIR LAW & COMM. 230 (1963); Moulton, *Some Legal Aspects of International Communications,* 41 N.C.L. REV. 354 (1963); Sarnoff, *Communications and the Law,* 7 ANTITRUST BULL. 677 (1962); Segal, *Communications Satellites—Progress and the Road Ahead,* 17 VAND. L. REV. 677 (1964); Underwood, *Problems of Participation in the Global Commercial Communications Satellite System,* 18 S.C.L. REV. 796 (1966). *See also* PRESIDENT'S RECOMMENDATIONS RELATIVE TO WORLD COMMUNICATIONS, *supra* note 28.

73. The material in this section is developed more fully by Johnson, *supra* note 67. On satellite broadcasting, see also Johnson, *supra* note 28; Hult, *supra* note 28; Pierce, *supra* note 28; DIMLING & COFFEY, THE EVALUATION OF ALTERNATIVES FOR THE PRODUCTION, DISTRIBUTION AND FINANCING OF TELEVISION PROGRAMS (Report 219 prepared for DTM by Spindletop Research 1967); Smythe, *Freedom of Information: Some Analysis and a Proposal for Satellite Broadcasting,* Q. REF. OF ECON. & BUS., Autumn 1966, at 7.

74. The first four items are discussed in Johnson, *supra* note 67.

(3) Waveguides and laser pipes. High frequency emissions can be confined within conduits to achieve point-to-point transmissions without raising problems of intereference with other signals. The systems envisaged, while very costly, have a high capacity and a low cost per unit at high levels of utilization. Their development probably will be associated with increasing demands for point-to-point communications, stimulated by data transmission and new uses of electronic media.

(4) Transistorized cables. Like waveguides and laser pipes, transistorized cables are conduits for electronic transmissions that avoid atmospheric interference. The introduction of such cables in recent years has increased capacity and reduced cost in comparison with previous cable technology.

(5) Video tapes. While video tapes are presently used extensively in television production, there are suggestions that they may prove to be valuable in television distribution as well. Thus the transportation of television tapes by aircraft may provide a suitable alternative to the point-to-point electronic transmission of television programs. (This mode of distributing tapes is now being used by the educational network.) Tapes also may provide a basis for instructional television over closed circuits, reducing reliance on over-the-air transmissions. Finally, single-program video records may be sold to consumers for replay through their television sets in the same manner as audio recordings are played on phonographs. But though this use of tapes may provide a non-spectrum mode of program distribution (to stations, classrooms or consumers), this method may be more costly and less satisfactory than the spectrum alternative in some applications.

(6) Redesign of television assignments. As previously noted, there are several alternatives to the present method of distributing television programs via local broadcasting stations, including wire television and direct satellite broadcasting. The former clearly economizes on spectrum use, and the latter may do so. Still another method of economizing on spectrum used for television is to redesign the present geographical distribution of television stations. This proposal envisages the assignment of more stations to more communities with lower power and closer spacings; alternate vertical and horizontal polarization of signals would facilitate closer spacing. There would be increased interference and smaller service areas; but this would be more than outweighed by the larger number of stations made possible. With such a redesign of television assignments, it was claimed that "the same broadcasting activities . . . could be carried on with smaller spectrum, or, alternatively, more broadcasting services could be accommodated with increased competition."

The objection to this proposal (as to such other alternatives as wire tele-

vision and direct satellite broadcasting) is "the Commission's concern with stations as local entities, which means that a station is licensed to a community and has a basic initial responsibility to serve the community." It was feared that these alternative modes of program distribution would tend to break down the identification of stations with local communities.

> You could have done the same thing, of course, by stratovision, putting a number of airplanes up there, and they would have supplied again national coverage but with very little in the way of . . . local identification and local service.

This point was disputed in the context of particular proposals, but an additional and more general observation also was advanced:

> A great deal that [the FCC does] is premised on the assumptions . . . that the broadcasting station is a part of the local community, that its local programming serves the local community, and that this is a net social good, and presumably that the programming is responsive to needs of the local community, is in response to expressed desires on the part of local citizens. . . . I would say at the very least there is some question as to the viability of those assumptions. . . .
>
> [I]f in fact what we have is national programming distributed out of New York City by means of a network of microwave towers interconnecting local stations that are broadcasting to people within the local community . . . and carrying in large measure national [programs], that service can be provided in many other ways than through this system of networks and local stations.
>
> There are advantages to those other ways. The disadvantages are principally that you don't have the local programming. And that brings us back again to the question of: What is this local programming? What in fact is it doing? How useful is it? How would the community be different if it did not exist?

VI. Concluding Observations

The Airlie House conference provided some interesting insights into the problems of radio spectrum management. Its success on this score was attributable in large measure to the diversity of the participants—economists, engineers, lawyers and administrators from government, industry the universities and research organizations. However, this diversity also presented some problems in communication among the different disciplines, particularly as between the economists and the engineers, the two disciplines having the largest numbers in attendance. At a number of points in the discussion, it became evident that the economists or the engineers had failed to present their views in a manner that was comprehensible to members of the other group. This difficulty in interdisciplinary communication suggested still another problem: the means by which the findings of the spe-

cialists are to be communicated to the general public and their elected representatives. Spectrum management presents complex problems of engineering, economics, public administration and law, and it is not clear how the alternatives can be reduced to terms sufficiently simple for public understanding and political action.

The conference suggested a number of avenues for further exploration:

(1) If changes are to be made in the present method of frequency management, it is essential that this method be fully understood so that any proposed revision may be compared with the status quo. It was suggested that the problems of frequency allocation under existing government procedures might be studied in the context of specific allocation decisions.

(2) Any alternative to present frequency management arrangements must be set forth with sufficient clarity to indicate the extent of departure from present arrangements and the manner in which existing management functions will be performed. Thus, any proposal for a market system in spectrum rights must indicate how the rights will be defined; how their transfer among different uses will be reconciled with international obligations and the advantages of establishing "zones" for disparate uses; and how weight will be given to various social interests which may not find adequate recognition in the market place. Probably such a proposal will require the combined efforts of economists, engineers and lawyers.

(3) To the extent that a revision in frequency management arrangements is premised on poor economic performance under the present system, an effort should be made to determine the extent of economic loss—even if very crude estimates must be employed. Similarly, to the extent that some improvement is envisaged under a proposed revision in management approach, some estimate should be made of the costs of transition, so that these costs may be offset against any benefit to be derived.

(4) Finally, recognizing that revision of the present system is not likely in the short run at least, efforts should be made to live within the present system as intelligently as possible. To this end, much of the information that is gathered under the preceding heading might well be transmitted to the pertinent regulatory authorities for use in the performance of their frequency management functions.