BROADCASTING SATELLITES–PROSPECTS AND PROBLEMS

*James J. Gehrig**

I. INTRODUCTION

Recently the following paragraph appeared in a well-thought-of newspaper in the United States:

> Technology is now available that will permit the United States to broadcast television programs directly from satellites into any home anywhere in the world that has a receiver. This fact has shaken the Soviet Union and much of the Third World which fears its fragile cultures cannot withstand the onslaught of the hard-sell from highly developed commercial societies.[1]

These fears, if they exist, are mistaken. The quoted paragraph overrates the current state of the technology, greatly underestimates the attendant system problems and associated costs, and ignores existing international agreements. Nevertheless, this concern has provided cause for the study and discussion of an international agreement on broadcasting satellites. However, legal questions should not be resolved independently of technology. The rational resolution of a legal question involving technology must be based on an understanding of the current technology and a realistic estimate of its future. In the case of broadcasting satellites, this involves both the technology of the satellite and of the ground terminals, especially the receiving ground stations (receivers).

"Broadcasting satellites" are essentially of two kinds: those that can broadcast into an augmented community receiver for service to that community, and those that can broadcast directly into home receivers.

More precisely, a broadcasting satellite service, as defined by the Radio Regulations of the International Telecommunication Union (ITU), is "[a] radiocommunication service in which signals transmitted or retransmitted by space stations are intended for direct reception by the general public."[2] A footnote to this definition provides that "[i] n the broadcasting-satellite service, the 'direct reception' shall encompass both individual reception and community reception."[3]

---

*Member of the Professional Staff, Committee on Aeronautical and Space Sciences, U.S. Senate. The views in this paper are those of the author and are not necessarily related to those of any organization of which he is a member.

[1]Christian Science Monitor, Apr. 26, 1974, at 20, col. 1.

[2]Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, [1972] 23 U.S.T. 1527, 1573, T.I.A.S. No. 7435, at 47 (effective Jan. 1, 1973).

[3]23 U.S.T. at 1573, n.1.

"Community reception" is

> [t]he reception of emissions from a space station in the broadcasting satellite service by receiving equipment, which in some cases may be complex and have antennae larger than those used for individual reception, and intended for use:
>
> —by a group of the general public at one location; or
>
> —through a distribution system covering a limited area.[4]

"Individual reception" is

> [t]he reception of emissions from a space station in the broadcasting satellite service by simple domestic installations and in particular those possessing small antennae.[5]

These definitions and the regulations apply to both radio and television (TV) satellite broadcasting.[6] However, this paper will be concerned primarily with TV satellite broadcasting because this is where the discussion generally centers, particularly in the United Nations and its kindred groups.

II. THE CURRENT TECHNOLOGY

TV broadcasting by satellite into community receivers has been demonstrated. Currently the United States is demonstrating this kind of broadcasting with Applications Technology Satellite No. 6 (ATS-6) which was launched May 30, 1974, from Cape Canaveral, Florida.[7] ATS-6 is the most complex, versatile and powerful communications spacecraft launched to date and carries more than 20 scientific and technical experiments, most of them dealing with communications and satellite technology.[8] The ATS-6 has a capability of broadcasting a TV signal in the 2500 to 2690 MHz band[9] over a substantial area (the one-half signal strength contour includes nearly one million square kilometers) to ground stations consisting of a 10-foot (about 3 meters) parabolic antenna, a special electronic preamplifier and signal converter, and a television receiving set. Each station costs between $3,000 and $4,000, not including the TV receiver—very inexpensive

---

[4] 23 U.S.T. at 1574.

[5] *Id.*

[6] In this article, "broadcasting satellites," "broadcast satellites," "TV broadcasting by satellite," "satellite broadcasting," and similar terms are used in the context of the definition of the "broadcasting satellite service."

[7] Hearings on S. 3542 Before the Senate Comm. on Aeronautical and Space Sciences, 93rd Cong., 2nd Sess., at 2 (1974).

[8] *Id.* at 3.

[9] Hearings on H.R. 4567 Before the Subcomm. on Space Science and Applications of the House Comm. on Science and Astronautics, 93rd Cong., 1st Sess., pt. 3, at 131 (1973). ATS-6 can also broadcast on other frequencies.

compared to an INTELSAT station, but expensive compared to the average home TV receiver.[10]

During its first year in orbit the ATS-6 will be in a geostationary orbit at 94° West longitude overlooking the United States. An experiment of special interest to be performed in this location is the Health, Education, Telecommunications (HET) experiment (which is really a group of about six experiments) that will use the satellite to broadcast educational programs of various kinds for educational levels varying from the elementary grades through university post-graduate courses and for health-care activities located in remote and highly developed areas in the United States.[11]

In 1975, ATS-6 will be moved to a location over East Africa (35° East longitude) where it will be visible to the Indian subcontinent to permit its use by the Indian Government for about 4 hours per day during a period of one year to conduct the Satellite Instructional Television Experiment (SITE). In this experiment, television programs, the contents of which are entirely the responsibility of the Government of India, will be broadcast daily on a frequency of 860 MHz to approximately 5000 villages and cities throughout India.[12] Some 2400 of the villages will be equipped with TV sets augmented by converters and 3-meter parabolic antennae to receive the signals directly from the spacecraft. It is reported these ground receiver terminals will be manufactured in India at a cost of about $600 each.[13] Another estimated 2600 villages will use unaugmented television sets to receive the signal rebroadcast from a ground station in the area. These programs will stress improved agricultural techniques, family planning, hygiene, school instruction, and teacher education and occupational skills.[14] The audio portion of the program will be supplied in different languages.

In 1975 NASA will launch another communications satellite called the Cooperative Application Satellite-C (also referred to as the Communications Technology Satellite). This is an international experimental project being undertaken jointly by the Governments of Canada and the United States.[15] Under this program, Canada is building the satellite and the U.S. will supply the 200-watt traveling wave tube, the launch vehicle, and the launch operations. Among other experiments, this satellite will broadcast at a frequency of 12 GHz into community-type ground stations having an 8-foot (about 2.4 meters) parabolic antenna, some front-end electronics to reduce the frequency and

---

[10] *Id.* at 104.

[11] Hearings on S. 2955 Before the Senate Comm. on Aeronautical and Space Sciences, 93rd Cong., 2nd Sess., pt. 2, at 12-13 (1974).

[12] *Id.* at 670-71; Hearings on H.R. 4567, *supra* note 9, at 104-05.

[13] NASA Press Release No. 74-111 (May 21, 1974); Rao, Educational Television in India, 30 Advances in the Astronautical Sciences (AAS 1974).

[14] Hearings on S. 2955, *supra* note 11, at 671.

[15] Communications Technology Satellite Agreement with Canada, April 21 and 27, 1971, [1971] 22 U.S.T. 713, T.I.A.S. No. 7131 (effective Apr. 27, 1971).

change the modulation, and a standard TV set.[16] The reported estimated cost of these ground stations is about $7,000.

Germany and Japan are studying the application of satellite broadcasting systems to meet the domestic needs of their respective countries. Japan has under development an experimental broadcasting satellite having the capability of broadcasting two color TV channels at 12 GHz.[17]

To supplement the existing terrestrial TV transmission system capabilities in the Federal Republic of Germany, one study proposes a 4-channel broadcasting satellite system capable of broadcasting in the band between 11.7-12.5 GHz. The study estimates that it would cost approximately $200 million and take 7 years to develop the operational satellite system.[18]

In conclusion, the technical aspects of television broadcasting from satellites into community-type receivers are being demonstrated. This does not mean that any satellite capable of broadcasting into community receivers can broadcast into any community receiver any place in the world. The satellite and the ground receiver must be designed to be compatible.

On the other hand, television broadcasting into current home-type television receivers has not been demonstrated. The technology is not available to permit the United States or any other country to broadcast television programs directly from satellites into today's home receivers anywhere in the world. It is fair to say that the United States and a number of other countries could develop a broadcasting satellite system with the capability of broadcasting television programs directly from a satellite into *augmented* home receivers for an expenditure of not less than several hundred million dollars. However, such satellite systems could not broadcast into existing unaugmented home receivers without violating present ITU Radio Regulations.[19] Under the ITU Radio Regulations, the only band of the frequency spectrum in which there are provisions for both the broadcasting service and the broadcasting satellite service is the 620-790 MHz band; but frequency modulation must be used in the broadcasting satellite service while a form of amplitude-modulated signal is widely used in surface TV broadcast systems.[20]

---

[16] Hearings on S. 2955, *supra* note 11, at 676-78; Hearings on H.R. 4567, *supra* note 9, at 106-08.

[17] A High-Powered Experimental Broadcast Satellite Using Tried and Proved Technology, General Electric Co. brochure (current).

[18] Lassak, The German Direct Television Broadcast Satellite, AIAA Paper No. 74-494 (1974).

[19] Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, art. 9A, [1972] 23 U.S.T. 1527, 1684, T.I.A.S. No. 7435, at 158 (effective Jan. 1, 1973).

[20] *Id.* An exception permits India to use the band 845-935 MHz for experimental TV satellite broadcasting under certain restrictions.

Furthermore, Recommendation No. Spa 2-10[21] of the regulations sets the maximum signal strength (power flux density) produced at the surface of the earth within the area of a terrestrial broadcasting station too low (-129dB W/m^2) for reception by home TV receivers. Although the recommendations attached to the Radio Regulations are not a part of the protocol and so might be considered to have a different legal character, they are in fact regarded as binding and in the U.S. are adhered to.[22]

III. TELEVISION RECEIVER STANDARDS

Of more importance to international law, it should be noted that it is not now technically possible to develop a broadcasting satellite system having the capability to broadcast television programs directly into any home anywhere in the world that has a receiver. The most important reason for this is the great variety of standards existing throughout the world for television receivers. Such different standards include the number of lines per frame (the resolution), the modulation technique for both video and sound, color systems, and band width of the signal. The following table summarizes some (but not all) of the receiver characteristics of the major television systems in use throughout the world.

THE TWELVE MAJOR WORLD TELEVISION SYSTEMS[23]

System	Number of Lines	Channel Width MHz	Vision Band Width MHz	Vision/ Sound Separation MHz	Vestigial Side-band MHz	Vision Modu-lation	Sound Modu-lation
A	405	5	3	3.5	0.75	Pos.	AM
B	625	7	5	+ 5.5	0.75	Neg.	FM
C	625	7	5	+ 5.5	0.75	Pos.	AM
D, K	625	8	6	+ 6.5	0.75	Neg.	FM
E	819	14	10	+11.5	2	Pos.	AM
F	819	7	5	+ 5.5	0.75	Pos.	AM
G	625	8	5	+ 5.5	0.75	Neg.	FM
H	625	8	5	+ 5.5	1.25	Neg.	FM
I	625	8	5.5	+ 6	1.25	Neg.	FM
L	625	8	6	+ 6.5	1.25	Pos.	AM
M	525	6	4.2	+ 4.5	0.75	Neg.	FM
N	625	6	4.2	-----	----	Neg.	---

21 Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, recommendation no. Spa 2-10, [1972] 23 U.S.T. 1527, 1850, T.I.A.S. No. 7435, at 324 (effective Jan. 1, 1973).

22 Conversation with Wilfred Dean, Assistant Director for Frequency Management, Office of Telecommunications Policy, Executive Office of the President of the United States of America, in Washington, D.C., Aug., 1974.

The following example illustrates the complexity of the problem: Great Britain uses systems A and I;[24] France uses system E; most of the rest of Western Europe uses system B; the U.S.S.R. uses system D; the United States and Japan use system M. Even if several countries use the same system according to the above table, they may have different frequency assignments for their channels or have other parameters of their TV receivers that do not agree; *e.g.*, they might use different color systems, three of which exist in the technology today.[25]

IV. FREQUENCY ALLOCATION AND SOME TECHNICAL PROBLEMS

Frequency allocations for the broadcasting satellite service were agreed to by the ITU's World Administrative Radio Conference for Space Telecommunications, in Geneva, Switzerland in 1971.[26] These frequency allocations are in the nature of a treaty, and in the United States they have the force of law with respect to those countries which belong to the International Telecommunication Union and have ratified or otherwise acceded to the protocol.[27] Most countries are members of the ITU, but even countries not members of the International Telecommunication Union adhere closely to its regulations.

For the allocation of frequencies the ITU has divided the world into three Regions:

---

[23] Office of Telecommunications, Dept. of Commerce, Cable Television for Europe, O.T. Rep. No. 74-28, at 51 (1974). This table was originally presented in CCIR Rep. No. 308, 10th Plenary Assembly, Geneva (1964), and updated by the CCIR report of the XIIIth Plenary Assembly, Geneva (1974), but the original sources were not available to the author at the time this article was prepared.

The field repetition frequency for the systems shown is 50 per second except for system M, used principally in North America and Japan, for which it is 60 per second.

Three color systems are in use:

(1) NTSC (National Television System Committee) used in the United States and Japan.

(2) PAL (Phase Alternation Line), a modification of the NTSC system which is much less sensitive to hue color changes caused by transmission problems. It is used in most of Western Europe except France.

(3) SECAM (Sequential with Memory), which is used in France, the U.S.S.R., and Eastern Europe. O.T. Rep. No. 74-28, at 56-59.

[24] The United Kingdom is phasing out system A. Eventually all U.K. TV broadcasting will be at UHF using system I. There are reports that much of Western Europe will change to system I.

[25] O.T. Rep. No. 74-28, *supra* note 23, at 52-54 (1974). Japan and the United States both use system M as defined in the table, and both use the NTSC color system, but a TV receiver made in Japan to receive on the Japanese network will not receive on U.S. networks.

[26] Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, [1972] 23 U.S.T. 1527, T.I.A.S. No. 7435 (effective Jan. 1, 1973).

[27] As of Aug. 1, 1974, only 31 nations had acceded to the protocol. However, most of the 95 nations that signed at Geneva are expected to accede to it.

Region 1: Generally Africa, Europe, the U.S.S.R., Iceland and area between.

Region 2: Generally North and South America, Greenland and area between.

Region 3: Generally Asia (less the U.S.S.R.), Australia, South Pacific to 120° W and area between.[28]

Frequency allocations to the broadcasting satellite service[29] are as follows:

1. Within the band 620-790 MHz, assignments may be made using frequency modulation subject to agreement between administrations concerned and those having services, operating in accordance with the International Table of Frequency Allocations, which may be affected. However, such service should not produce a power flux density in excess of -129 decibel-watts (dBW) per square meter for angles of arrival of less than 20° within the service area of a terrestrial broadcasting station or the territory of another country without the consent of that country. Due to this very low level of power flux density, it is unlikely that other than community-type reception could be realized.[30]

2. Assignments are authorized between 2500-2690 MHz. However, the regulations limit the use of this allocation to domestic and regional systems for community reception; power flux density at the Earth's surface must be less than -137 dBW per square meter per 4 kilohertz (KHz) band depending upon the angle of arrival of the signal. These power levels are not sufficient to allow for other than community-type reception.[31] In regions 2 and 3, portions of the allocation are shared with the fixed satellite service. Also, administrations are urged to take all necessary steps to protect the radio astronomy service in the band 2690-2700 MHz.[32]

3. On a primary basis, assignments are permissible in region 1 in the frequency band 11.7-12.5 GHz, and in regions 2 and 3 in the frequency band 11.7-12.2 GHz. In these bands there are no power flux density limits. However, in region 2 the broadcasting satellite service shares the allocation equally with the fixed satellite service and is limited to domestic systems.[33]

---

[28] Radio Regulations, with Appendices, and Additional Protocol, Dec. 21, 1959, [1961] 12 U.S.T. 2377, 2790, T.I.A.S. No. 4893 (effective Oct. 23, 1961).

[29] Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, [1972] 23 U.S.T. 1527, T.I.A.S. No. 7435 (effective Jan. 1, 1973).

[30] Office of Telecommunications Policy, Executive Office of the President of the U.S.A., Internal Memorandum, Frequency Aspects of DBS (Nov. 30, 1972).

[31] *Id.*

[32] Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, [1972] 23 U.S.T. 1527, T.I.A.S. No. 7435 (effective Jan. 1, 1973).

[33] *Id.*

4. In region 3 the service is allocated on a primary basis along with the Fixed and Mobile Services to the band 22.5-23.0 GHz and is subject to power flux density limits for the protection of terrestrial services in this band.[34]

5. In regions 1, 2 and 3, the broadcasting satellite service is allocated on an exclusive basis to the band 41-43 GHz without any limitations.[35]

The only allocation for the satellite broadcasting service to a frequency band which might be found on existing home television sets is in the frequency band 620-790 MHz, but severe power flux density restrictions are imposed on the satellite broadcasting service. At the higher frequencies (11.7-12.5, and 41-43 GHz) there are few or no limitations, but today's home TV receivers do not operate at these higher frequencies. Moreover, the technical aspects of broadcasting from satellites at the higher frequencies are not fully understood. For example, at frequencies above 10 GHz, and especially above 20 GHz, the water vapor and oxygen in the atmosphere, particularly clouds and rain, attenuate propagation.[36] Investigations into the effects of these propagation losses on system design and on technical standards are just beginning.

Some other technical problems are:

1. Broadcasting satellites require a large amount of electrical power to transmit the TV video signal. Present television systems use a vestigial-sideband amplitude modulated (AM) signal requiring high power to produce a good quality TV picture. To reduce the power requirement (and in some instances to meet the ITU radio regulations) it is most likely that broadcasting from a satellite would use a frequency modulated (FM) video signal which requires that the signal be converted before it can be used by today's TV receiver. FM signals require at least 3 or 4 times more band width than do AM signals.[37] Yet, the radio frequency spectrum generally is regarded as a valuable and limited natural resource which must serve many users and is carefully allocated among the services by each administration (country). Clearly, use of the spectrum for broadcasting satellites will be questioned closely, although a few persons argue that the concept of treating the electromagnetic spectrum as a scarce commodity is obsolete and with the higher frequencies becoming available, frequencies should be liberally authorized and used to provide new telecommunications services at reduced cost.[38]

---

[34] *Id.*

[35] *Id.*

[36] Office of Telecommunications, Dept. of Commerce, Annual Report, O.T. Bull. No. 73-2, at 2 (1973); Koenig & Merle, Influence of Rain and Cloud Attenuation on the Design of a 20 to 30 GHz Spacecraft Communications Repeater, 26 Progress in Astronautics and Aeronautics (AIAA 1971); MacLellan, Anticipated Developments in Communications Satellite Applications, 32 Progress in Astronautics and Aeronautics (AIAA 1974).

[37] O.T. Rep. No. 74-28, *supra* note 23, at 56; Lassak, *supra* note 18; Prichard, Broadcasting From Space, presented at International Conference on Space Research and Exploration (Crete 1969).

[38] Visher, Frequency Usage in Future Space Systems, AIAA Paper No. 74-447 (1974).

2. One of the reasons given for cable television development in Europe is the aesthetic benefit of removing unsightly antennae from the roofs of buildings, particularly households. Some of the older towns have passed ordinances requiring new receivers to use cable systems where necessary to preserve historic structures and conserve the view. Examples are Salzburg, Austria, and Rosenheim, West Germany.[39] Imagine what a city would look like with a television set in every household that required a 5- to 10-foot parabolic antenna on the roof to enable it to receive signals directly from a broadcasting satellite!

V. BROADCASTING SATELLITES AND THE U.S.

Broadcast satellites will not be developed early or easily in the United States because an extensive national broadcasting system already exists. This national broadcasting system consists of a large number of ground-based broadcasting stations connected by a vast and elaborate system of microwave relay links and cables representing an enormous investment in capital, facilities, and existing infrastructure. This system in being works very well and is not abusive of the frequency spectrum as would be broadcasting satellites.

Moreover, in the United States telecommunications are generally viewed as the business of private enterprise, and decisions with respect to the development of new telecommunications systems are made with that policy in mind. Consequently, in January 1973, when the President decided that reductions in federal spending were necessary, a policy decision was made by the National Aeronautics and Space Administration, under pressure from the Executive Office of the President, to stop further communications satellite development after completion of the joint U.S.-Canadian CTS project, and that decision is the policy of the United States government today. This policy does not mean that the United States government is supporting no future developments in communications satellites. Such developments continue in NASA for its own needs; for example, NASA is planning to put into geosynchronous orbit a Tracking and Data Relay Satellite System (TDRSS) to meet the needs of the Space Shuttle age.[40] These efforts do not directly support the development of broadcasting satellites, but may result in technological advances that could contribute to broadcasting satellites at some future time.

Under the present policy, if broadcasting satellites are to be developed for use in the United States, it will have to be by private enterprise. However, U.S. telecommunication industry management is very practical when it comes to new investment. Management is faced with the necessity of earning a profit on invested capital to pay dividends to its stockholders and being able to raise new capital necessary to meet the demands of its customers. From a financial point of view, any broadcasting satellite system for the U.S. would have to take whatever place it can earn among other telecommunication systems.

[39] Black, What's Happening "Over There"? CATV in Europe, TV Communications, pt. 1, no. 6 (1973).

[40] Hearings on S. 2955, *supra* note 11, at 1022-79.

In this connection it is important to note that while the technology for a broadcasting satellite service into community receivers is being demonstrated technically, the market for this kind of broadcasting is not developed, and there has been no showing that the market can support the development and operation of such a broadcasting satellite system.[41]

Clearly, a formidable obstacle to satellite broadcasting directly into the home television set (augmented or unaugmented) is the absence of demonstrated technology. Yet, a much more formidable obstacle to such broadcasting is the fact that there are an estimated 69 million homes with 120 million television sets in the United States.[42] These television sets are an important part of the U.S. television broadcasting system and they would have to be replaced or augmented to establish a broadcasting satellite service direct to home TV receivers. To implement the required receiver capability it would be necessary for the Federal Communications Commission to establish discrete TV channels at the gigahertz (GHz) frequencies assigned to the broadcasting satellite service and to require that all new television sets after a certain date provide for receiving on those channels. Considering that the Federal Communications Commission required all television sets sold in the United States after April 30, 1964, to have UHF channels, and that today there are a relatively small number of these channels being used, it seems unlikely that such action increasing further the number of television channels available in the U.S. will be taken any time soon.

Aside from these technical and economic problems associated with the development and operation of a U.S. broadcasting satellite system, any intent on the part of either the government or private enterprise to develop such a system would receive immediate and concentrated opposition from the broadcasting industry. The industry would be compelled to act to protect its investment in the current system. Probably, there would also be objection from labor organizations who would see broadcasting satellites as a threat to jobs. These objections would create a political problem of substantial proportions that would require a political decision.

I believe it can be said with some certainty that a broadcasting satellite service with the capability of broadcasting directly into home receivers will *not* be developed in the United States within the foreseeable future.

VI. EDUCATIONAL AND OTHER CONSIDERATIONS

While many people around the world believe strongly in the efficacy of broadcasting satellites with respect to education, there is, as yet, no good data as to what these effects will be. Certainly the purpose, the application, the use, and the effect depend on the specific country where such satellite systems would be used. For example, in the

41 *See* Hearings on S. 3542, *supra* note 7, at 89-95.

42 1974 Electronic Market Data Book, Electronic Indus. Ass'n (Washington, D.C.); *see* U.S. Bureau of the Census, Statistical Abstract of the United States (95th ed. 1974).

United States, as part of the HET experiment, the ATS-6 is being used to broadcast educational material to augment existing classroom courses directly into junior high schools located in remote areas of the Rocky Mountains.[43] The teachers have been especially trained to use the broadcast material, and the children are accustomed to attending daily class during the school year. The purpose of the demonstration is to investigate the possibilities of providing educational television and other media services via satellite broadcasting to students isolated from the greater educational opportunities available to students in more densely populated areas.

In another part of the HET experiment, the ATS-6 system is being used to bring university courses at the graduate level to practicing teachers in the Appalachia area. By coupling ATS-6 with ATS-3, students are able to converse back and forth with some of the outstanding experts in their field of study and also to obtain immediate feedback on their progress.[44]

In other parts of the experiment, the ATS-6 is being used by the Veterans Administration for medical education and consultation, and experiments are being conducted in Alaska to develop the information needed to meet that state's specific telecommunications needs with respect to education, health, cultural exchange, entertainment, and interconnection facilities required to provide live programming to the general population.[45]

When the ATS-6 satellite moves to provide service to the Indian subcontinent, the educational purposes of Indian programming will be somewhat different. The Indian project is being designed by the Indians to investigate the needs of the Indian population as the Indian government currently understands those needs. The general objectives of the Indian SITE experiment are to:

> gain experience in the development, testing, and management of a satellite-based instructional television system, particularly in rural areas and to determine optimal system parameters
>
> demonstrate the potential value of satellite technology in the rapid development of effective mass communications in developing countries
>
> demonstrate the potential value of satellite broadcast TV in the practical instruction of village inhabitants
>
> stimulate national development in India, with important managerial, economic, technological and social implications.[46]

---

[43]Hearings on S. 3542, *supra* note 7, at 11-13.

[44]*Id.*

[45]*Id.* at 4-6; NASA, The ATS-F Data Handbook (rev. May 1974).

[46]NASA, *supra* note 45.

The Indian primary instructional objectives will be concerned with family planning, agricultural practices, and national integration. Indian secondary objectives include: contributing to general education, teacher training, occupational skills, and the improvement of health and hygiene.[47]

Indian technical objectives include: a system test of satellite broadcast TV for national development; enhancement of the capability to design, manufacture, deploy, operate and maintain village TV receivers; gain technical experience in design, manufacture, and maintenance of broadcast distribution facilities; and to determine the optimum receiver density, distribution, scheduling, and audience acceptance of the preparation of the program material.[48]

Almost universally, we have come to accept as fact that a broadcasting satellite service will bring advantages to education, but we really do not know what effects TV broadcasting will have on the educational process either in those countries with highly developed educational systems that have had TV for years, or in the economically less-developed countries. I think the innate belief of almost everyone is that the result will be a good one, and I am sure that for some students, young or old, that belief is correct. Still, it is important to stop and reflect on the fact that education at any level is an intensely personal thing; to learn requires an exceptional effort on the part of the individual whether he is learning at a young or older age to read and write, or is a graduate student in a university.

In addition to the formal educational effects which a broadcasting satellite service might have, there are other effects to consider which might be just as important and about which even less is known. Before the installation of a country-wide broadcasting satellite service into home receivers, one would prefer to have some assessment of what the effects will be on such intangibles as the country's political institutions, its local culture, and its social values. To my knowledge, little or no effort has been put into the study of such effects, which are often called technology assessments. Such a study is one of the general objectives of the Indian SITE experiments.[49]

VII. SUMMARY

In summary, broadcasting from satellites into community-type TV receiving stations costing on the order of a few thousand dollars has been technically demonstrated. However, satellite broadcasting directly into present home receivers is not foreseeable. Broadcasting satellite systems at the higher frequencies (above 11.7 GHz) are being investigated and appear technically feasible, but they can broadcast only into augmented home receivers that will cost substantially more than those of today. There-

---

[47] *Id.*

[48] *Id.*

[49] *Id.*

fore to say, ". . . radio and television services can speak, almost without restriction to listeners in all countries of the world"[50] and, "[t]hrough space and telecommunication techniques, everyone, wherever he may be, can receive directly broadcast radio and television programs coming from any other country,"[51] is incorrect.

Moreover, the ITU Radio Regulations contain restrictions and require coordination regarding transmissions from broadcasting satellites, especially outside of the originating country. In general, these regulations require that in designing a broadcasting satellite service, all technical means available shall be used to reduce to the maximum extent practicable the radiation over other territories of other countries (spillover) unless an agreement has been previously reached with such countries.[52] The specific restrictions included in the Radio Regulations relating to the lower frequency signal levels are at a level low enough so that they will not interfere with terrestrial broadcasting on the same frequency in the impacted country; such low signal levels cannot, of course, be received by home TV receivers, but only by large ground stations with large antennae and sophisticated electronics.

The establishment of broadcasting satellite services will be difficult in countries with highly developed telecommunications networks, such as the United States. Broadcasting satellites might possibly appear in some of the highly developed countries that feel a great need to increase the number of television channels available, but the signals will not be received by current home-type TV receivers; the television sets (receivers) will have to be redesigned and augmented to receive these signals. Moreover, a broadcasting satellite system will not provide a large number of new TV channels.

Broadcasting satellite systems into community-type ground stations to meet the telecommunication needs of some of the developing countries, particularly in the area of education, are being investigated. Should the results of experiments such as the Indian SITE experiment using the ATS-6 satellite and the experiments with the joint Canadian-U.S. Communications Technology Satellite prove successful, there is a possibility that some countries will opt to establish an operating broadcasting satellite service into community-type receivers. However, at this time, the usefulness of these satellites for educational purposes and their effect on the cultural, social, and political institutions of various countries is not known.

With respect to the international legal aspects of the television broadcasting satellite service, it is my view that the proposals that have been put forward are unnecessary at this time. I think it is important to consider that since enforcement procedures are few, international law depends very much upon respect for the law and the goodwill between

---

[50]Busak, The Need for an International Agreement on Direct Broadcasting by Satellite, 1 J. Space L. 139 (1973).

[51]*Id.*

[52]Partial Revision of the Radio Regulations, Geneva, 1971 and Final Protocol: Space Telecommunications, July 17, 1971, [1972] 23 U.S.T. 1527, T.I.A.S. No. 7435 (effective Jan. 1, 1973).

States. Good international law makes for good adherence to the international law and vice versa.

The international community, and particularly the legal community, should carefully analyze and understand the consequences of proposals to control broadcasting from satellites. It should be kept in mind that the kind of satellite broadcasting of most concern, that is, TV broadcasting into any receiver anywhere in the world, is not technically feasible; technical differences between TV systems and existing regulations of the ITU make impractical the use of broadcasting satellites for "intrusion-type" broadcasts. The ITU regulations contain provisions regarding spillover, and states can control unwanted broadcasting rather easily.[53] Unnecessary regulations and restrictions on broadcasting satellites should not be created lest they be used to impede or inhibit the free flow of information by other media where such is legal, and thereby reduce international understanding and cooperation between the peoples of the world.

---

[53] *E.g.*, in some eastern European countries the viewing of western TV broadcasts is prevented by the simple expedient of having the audio channel an extra MHz from the video channel. *See* O.T. Rep. No. 74-28, *supra* note 23.