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BROADCAST OPPORTUNITIES WITH SATELLITES AND CATV,
AND THEIR CONTROL IN THE PUBLIC INTEREST

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ABSTRACT

This paper explores the opportunities for providing new TV broadcast services and a variety of social benefits from broadcast using satellites and CATV. The relative costs of the various alternatives are outlined, and new regulatory and operational policies are suggested. The paper is intended to ease international concern about the control of satellite broadcasting in order to gain support for permissive frequency allocations. Also, it attempts to stimulate domestic vested interests by outlining a wealth of novel opportunities available under the suggested new policies.

INTRODUCTION

The possibilities of TV broadcast from satellites are viewed with mixed emotions in various quarters. On the international scene the opportunities to provide educational and entertainment services with the coverage potential of satellites at economically feasible rates are very attractive. However, there is apprehension that these facilities might be exploited for political, commercial, religious, or other propaganda purposes; or that some interests might be denied the opportunity to broadcast. These apprehensions can be allayed by showing how any governmental jurisdiction can exercise a full range of control over all reception within its jurisdiction, and how it has adequate opportunity to broadcast to any area subject only to local jurisdictional control over reception. These capabilities are likely to be required in order to achieve the international consensus necessary to obtain frequency allocations that would permit effective satellite broadcast.

On the domestic scene, the struggle of conventional TV broadcasting to resist the encroachment of CATV, as well as the more general concern about the control of Pay TV and television programming with respect to morality, violence, advertising, etc., present an environment that is not very receptive to the competitive intrusion of satellite television which would have an unknown but potentially ominous impact. Thus if we are to win the domestic acceptance of television broadcast from satellites, it

will be necessary to conceive methods for exercising better control over television in addition to providing large growth potential and the opportunity for the established interests to obtain a satisfactory piece of any new action.

The term "broadcast from satellites" as used in this paper includes a number of services that may be distinguished separately in other conventions. For example, it includes distribution services to terrestrial broadcast stations, broadcast to community receiving antennas for further distribution to homes or for community reception, and direct broadcast to individual homes or vehicles. The evolution of these systems may blur the distinctions so that two or more of these services may be satisfied simultaneously by the same satellite transmissions. Also, the term broadcast will be construed to include a variety of derivative services such as the common public distribution of video, audio, and data information with the provision for identifiable private and individual response.

This paper explores a variety of potentially desirable services and operations involving television from satellites and CATV. It compares their rough relative costs and suggests policies for regulation and operation which should permit the realization of more nearly the full potential public benefit possible from all means of television.

RECEPTION

The reception of broadcast can provide extraordinary opportunities for education, entertainment, government, merchandizing, opinion surveying, fund raising, and a variety of other services not yet adequately explored. Many feel that the potential importance of broadcast for every individual and for society as a whole is so great that no individual should be more limited in his choice of broadcast programs than the available resources will support. Thus the freedom of reception, though not explicit in law, is held highly like the freedom of speech, and likewise it has been construed to require sensitive control to protect it from abuses that might lead to its loss or erosion of value. However, any sovereignty may become concerned about and wish to exercise control over the reception of programs of foreign origin that may contain political, religious, commercial, or other types of propaganda. Even with programs of local origination, the need can develop for control of violence, morality, advertising, and

* Any views expressed in this paper are those of the author. They should not be interpreted as reflecting the views of The Rand Corporation or the official opinion or policy of any of its governmental or private research sponsors.

other factors in programs that may be offensive to the local tastes and times. The ability to control reception easily (as compared with clumsy and expensive brute force techniques of local jamming) within governmental jurisdictions may be influential in securing the acceptance of the concept of broadcast from satellites and in obtaining the international allocation of frequencies that will enable this type of service.

Technology would permit a number of levels of control to be exercised. The reception of a program (or any part of it) could be denied, or it could be taxed at selected rates at one or more levels of governmental jurisdiction without affecting the transmission and reception outside of the specific jurisdiction. For example, it would be feasible to impose controls by responsible individuals at a series of levels including the receiver, school district, state, national, and international levels. Control at the receiver may be desirable to limit the costs to the responsible individual for pay or receiver-taxed programs, as well as to control access to restricted programs, e.g., to deny children access to programs deemed suitable for adults only. Control at the school district level may be desirable to provide a sense of involvement and local determination in choosing educational material and in providing an interpretation of programs offensive to the local tastes and times. The responsibility for control at the school district level could be placed in the hands of locally elected officials, e.g., the school board. The control at the national level by suitable agents might involve policies determined by a variety of agencies such as the Supreme Court to adjudicate conflicts with constitutional rights, e.g., censorship of films, the executive branch to assess a threat to national security or prestige, and the legislative branch to impose tariffs for the protection of domestic industries.

Control at the international level might consist only of a charge for the use of the limited international spectrum and orbit resources. There is no accepted mechanism for accomplishing this yet; however, an attractive method for satellite broadcast might be to assign a small portion of the satellite relay capacity in every broadcast beam to the United Nations for their use or to be sublet at their discretion (see later section on Costs, Revenues, and Assessment Options).

Conventional TV broadcast signal format uses time division with 10 to 20 percent of the time reserved for receiver synchronization and circuit adjustment functions. There should be enough capacity potentially available during this portion of the format to permit control by tens of thousands of independent jurisdictions, each of which could select from a number of levels of control ranging from denial through several rates of taxation for reception. Thus such control might be exercised without adding a significant power, spectrum, or cost burden to the broadcast transmission.

The receiving system must, of course, be designed to respond to the control signals. This might be accomplished with a converter (wideband FM to conventional television modulation) which would be com-

bined with metering and monitoring equipment and would be provided and maintained by the broadcast transmission utility in much the same way as meters are used for electrical power, water, and gas. Control at the home could be exercised with individual personal identification and authorization using suitable credit card-like devices to accomplish this automatically. A meter could be provided at each converter to display the total receiving cost rate (including all taxes and pay programming) and a cumulative total of charges.

The control options at the various levels of jurisdiction could be exercised by preview of taped programs or by review of self-rated programs and acceptance of self-rating based on past performance. Programs without adequate prerating might be controlled conservatively, i.e., taxed at the highest rate that might be considered for the program if it had been adequately reviewed in advance.

Another feature associated with reception that could be very useful is that of monitoring. Live aggregate monitoring would provide an invaluable tool for the assessment of programs. It could give a direct measure of advertising reach and of the value and effectiveness of any program intended to serve the public, and would provide a timely basis for evolving program improvement. Individually identified live monitoring would permit more reliable monitoring and billing of pay or receiver-taxed television. It might be achieved easily at little additional cost if individually identified, private response circuits are provided anyway for educational, administrative, or commercial purposes. The system for monitoring of reception could be designed to be compatible with direct reception at a home, with reception through a CATV system, or with any number of receivers for each antenna/converter and with any number of viewers for each receiver.

Privacy of reception interests may become a concern for the individual or for any level of governmental jurisdiction. In order to avoid exploitation of individual reception interests by commercial, political, religious, or other interests, it would be appropriate to protect the access to the records of individual reception in ways similar to those exercised for telephone toll service, income tax returns, or the census. The protection of aggregate interests from exploitation not in the government's interest could be accomplished by appropriate use of tax assessment or reception denial. For example, if a foreign government wished to determine the aggregate interests of a local population with respect to some issue which was deemed by that local government to be contrary to its own best interests, it could tax or deny the local reception to control the information that the foreign government was attempting to extract.

Private individual response circuits for broadcast may become attractive for a variety of services. For example, the effectiveness of some types of educational broadcast might be greatly enhanced by response circuits of suitable bandwidth. It should be possible to conduct certain tests and progress checks with much narrower bandwidths than a voice channel, including satisfactory identification and authentication. Also, the evolution of the instruc-

tion toward better programs might be fostered and expedited by response circuits, and the opportunity for personal participation may stimulate a more effective learning experience. If individual response circuits of voice bandwidth are needed, it may be more appropriate to supply them through conventional telephone exchanges. Some types of response to demands for attention could be obtained without a return circuit. For example, the viewer might be required to make some kind of switch operation at a certain time or his monitoring control would switch the program off. This type of response might be elicited in order to induce attention to programming that the viewer is being paid to watch, either by credit to his Pay TV and tax account or by following with programming for which he would be willing to pay. He might be paid to give his attention to certain types of instruction, advertising, or other sponsored programs, and of course, this sort of payment exchange is implicitly accomplished with most commercial TV advertising today.

Narrow-bandwidth response circuits may prove particularly useful for obtaining live polling totals on issues being considered by various levels of government or for issues having wide public concern that are being addressed by other administrations. Also, merchandizing interests might conduct more efficient and less obtrusive surveys with narrow-bandwidth broadcast response circuits than is possible with current practices. The monitoring and response system may become a convenient fund raising mechanism using the Pay TV provisions. A politician running for office could communicate with his supporters by way of a Pay TV program. Support given by tuning to the program would provide campaign funds to pay for reaching others through free TV or other means. The same mechanism could be used to raise funds for any charitable or other purpose without the inconvenience of developing efficient mailing lists or burdening the uninterested public with unwanted contacts.

The design of the system for controlling, monitoring, and billing of reception at the receiving terminals must consider the threat of cheating. If the mechanism for accomplishing these functions is owned, installed, and serviced by the transmission utility and if the penalty for cheating is high, it could be deterred adequately. If the signals are received directly from a satellite relay rather than through CATV, the equipment needed to convert the signals for effective use with conventional TV would be fairly expensive to build and operate as an individual item for cheating. Since the converters would be available legally only to the broadcast transmission utility, no additional scrambling of the signal would be necessary to prevent significant unauthorized reception. The converter would serve as an unscrambler, and it could be mass produced more cheaply and used with less degradation in quality of service than most other proposed "over-the-air" Pay TV scrambling systems.

The most difficult problems may develop when programs cross sovereign jurisdictional boundaries. For example, if a program producer buys satellite transmission time from a transmission utility under one sovereign jurisdiction to broadcast a Pay TV

program to receivers under another sovereign jurisdiction either on home or international territory, the program producer must depend on the agreements between the two sovereignties involved for the collection of his revenues. The sovereignty having jurisdiction over reception would normally be able to monitor and control the reception and could ensure the collection of receiver assessments. However, in international territory, the transmission utility may be the only monitor of reception and special agreements may be necessary to handle assessments on foreign receivers in such situations.

The possible organization and operation of reception to better exploit the service opportunities that have been outlined will be discussed in a later section on operational opportunities that will include transmission and programming as well as reception.

TRANSMISSION AND PROGRAMMING

There is a variety of broadcast transmission opportunities that can be considered for satellite relay. Network programming could be distributed to terrestrial broadcast stations for their local use. Programs could be distributed to CATV head ends or to community antennas for further distribution to home receivers or to receivers for community or theater reception. And programs could be distributed directly to home or vehicle antennas. An exciting possibility exists for the combining of all three of these types of transmission into a common service at UHF that would be less expensive to each user type than a single independent service. It would be technically feasible and economically advantageous to provide enough satellite transmitting power to reach small inexpensive earth terminals with the highest quality broadcast signal. This could be done at UHF by superposition on the current allocation and use of this spectrum without interfering with its present use or future development.⁽¹⁾ Such a common satellite distribution system would provide network distribution to terrestrial broadcast stations at the least possible cost. It would at the same time permit CATV head ends to acquire the same programming directly with better quality and less cost than current practice, and the satellite relaying service could be so inexpensive that it would become feasible and attractive to distribute many other programs of much smaller minority interest for CATV use. Also, mobile or remote locations that would not have adequate access to CATV or terrestrial broadcast could obtain the same satellite service at modest cost.

The freedoms of speech and of the press can be interpreted to be rights that extend with equal or greater application to the opportunity for broadcast, since this medium is simply an extension of the others with greater reach and impact. However, in the case of broadcast, the transmission is accomplished through the use of more obviously limited public resources (the spectrum). Thus conflict develops among different aspirants to the same rights. The practice in the United States of granting, for token considerations, the exclusive rights to a public resource (the spectrum) that is so limited as to obviously constrain its use for public

service without regulating the earnings or profits that may be developed from these rights, seems unjustifiable on any grounds. When limited public resources, which are no longer adequate to meet the demand, have been appropriated with only token consideration for their use, it would seem only logical to introduce sufficient economic considerations to control the demand. This could be accomplished with a government, public cooperative, nonprofit, or earnings regulated organization serving as custodian of the use of the public resource (portion of the spectrum).

In the case of broadcast, it would be desirable to separate the programming and transmission operations so that the transmission, which involves the limited public resources, could be earnings regulated without in any way limiting the earnings from programming which could be left under the control of free market forces. The transmission could be accomplished with an earnings regulated common carrier with a franchise to serve everyone with equal opportunity. In any area this common carrier would provide the transmission services for all broadcast programs. It would operate all the CATV and conventional TV transmitting facilities, and convey all the channels and programs to the consumer. This arrangement would enable a graceful evolution of the division of transmission services between broadcast and cable facilities, and would allow program producers to negotiate with a single transmission carrier to deliver a program to a given area.

Even with such control over the limited broadcast transmission facilities, further protection of the rights to broadcast may be needed. For example, within any sovereignty's assigned transmission capacity from a satellite relay, a competing programmer might try to use an economic advantage to monopolize the transmission facilities during a critical period, e.g., a political candidate or issue might try to "buy" an election. Protection from such action could be adjudicated by the same jurisdictions that exercise control over reception.

A more difficult problem might be the acceptable partition of the transmission capacity of a given satellite broadcast beam among the sovereignties that it illuminates. In the early phases of even a relatively primitive broadcast satellite, the principal concern would more likely be with fully subscribing the satellite relay capacity. However, the demand for these services is apt to eventually exceed the limited capacity in some areas during the life of the broadcast satellite relay, and some basis other than bidding the price up much above cost will be needed for a more equitable partition of the limited common resources. Some possibilities would be to allow the subscribed partition to evolve toward capacity assignments proportional to one of several factors: the independent sovereign populations competing for the capacity within the sharing coverage of the beam; the average revenue developed during the past year from each total sovereign transmission assignment within the beam; or the number of receiver-use hours during the past year from each total sovereign transmission assignment within the beam.

The latter possibility seems the most attractive because it would evolve the partition of capacity toward greatest use, independent of geographical boundaries. It might also serve as a useful basis for capacity assignments within a sovereignty's jurisdiction in order to insure that important minority interests were better served. If usage is an important consideration in the partition of the capacity, it would tend to increase the maximum public benefit from the spectrum and not unnecessarily leave fallow some portions of it because the population did not exploit it. The latter might occur because of disinterest, because the receiving costs limited the participation, or because other means, e.g., CATV systems, better satisfied the needs.

The positioning and shaping of satellite broadcast beams to select the detailed coverage would encounter similar problems to those involved in the partitioning of the capacity of each beam, and similar selection criteria should apply to this process. In the early life of any such satellite system, the principal problem is likely to be found in arranging the coverage to achieve adequate subscription to the service so that each user can fully benefit from the cost savings that accrue from large scale operations. Later, in some areas the demand for capacity may exceed the supply, and usage can be used as an aid in partitioning the capacity. It may also prove desirable to make one or more of the beams independently pointable so that the coverage can be augmented or changed to better satisfy the needs as they develop.

Control of programming involves two principal functions: censorship of privately or independently generated programs, and selection and generation of government or publicly sponsored programs. With the comprehensive jurisdictional control of reception that was previously discussed, there would be little need for censorship of programming for internal consumption at the point of program origination. On the other hand, a sovereignty may wish to control or censor programming that originates within its jurisdiction, but which may be exported for reception in outside jurisdictions. This control of export programming can be accomplished in traditional ways and needs no new control mechanism.

The greatest potential growth of programming is probably in the area of government or publicly sponsored programs—educational, cultural, and civic programs. These programs could benefit from central (Federal and State) guidance and support to assure minimum standards. However, they are likely to have greatest impact if they involve as much local participation in selection and generation as possible. The same organization that is responsible for the selection of teachers and classroom instruction might prove most appropriate in handling the responsibility for the local control of broadcast reception and the local selection and generation of educational, cultural, and civic programs. The greatest opportunities for growth in local programming involve CATV systems that could provide transmission capacities many times those needed for commercial programs at very little additional transmission cost. Some of these and related possibili-

ties will be explored in greater detail in following sections of this paper.

COSTS, REVENUES, AND ASSESSMENT OPTIONS

The costs of programming range over a full spectrum of values. Extravaganzas produced for general release to theaters and television might cost many millions of dollars per hour of program to produce. The program of man's walk on the moon cost many billions of dollars, but the incremental cost to televise the moon-walk program was incidental. However, the associated programming costs that explained the activity, simulated certain operations, and coordinated the many additional inputs may have been significant in most of the programs that were broadcast. Many natural unstaged programs such as those presented in live news may be obtained at low programming cost for the basic material, but may involve important selection, interpretation, coordination, and presentation costs. Thus the costs of programming may be quite varied and subject to many choices and interpretations depending on the objectives and whether the program is for exclusive or competitive showing and for primary or incidental presentation.

Most of the types of programs already mentioned are sufficiently attractive that the potential audiences would be willing to pay to receive them. On the other hand, sponsors of advertising programs are willing to pay an audience for receiving the advertising. It is also conceivable that public sponsorship would be willing to pay for audience reception of training or educational programs that are deemed to benefit the general public. In much of commercial broadcasting the programming is arranged so that the programs for which the audience is willing to pay more than compensate the audience for the companion advertising programs received; and the amount that sponsors of advertising are willing to pay more than covers the cost of program production. Thus the programs are bartered with the audience, and the advertisers pay the program producers and transmitters.

The above arrangement is much more constraining than it needs to be on the programs that can be offered for broadcast. Many potential programs cannot be offered simply because no advertiser can benefit enough to justify paying the full price of the program. Also, the conventional broadcasting arrangements do not provide a very good quantitative measure of the advertising reach and impact achieved, so the sponsor has no good assessment of the value of his advertising. Without proof of any special added value of the advertising, sponsors would naturally rather support a lower priced program for their advertising. Pay TV would offer program producers and presenters the opportunity to extend and expand their theaters, arenas, and stadiums to larger audiences at home who could benefit from the programs at greater convenience and less cost than attending the live presentation. There need be no serious concern about milking the public, denying it "free" access to certain special programs, exploiting both audience pay and advertising support, or providing unfair competition to theaters, etc., if transmission and programming are

separated and adequate inexpensive transmission capacity is made available to invite free competition in all types of programming.

Transmission costs are small compared with programming costs, and are only a minor portion of the total costs for conventional TV broadcast. The relative costs would be even more accentuated with satellite relay transmission if there was at least a modest subscription to the service so that economies of scale with the satellite relays could be exploited. The transmission costs with CATV or cable systems, on the other hand, are a substantial portion of the total system costs and typically are comparable with receiving costs (e.g., a typical amortized cost of \$60 per receiver per year). It is the greater service opportunities potentially available with cable systems that justify their cost. There is virtually no technological limit to the channel capacity they could provide at very low incremental costs. Thus the transmission costs per opportunity channel could be made small at no spectrum sharing costs to other services. In order to insure adequate potential transmission capacity it would be important to separate the transmission from programming and to make the transmission operations similar to those of a common carrier with regulation of earnings or with public or nonprofit ownership.

The receiving costs in any television broadcast system are apt to constitute a major portion of the total system costs. The typical amortized cost of a color receiver and antenna, including installation, maintenance, etc., is in the range of \$50 to \$100 per year. Thus the cost to the owner of a TV receiver for "free" television is a major component of his total costs for CATV or Pay Television, and the latter costs if assessed to the receiver-owner are not apt to prove to be as much of a deterrent to their acquisition as was color TV, which approximately doubled receiving costs with much less potential improvement in service offerings. The claims that CATV and Pay TV may deny the benefits of some television to many if they are assessed the additional costs have been considerably overstated. A more legitimate statement might be that many potential benefits of television are denied everyone without the opportunity to participate in CATV and Pay TV appropriately regulated as previously discussed.

In addition to the various receiving, transmission, and programming costs already discussed, there is the opportunity and justification for the assessment of taxes at a number of governmental levels. If satellite relays are involved, they use common limited international resources (the frequency spectrum associated with orbital locations), and there should be some consideration given for the benefits that may be derived, particularly if this is done at the expense of denying others from similar benefits, as is ultimately likely to be the case with limited resources. The objectives of the international assessment would be to contain the demand within the available supply of the resources, and to provide revenue for common international benefit.

The most difficult problem with an international assessment is probably achieving a consensus on who and how to accomplish it. One simple approach might

be to allocate some fraction of the satellite broadcast relay capacity of every beam to the United Nations for their use, sublease, or disposition at their discretion. A similar type of arrangement might prove attractive for local jurisdictions, e.g., a local school district might be allocated some CATV channel capacity for their use, sublease, or disposition. The opportunity also exists, of course, to tax individual programs by assessing the receiver, as discussed previously under control of reception, or by assessing the transmitter or program producer if they are within jurisdiction.

There are many costs and tax possibilities associated with the various broadcast configurations that might be considered, and there are a number of ways in which these costs might be assessed. In conventional broadcast, all the transmission and programming costs are paid by program sponsors, and the receiving consumers pay all the receiving costs. With CATV, the lion's share of the transmission costs are also shouldered by the receiving consumers, and it has even been proposed⁽²⁾ that they should share some of the programming costs by paying for copyright privileges. The latter proposal would seem inconsistent with other broadcast practice and might be construed to be discriminating against CATV consumers. A more attractive policy might be for program producers to pay the costs for conventional distribution and transmission so that the portion of CATV transmission costs equivalent to those for broadcast transmission would be paid by program producers. In addition, for those systems involving monitoring and response circuits primarily for the benefit of the programmers or transmitters, further sharing of the transmission costs by program producers could be justified. Thus a significant fraction of the CATV transmission costs, and all the satellite and terrestrial broadcast transmission costs, could logically be assessed to the program producers for the delivery of their programs and the acquisition of data on potential audience reactions.

The above arrangement would reduce the direct assessment on the consumer for CATV services and encourage greater subscription. If monitoring circuits are provided to obtain all the benefits previously discussed, they would facilitate a charge according to use so that the threshold consumer cost to remain wired to the system with the opportunity for its use could be made minimal. This should be a further inducement for greater subscription and participation in CATV services.

There are, of course, other ways of subsidizing and inducing greater exploitation of TV services for public benefit. The building and occupancy codes could specify minimum TV facilities requirements. General tax funds might be used to pay people to take instruction or training over TV that would help to take them off welfare or unemployment rolls. However, there does not seem to be any simple acceptable way of greatly reducing the initial investment receiving cost to the consumer, which is the major portion of the total broadcast system costs. Because of its relative magnitude, it would not seem feasible to expect a significant fraction of these receiving costs to be subsidized by commer-

cial interests, nor for most of the initial investment to be subsidized by usage fees. Furthermore, there is a large variation in the receiving facilities and services from which to choose, and the subsidization of their acquisition would tend to limit the free competitive development of new and better facilities.

OPERATIONAL OPPORTUNITIES

The organizations needed for the regulation of reception have been alluded to in the discussions on the control of reception. This could involve many levels of jurisdiction; however, in the United States it may prove attractive to exercise much of the control at the school district level. The same organization that is responsible for local control of reception could also be given the responsibility for the selection, development, and procurement of educational, cultural, and civic programs to meet the needs of the local community. The continuing education of all its members is one of the most important tasks of any society. As the population and times place ever-increasing burdens on the educational processes, we may expect that the roles of TV and automation will grow to become more important and perhaps eventually to become the principal forms of instruction. Thus the organizations currently serving as trustees of education and focusing on the needs of the young should become concerned with the educational needs of all the people and play a prominent part in the use and control of TV (which could become the most important means of information transfer to people).

The communications capacity required to satisfy all the educational needs may eventually absorb a major portion of the local TV capacity that is provided in CATV systems. Because of the large potential capacities at small incremental costs that CATV systems can offer, their share of the local TV services should grow to include much of the urban and densely populated areas. The role of satellites would then evolve to one of broadcast distribution of network and general interest programs to CATV head ends, vehicles, remote locations, and local broadcast stations (the latter serving as local cableless CATV).

One way of evolving with minimal disruption from current to future operations involving separated transmission and programming and the postulated eventual roles of CATV, satellite TV relay, etc., would be to take local initiative with Federal support. For example, any local area of broadcast TV coverage could organize a public, nonprofit, or earnings regulated broadcast utility that would apply for all the TV broadcast licenses as they came up for renewal and would pay the previous licensees a "fair" price for their broadcast transmission facilities and equipment. The broadcast transmission carrier could then offer broadcast transmission services to the previous licensees and other program producers. They might offer yearly contracts open for bids at least equal to the costs of transmission. The high bidder could be asked to prorate his total bid over all the broadcast hours of the year with the stipulation that any independent producer could get access to the broadcast transmission

by paying the yearly contractor no more than some specified standard (say 100 percent) excess over his prorated contract costs for any time displaced. There would need to be some minimum advance notice required, (e.g., 10 days) and enough transmission time would have to be purchased to pay for any programming that might be disrupted. Also, regulatory control would be needed to prevent any monopoly practice that is objected to by other programmers, i.e., broadcast transmission time monopolized by certain interests to the disadvantage of others who would be willing to pay the standard maximum excess over the prorated yearly contract price.

In addition to transferring the broadcast transmission stations to a common broadcast transmission carrier, the authorities having jurisdiction should impose an earnings regulation of all franchises involved in broadcast transmission, including CATV. This could be used to encourage transfer of these facilities to the broadcast transmission utility so that eventually all such facilities would be operated by a single utility in a given area. This would facilitate the evolution of operations between broadcast stations and CATV, permit standardization of services (pay TV, response circuits, etc.), and enable program broadcast negotiations with one transmission agent in a given area.

In addition to the opportunities for control of reception, for receiver monitoring and response services, for extreme flexibility in pay TV, for organization and regulation that would make transmission access available to anyone, and for great flexibility in the assessment of systems cost that could be used to promote greater public participation and benefits, there are many other services that may become attractive for various applications. This can be illustrated with Snapshot TV, which has received only very preliminary investigation and has yet to reveal its true potential.* There are many communication applications for which an apparently continuous motion in the picture is not of great benefit or may even be a distraction. In this situation it may prove feasible to time-share the picture information so that a single TV channel could carry, say, 30 to 300 independent picture snapshot sequences. The receiver could be designed so that any one of the sequences could be selected and automatically lock to an associated audio channel. Thus the viewer would be able to select the snapshot sequence and audio that he wished to follow from among a large number that would be multiplexed on one conventional TV channel.

Snapshot TV may prove attractive for transmitting and monitoring all levels of education. All the classrooms in a community could be multiplexed on one CATV channel so that every parent (or a sick child at home) could monitor the progress and activity of the children at school. Classrooms could exchange programs between schools so as to obtain

* This method of reducing the information rate has been suggested in private communications by Dr. R. M. Salter as an attractive way of televising newspapers or other material to be read.

many of the benefits of "bussing" without many of the disadvantages. Most of the higher education courses in any area could be audited without using excessive channel capacity. In most cases, at any level of education the information transfer does not benefit greatly from continuous motion in the picture information. Thus Snapshot TV may prove very effective for educational communications at great savings in TV transmission capacity.

Snapshot TV may find application to many types of surveillance. Most of a community as seen from streets and public property could be multiplexed for surveillance by police, firemen, and the general public. Snapshot TV would provide full TV resolution for identification and could provide enough motion connectivity to follow most action of interest. Besides aiding public officials in their surveillance tasks, Snapshot TV would enable the public to maintain surveillance of public actions and could assist each individual in his own private surveillance interests and personal security.

Snapshot TV could make available to everyone, without excessive channel-capacity cost, all the public action of every government agency so that the public could conveniently choose to follow any such activity and the participation of any public official.

Newspapers, magazines, and any printed information might find Snapshot TV a particularly attractive means of transmission. Without the necessity of multiplexing audio information, even greater numbers of independent sequences could be multiplexed on each TV channel. Thus Snapshot TV news at a thousand times the information capacity of conventional TV news might be transmitted over a single TV channel.

As a final consideration for the Snapshot technique of time-sharing wideband communication circuits, the possibilities for applying it to public video telephone should be investigated. What portion of such potential communication would prefer the cost benefit derived from high-resolution Snapshot picture sequences, rather than the much more costly (in circuit capacity), more continuous motion pictures of other proposed picture communication systems? The Snapshot technique may be able to provide the desired high-resolution communication capabilities using one-hundredth of the circuit capacity of other techniques, and using transmitting and receiving equipment that could be made compatible with conventional television equipment and distribution systems.

This sampling of potential TV and communications applications merely illustrates possible future applications that TV and communication systems may be asked to provide. In making policy decisions today about development, organization, regulation, and operations, it would seem only prudent to select those paths that offer growth options that could accommodate as many of these potential services as possible.

CONCLUSIONS

There are many exciting broadcast opportunities

using satellites and CATV. The potential applications and benefits, only sampled in this exploration, are almost unlimited. However, if we wish to realize many of these possibilities in the near future, we need to obtain international consensus for radio spectrum usage and to make service opportunities attractive to vested as well as new entrepreneurial interests. This should be possible by:

- o Instituting diversified, flexible control of reception as an option at a number of levels of jurisdiction
- o Providing receiver monitoring and response services
- o Offering much greater flexibility in Pay TV
- o Separating and emancipating the private investments in programming from those involved in transmission for broadcast purposes
- o Making broadcast transmission available to anyone through a common broadcast transmission utility whose earnings are regulated
- o Establishing a formal interest and major role for education in the operation and use of TV
- o Using the flexibility in the assessment of systems costs to promote greater public participation and benefits
- o Offering a variety of attractive new services such as Snapshot TV
- o Establishing organizations and regulations to foster the prompt evolution of those operational services with the most desirable characteristics

The adoption of policies and actions favorable to the above proposals could usher in new styles of living with an exhilarating impact on society.

REFERENCES

(1) Hult, J. L., "The Promise of UHF Satellites for Mobile, Broadcast, and Low-Cost Services and Related New Communications Allocations, Operations, and Policies," The Rand Corporation, P-4071, May 1969.

(2) Johnson, L. L., "The Future of Cable Television: Some Problems of Federal Regulation," The Rand Corporation, RM-6199-FF, January 1970.

