

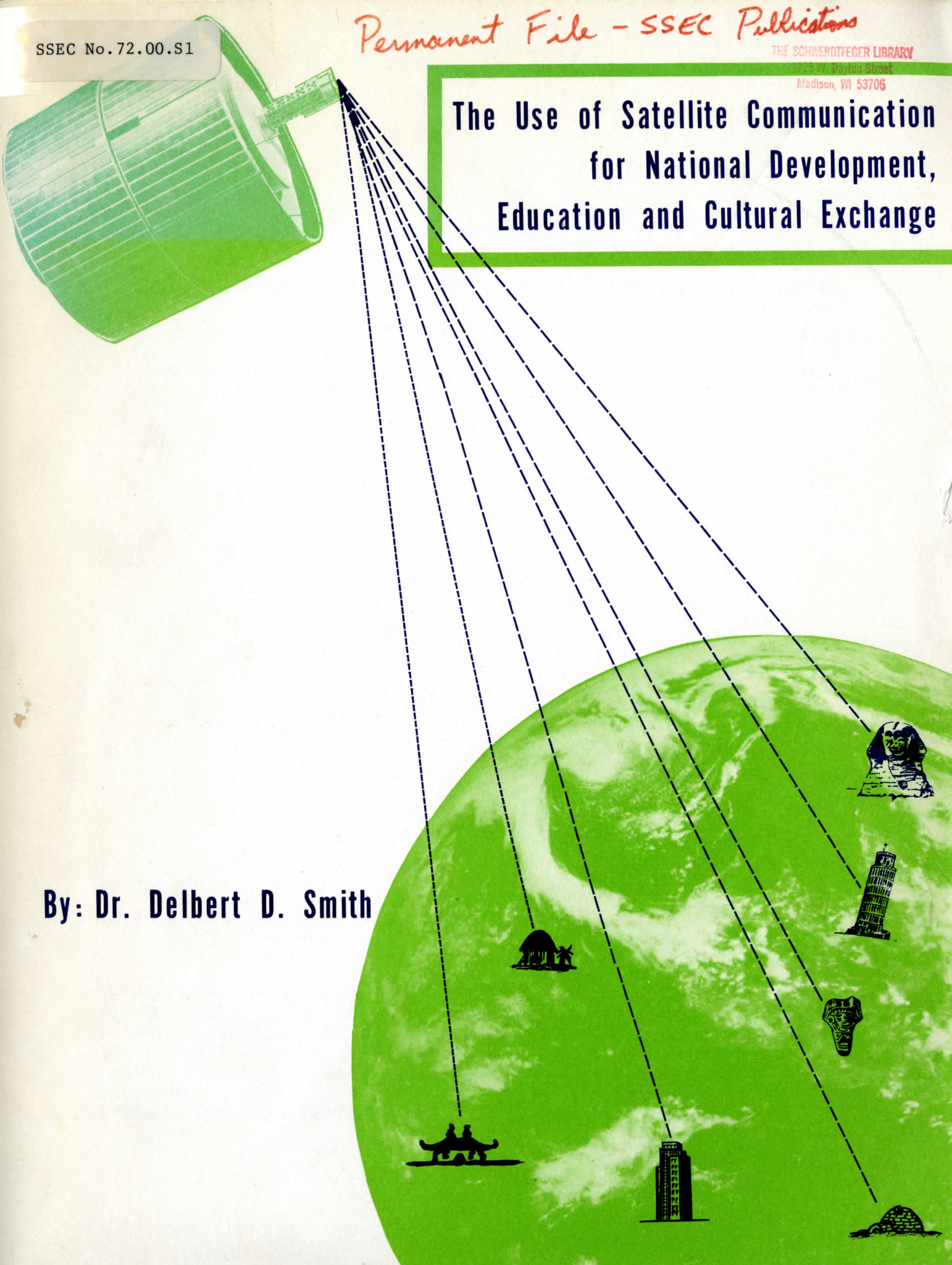
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# The Use of Satellite Communication for National Development, Education and Cultural Exchange

By: Dr. Delbert D. Smith



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THE USE OF SATELLITE COMMUNICATION FOR NATIONAL DEVELOPMENT,  
EDUCATION AND CULTURAL EXCHANGE

by

Delbert D. Smith\*

1972

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## INTRODUCTION

The process of imparting knowledge and information for whatever purpose - improving economic standards, encouraging political and social development or developing cultural ideals - involves communication. Under ideal circumstances the means of communication would be personal interchange. But this is not always possible, and thus some form of mass media must be used. Since it has been found that broadcasting is a particularly effective means of mass communication, it is widely used for educational and developmental purposes. Given the great distances between the teacher and learner in some situations, it becomes necessary to develop an effective long range communication carrier. This may be a radio or television broadcast via terrestrial means or it may be a transmission via satellite. It is a consideration of this latter, and most technologically advanced transmission means, the communication satellite, that forms the basis for this work.

There are many benefits to be derived from a communication satellite: education, national development and cultural exchange. If one accepts the premise that effective communication leads to the adoption of innovations and that this in turn leads to social change, economic development and political maturation,<sup>1</sup> it becomes necessary for one to fully understand the ramifications of communication satellite technology and its application to human needs. Concentrating on only a single aspect of the

communication satellite will lead to inadequate conclusions. What is needed is a comprehensive or systems analysis approach. Within this context the emphasis must be on software development. The technology and the intellectual elements of the system must be considered together with the stated goals of furthering the education, development and culture of mankind. "Times have changed, of course, but communication satellites are only means to an end - they are carriers of the message - and the greatest problem of all is likely to be the provision of the 'software'."2

It is the potential of the communications satellite that must be realized. While we are now at the experimentation stage, we will shortly be considering operational satellite systems for which a great deal of planning must be done.

There is no utilization of modern means of information which has so interested the planners of developing countries and various individuals and groups concerned with economic and social expansion, as the possibility of using space communication to raise the level of instruction by an increased application of television. Where highly qualified teachers are rare, communication by satellite permits vast sectors of the population to benefit from better teaching; where scholarly establishments lack pedagogical auxiliaries it offers the possibility of distributing audio-visual material and making demonstrations from a central studio; where it is necessary to give special courses or particular instruction, it permits the elaboration of programs at one point and their distribution in all areas of the country. Thus, thanks to communication by satellite, education will perhaps be able to win out in the race against time, and perhaps it will be possible to disseminate a high quality education even in the most remote zones.<sup>3</sup>



In particular geographic areas, such as Latin America, the need for recourse to modern technology for educational purposes was recognized by a UNESCO mission.

The mission is convinced that the demands that are and will be made on the educational systems of the countries visited cannot possibly be fulfilled through the traditional methods. Quantitatively, the demands due to population growth, national programmes to achieve universal primary education of up to 5-6 years of schooling, to extend and redirect secondary education, to increase and reorient higher education, to expand vocational training in all fields, can only be met by a massive use of modern technology as provided particularly by television. If to these quantitative demands are added the qualitative demands in terms of a higher level of capacity amongst the teachers, the introduction of new methodology and teaching methods, the insistence on a massive extension of technical and scientific training, and the initiation of new programmes intended to contribute to the modification of attitudes, the conclusion seems inevitable that the methods to be used must be as massive as the changes required.<sup>4</sup>

The use of a communication satellite is indeed a massive methodology, but it is also one which can provide for specialized programming to cultural units and other special interest groups. It will enable the traditional distinctions between information and education to be merged "...since valid information educates and valid education also informs."<sup>5</sup> Thus, the acquisition of knowledge will create a desire for change and innovation which will benefit all nations. The resultant flow of information and education will result in global progress while at the same time maintaining respect for discrete national cultures.

It is the purpose of this work to consider the potentialities of space communication for education, national development and cultural exchange, and to discuss program content and the cultural and social aspects of developing communication satellite systems. Section II of this work deals with communication satellite system alternatives, drawing distinctions between distribution, community and direct broadcast satellite systems. It also provides a listing of space-related definitions, and in a consideration of the basic economics of satellite communication draws a comparison with terrestrial distribution systems. It concludes with a short history of broadcasting satellites and their advantages to rural areas.

Section III considers the basic alternatives in educational and national development satellite program content areas; this information is necessary for national decision-makers planning satellite systems. Emphasis is put on the need for innovative educational methodology and the options for different types of educational programming. This information provides a basis for the following Section, Section IV, which discusses the complementary software that is available for communication satellite systems. In this Section, one-way and two-way transmissions are considered as well as computer/satellite interface, video discs and other technological developments. Cost estimates are given for the various system configurations.

Inasmuch as space broadcasting system development will be regional or even global in nature, it is necessary to consider

the relevant legal ramifications with particular consideration given to international program content regulation. This is the subject of Section V. Query whether the regulation of space broadcasting should be at the point of transmission or the point of reception of the broadcast? The Harmful Effects Doctrine is offered along with a set of determinative criteria for dealing with the various international legal problems that will arise.

In order to appreciate the potential of space broadcasting, it is necessary to have an understanding of the current and planned communication satellite experimentation in the educational and national development areas. Thus, Section VI discusses these experiments together with an evaluation of each. The differing approaches, scope and magnitude of the experiments indicate a basis for charting the direction for future experimentation.

Section VII outlines the educational, cooperative and cultural exchange aspects of satellite broadcasting and develops a model for their application. These aspects include an analysis of national and regional objectives, an inventory of the available resources, curricula planning, educational research, international cooperation and international co-production. The following Section, Section VIII, then considers an application of the model for a comprehensive communication satellite system using the South Pacific as an example. The needs of the region, the special nature of these needs, and the steps to be undertaken to develop the system are presented.

There will be a number of international law problems surrounding the development of a comprehensive communication satellite system, the major one of which is the question of liability. Therefore, Section IX addresses this question and also considers the recent World Administrative Radio Conference for Space Communication which dealt with various aspects of communication satellite operation, frequency allocation and the special case of the international educational community.

Finally, Section X discusses the intercultural implications of satellite communication. All of the preceding material bears on this section since it is only through an understanding of the intercultural problems of communication satellites that the potential of this medium will be realized. By considering all of the above sections as parts of a whole, it will be possible to gauge the potentialities of space broadcasting, and thus enable the development of space broadcasting for educational, national development and cultural exchange purposes to proceed in a rational and desirable way.

## FOOTNOTES

1. See I.B. Singh and B.N. Sahay, Communication Behaviour and Social Change (1972).
2. E. Lloyd Sommerlad, "The Use of Space Communication for Education and Development - Evolution and Prospects," at 39. Colloque International, Nice, France, 2-7 May 1971.
3. Arrangements internationaux de nature à développer l'emploi des communications spatiales pour la libre circulation de l'information - UNESCO (distribution limitée) 1969 at 13.
4. Preparatory Study of the use of satellite communication for education and national development in South America - UNESCO (distribution limited) 1969 at 3.
5. Id. at 3-4.

## II

COMMUNICATION SATELLITE SYSTEM ALTERNATIVES

In the early stages of the development of communication satellites, three categories emerged: telecommunications, broadcasting, and distribution.<sup>1</sup> Telecommunications satellites are designed for traffic handling of such point-to-point telecommunications as telephone, telegraph, facsimile and data transmission, as well as the exchange of radio and television programs (both monochrome and color). Broadcast satellites are primarily intended for direct transmission of radio and television programs to home receivers of the general public. The purpose of distribution satellites is to disseminate radio and television programs directly to local stations for re-broadcast to the public.

The above classifications have been enlarged slightly by the National Aeronautics and Space Administration in the United States to include:

Class A - Distribution Satellite

This is a system of television distribution in which a satellite broadcasts on many channels to elaborate ground receivers for retransmission by conventional stations (national emphasis).

Class B - Community Satellite

This system requires a more modest receiver complex than Class A, with distribution of program material to multiple

users being made by cable, microwave, or low-power re-broadcast channels (limited geographical area).

#### Class C - Direct Broadcast Satellite

This system includes direct reception of a television signal in homes or schools, using supplementary antennas and preamplifiers attached to receiver sets.

#### Class VC - Direct Voice Broadcast

This is the same as Class C, (i.e., direct broadcast), but transmits FM-voice instead of television.

The most critical factors influencing the design of satellite distribution systems for television are: the number of ground stations receiving satellite signals, the required video quality, the number of simultaneous video channels to be transmitted, and the transmission frequencies. These factors all contribute to grouping the systems into the three basic categories:<sup>2</sup>

- (1) The distribution system uses small, low-power satellites to relay numerous television channels between a few large, sophisticated earth terminals. They, in turn, route the signals to a standard broadcast station for distribution in the local area. Commercial and public television networking and international exchange networking are primary applications. The earth terminals use high-gain, narrow beam-width tracking antennas with cooled, low-noise receivers to meet the high signal quality recommended by the International Radio Consultative Committee (CCIR).

- (2) The community system uses moderately-sized, medium-power satellites to relay a small number of television channels to many augmented receivers, either for direct viewing by groups, or, indirectly, through a local broadcasting system. Educational television/instructional television (ETV/ITV) systems, cable-television (CATV) systems and closed-circuit television (CCTV) are primary applications. The earth terminals use medium-sized fixed antennas with uncooled low-noise receivers, but performance requirements do not meet CCIR recommendations. The large numbers of earth stations permit a low cost approach to the design of the earth segment at the expense of higher performance in the satellite segment. This can result in a reduction in overall cost of the system.
- (3) The direct broadcast system uses large, high-power satellites, and broadcasts a few television channels directly to home receivers which may or may not be augmented. For use on a broad scale, the major concern of the system designer is to minimize the home receiver cost, thus placing the technological burden on the satellite segment.

At the World Administrative Radio Conference held in Geneva, Switzerland this past summer a number of specific definitions and revisions were made for the Radio Regulations of the International Telecommunication Union. The relevant ones include:



Broadcasting Satellite Service

A radiocommunication service in which signals transmitted or retransmitted by space stations are intended for direct reception\* by the general public.

Individual reception (in the broadcasting satellite service)

The reception of emissions from a broadcasting satellite space station by simple domestic installations and in particular those possessing small antennae.

Community reception (in the broadcasting satellite service)

The reception of emissions from a broadcasting satellite space station 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.

Fixed Satellite Service

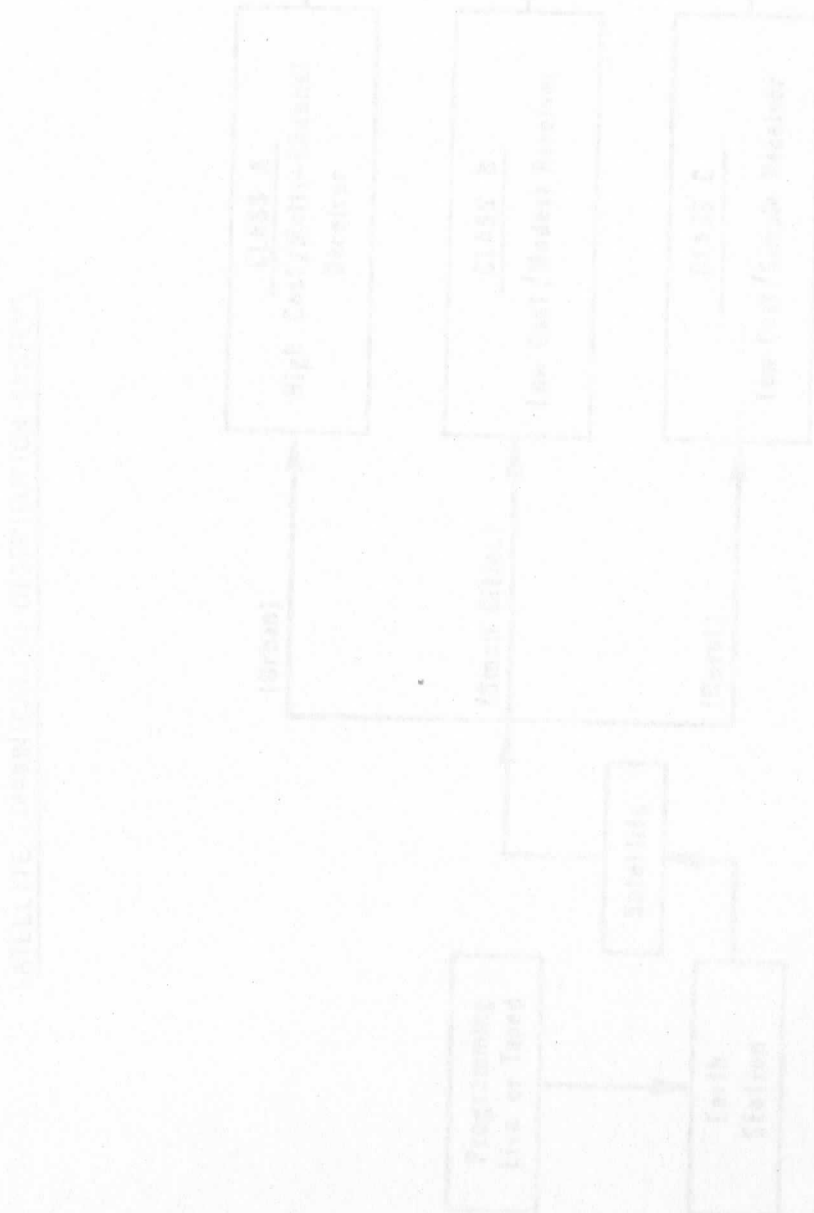
A radiocommunication service:

between earth stations at specified fixed points when one or more satellites are used; in some cases this service included satellite to satellite links, which may also be effected in the inter-satellite service;

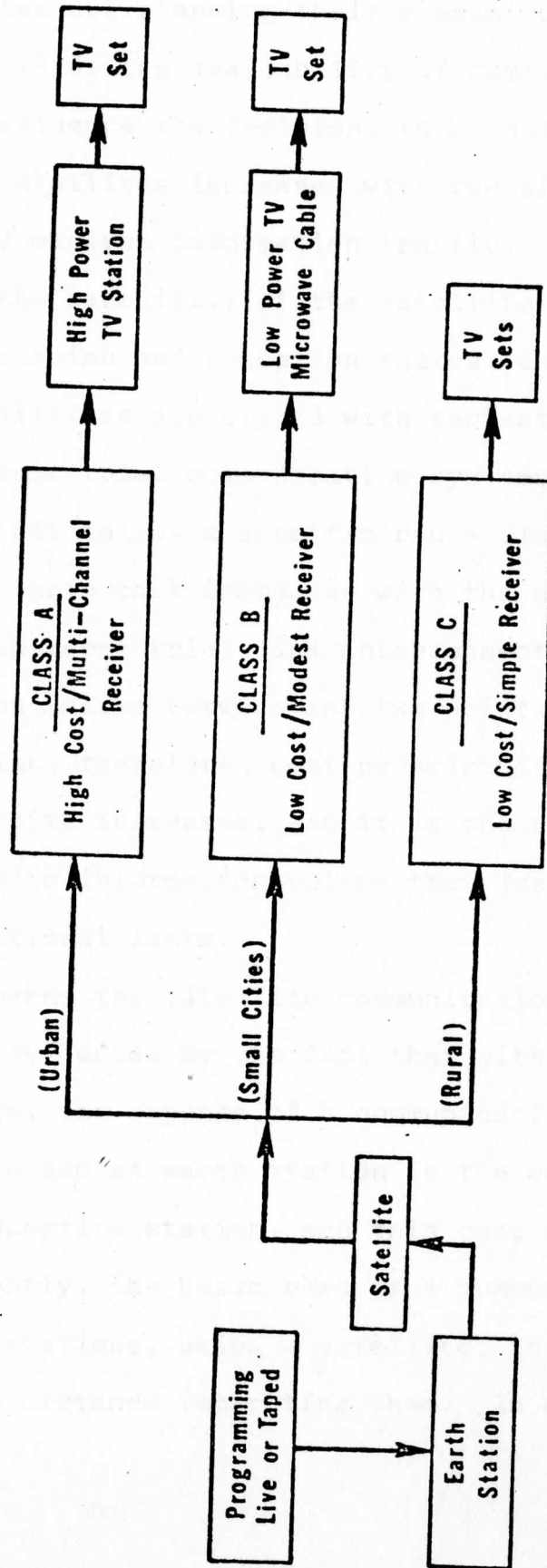
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\*In the broadcasting satellite service, the term "direct reception" shall encompass both individual reception and community reception.

for connexion between one or more earth stations at specified fixed points and satellites used for a service other than the fixed satellite service (for example, the mobile satellite service, broadcasting satellite service, etc.).

These definitions will no doubt change as the technology advances but they are good guidelines for observers wishing to categorize satellite communication services.



SATELLITE COMMUNICATION DISTRIBUTION SYSTEMS



BASIC ECONOMICS OF SATELLITE COMMUNICATION

When countries are planning their communications systems for the 1970s and 1980s the availability of communication satellite technology will influence the decisions to be made. The advantage of communication satellites increases with the size of the area to be serviced and minimum information traffic. This advantage is a function of the capability of the satellite to use multiple information transmission and reception routes, as opposed to the single route capabilities associated with terrestrial communication systems. Terrestrial communication systems have interconnecting links that follow a specific route along the surface of the earth, and their cost increases with the number of locations they connect. Each terrestrial link interconnects two points, and the information volume between any two points justifies the cost of the link; therefore, cost-per-circuit diminishes as the number of circuits increases, and it is the anticipation of heavy increases in information volume that justifies the investment in additional links.

Now, as concerns the satellite communication system, the cost advantage is evidenced by the fact that within the coverage area of a satellite, the expense of a communications link between a satellite and an earth station is the cost of the transmitting or reception station, and this cost is generally uniform. Consequently, the basic cost of a communication link between two earth stations, using a satellite, is mainly independent of the distance separating them. In addition,

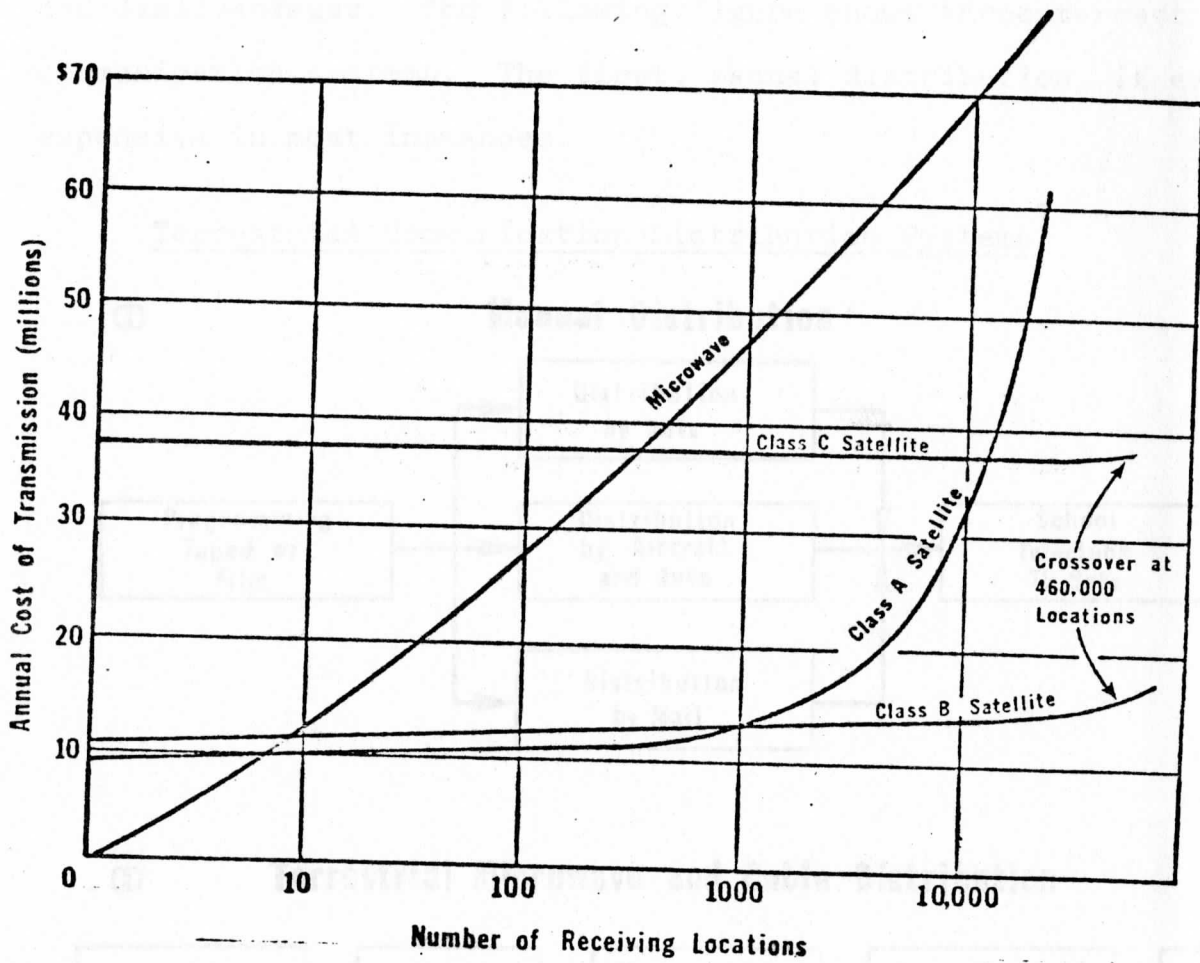
since a transmitting or receiving station can be linked with many other stations simultaneously, via the same satellites relay, the basic investment per communication route diminishes as the number of such routes increases on a per-station basis. It would be misleading, though, not to point out that variable costs for satellites and earth stations do increase with the number of routes served.<sup>4</sup>

To determine total costs of satellite service, one must add to these basic costs the per-circuit costs of both satellite and earth station facilities. Since both these facilities serve multiple routes, the volume of traffic over a given route has little effect on per-circuit costs. The total volume of traffic through each facility - satellite or earth station - like that of terrestrial systems reduces per-circuit cost as the number of circuits increases. Thus, per-circuit costs of satellite interconnection within a given coverage zone are largely independent of the number of routes or individual route traffic volume but inversely proportional to the total traffic volume over all routes served.<sup>5</sup>

Therefore, it would appear that satellites do have cost advantages for long, low-traffic routes. This is particularly true when several routes are being served by one satellite and one earth station, but a terrestrial system will be a competitor for high-volume, short-route information transmission, particularly when only one route is needed for a particular location.

The following chart indicates that since the satellite system does not require numerous duplications along the transmission path, the number of routes has a smaller effect on the total cost of the system.

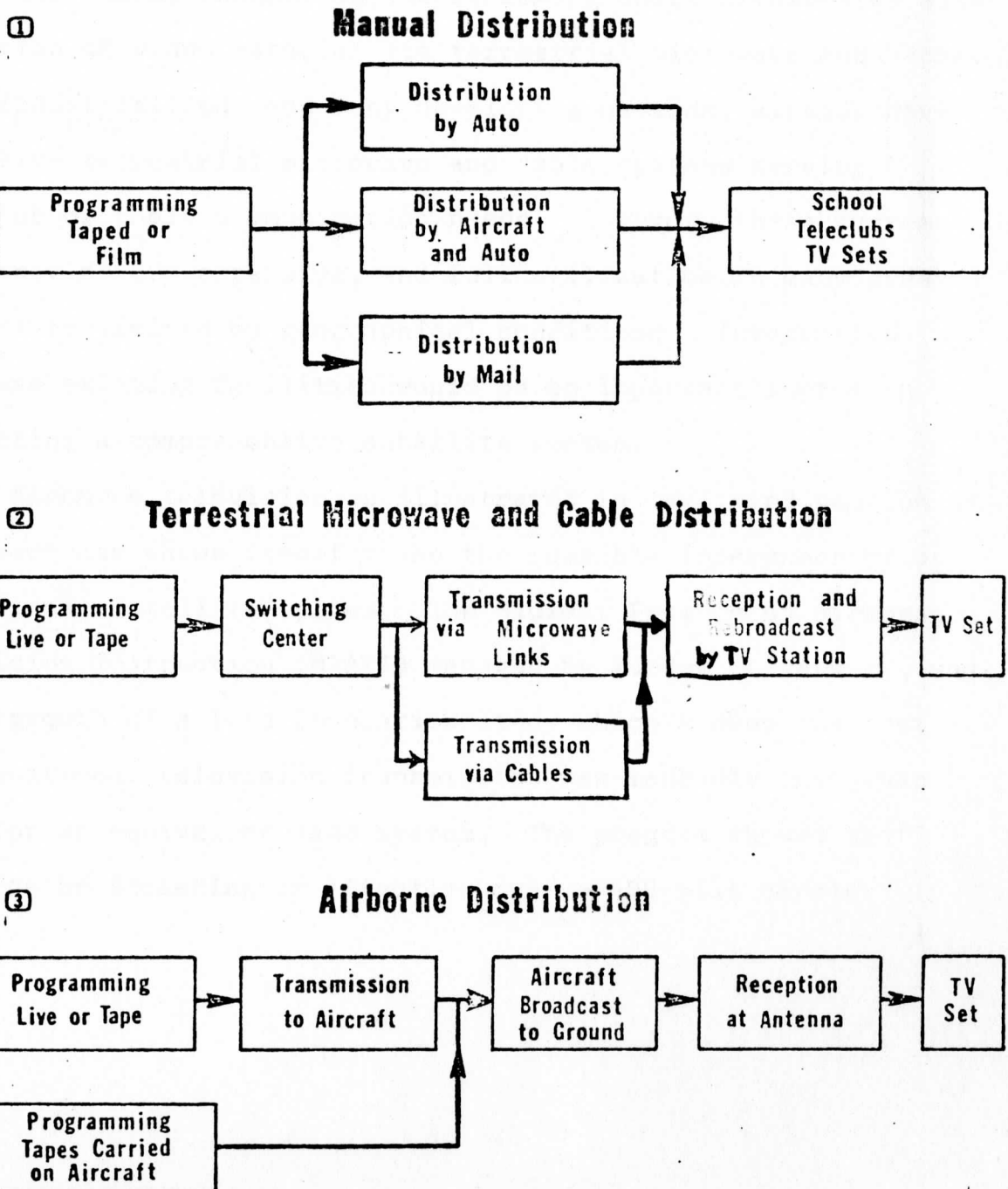
SATELLITE AND MICROWAVE DISTRIBUTION SYSTEMS COSTS<sup>6</sup>



## TERRESTRIAL COMMUNICATION DISTRIBUTION SYSTEMS

There are a number of alternative distribution systems utilizing terrestrial means, each of which has certain advantages and disadvantages. The following figure shows three terrestrial communication systems. The first, manual distribution, is extremely expensive in most instances.

### Terrestrial Communication Distribution Systems<sup>7</sup>



The determining advantage of television over film (and video tape) lies in distribution economies. Further, the staggering costs of producing enough prints, and the logistics by which films and projectors are brought together at the correct time and place, are almost impossible to manage on the scale necessary to meet programming needs for educational systems in developed or developing countries.<sup>8</sup>

The second example on the following chart illustrates distribution of video material via terrestrial microwave and cable. Most industrialized, and many developing nations, already have extensive terrestrial microwave and cable systems serving portions of their communication needs. However, these systems have proven very expensive, and full utilization in many areas is further limited by geographical conditions. Integration of these existing facilities could be an important factor in completing a comprehensive satellite system.

Airborne television as illustrated in the third section of the chart has shown itself to be the possible forerunner of an educational satellite system. The Midwest Program on Airborne Television Instruction (MPATI) managed by Purdue University, was an outgrowth of a Ford Foundation study which showed the cost of educational television transmission was markedly less than that for an equivalent land system. The program showed that airborne broadcasting is effective over a 400-mile circle.



ECONOMIC COMPARISON OF PROGRAM ALTERNATIVES\*<sup>9</sup>

Distribution System	Number of Users	Annual Cost of Display \$	Annual trans- mission Costs \$	Total Program Annual Cost \$ ***
Aircraft dis- tribution tape	20	618,700**	54,300	673,000
Aircraft and auto distribution tape	20	618,700**	37,300	656,000
Terrestrial and 25 broadcasters	1,000	71,700	189,300	261,000
Terrestrial and 200 broadcasters	1,000	71,700	76,200	147,900
Airborne broadcasting	1,000	71,700	25,300	97,000
Satellite with 200 receivers (distribution)	1,000	71,700	60,300	132,000
Satellite with 70,599 receivers (community broadcast)	1,000	71,700	17,300	89,000
Satellite with 1,000,000 receivers (direct broadcast)	1,000	71,700	51,300	123,000

\* All numbers should be interpreted in thousands, e.g., 20= 20,000.

\*\* Includes annual costs for television tape.

\*\*\* Annual costs are the sum of depreciation, amortization, maintenance and operation costs expressed in 1967 dollars. Capital costs are assumed to be zero.

A COMMUNICATION SYSTEM EXAMPLE

The basic problem addressed in the example is the cost-effectiveness of introducing a broadly distributed television service in the shortest period of time, and involves a hypothetical country having an area of 1,000 square miles and a population of 70 million dispersed over 20,256 cities and towns grouped in the following manner:

- 1 of 5,000,000
- 8 of 1,000,000 (500 miles apart)
- 16 of 100,000 (250 miles apart)
- 500 of 10,000 (50 miles apart)
- 20,000 of 2,500 (7 miles apart)

The environment was that of a less-developed country which had few paved roads, sparse terrestrial communications (exception: major cities), primitive or second-class airports (16 largest cities), no trained personnel, and few maintenance facilities.<sup>10</sup>

Acceptable distribution of the information could occur in two ways: (1) transmit to 20,000 locations for group viewing, or (2) transmit to 1,000,000 locations for group or single family viewing. In both instances there would be variations in the number of people viewing the programs, and in the viewers' travel distances. The following chart contains basic cost information for information distribution for five terrestrial and three satellite support communication systems.

The distribution systems used in this chart are defined as follows: the automotive/aircraft distribution system produces all of the television tapes in one city and delivers them via

a C-140-type cargo aircraft to sixteen of the country's largest cities. Each city uses small planes, such as Piper aircraft, to drop the tapes to sixty pickup points, and motor vehicles are then used to deliver them to 20,000 towns and villages where they are displayed on one video display unit per population center. The tapes are recycled daily to provide twelve hours of programming each day for the viewing public. The aircraft distribution system produces and delivers the tapes in the same fashion as above, but with the exception that smaller aircraft are used to deliver the tapes directly to the towns and villages. In the airborne distribution system the tapes are produced in the same manner, but aircraft from seven centrally-located airports fly broadcast patterns at seven locations and broadcast to receivers via UHF and VHF for twelve hours a day.

Terrestrial system (1) is a microwave system interconnecting cities having populations of 10,000 or more. Information is broadcast over a fifty-mile radius from the twenty-five largest cities via UHF and VHF stations. Coaxial cable is used for distribution to the remaining cities. Terrestrial system (2) is the same basic system as (1) with the exception that 200 of the cities with a population above 10,000 rebroadcast via conventional UHF (VHF) facilities.

Satellite system (A) is a distribution system in which information is transmitted from a central transmitter via a satellite to 200 regional locations where the information is transmitted by conventional UHF or VHF receivers within a radius

RELATIVE PERFORMANCE OF ALTERNATIVE DISTRIBUTION SYSTEMS<sup>11</sup>

Criteria	ETV Distribution System			
	Video Tape	Microwave	Rebroad- cast Satellite	Direct Broadcast Satellite
<u>Educational</u>				
Ability to pace and control modernization	Poor	Good	Good	Exc.
Ability to reflect local programming needs	Exc.	Fair	Poor	Poor
Psychological impetus for modernization	Fair	Fair	Good	Exc.
Encouragement for multi-national integration	Poor	Fair	Good	Exc.
Potential for growth in geographic coverage	Fair	Poor	Fair	Exc.
Simultaneous reception of important events	None	Good	Good	Exc.
<u>Management</u>				
Simplicity of local management	Poor	Fair	Fair	Good
Simplicity of central management	Good	Exc.	Fair	Fair
Adaptability to pilot tests of software	Exc.	Fair	Poor	Poor
<u>Indirect Effects</u>				
Spillover benefits for local communication	Good	Exc.	Good	Poor
Opportunity to develop local industries	Exc.	Good	Fair	Fair
<u>Reliability</u>				
Freedom from overall system interruption	Exc.	Good	Fair	Poor
Freedom from local failures	Poor	Fair	Fair	Good
<u>Fiscal</u>				
Cost of covering major urban centers	Exc.	Good	Fair	Poor
Cost of covering entire country	Fair	Poor	Poor	Good
Potential for major foreign assistance	Poor	Fair	Good	Good

of fifty miles. Satellite system (B) is a community broadcast system - information is transmitted from a central transmitter via a satellite to 70,599 receivers for rebroadcast to cities with a broadcasting radius of twenty or fifty miles, and to stations broadcasting directly to receivers. Satellite system (C) is a direct broadcast system. Here information is transmitted via a satellite directly to 1,000,000 television receivers.

Generally, all satellite distribution systems have the advantage over all other systems, with the exception of airborne broadcast. But even here the class B satellite system is cheaper by \$8 million. This example then serves to emphasize the possibility of savings through usage of satellite distribution systems.

It should be noted that the medium receiving most of the attention for satellite distribution is television. As terrestrially-distributed ETV/ITV has shown, television adds to rather than subtracts from costs of on-going education. This additional cost factor will hold true for satellite distributed television to on-going terrestrially-supported educational systems.

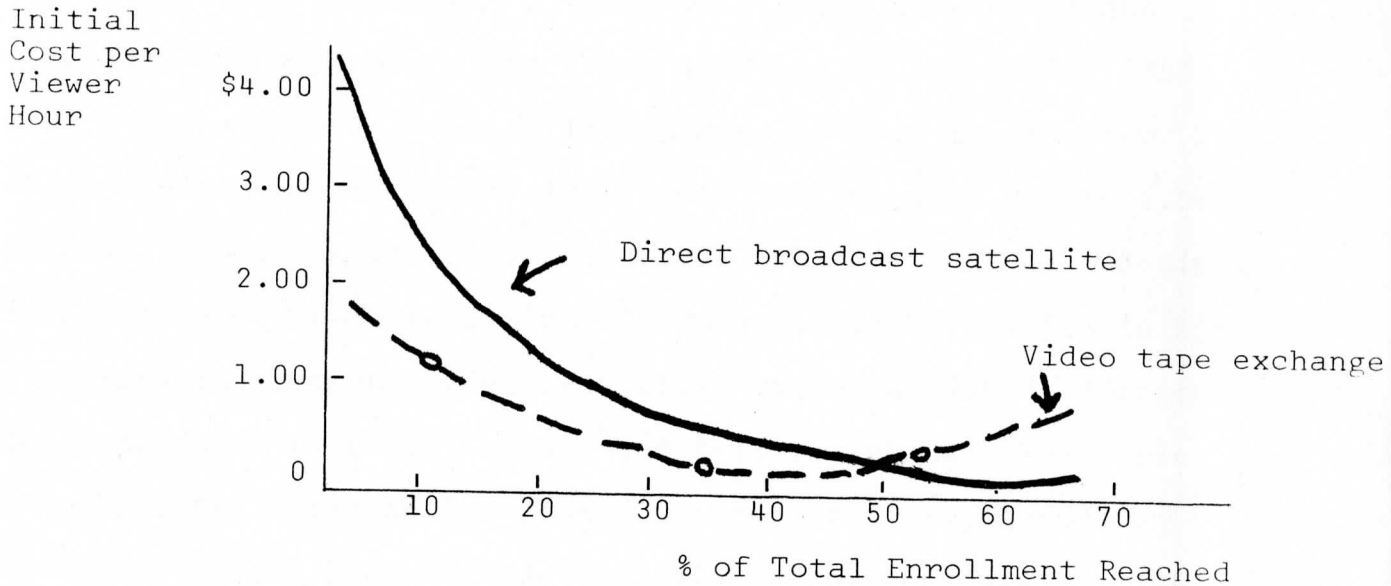
It is possible that the real economic advantage of satellite distribution systems will be related to doing something new or providing better or hitherto nonexistent services in areas where terrestrial distribution systems are either limited, nonexistent, or else not geared to providing a desired service. Consequently, satellite distribution systems undoubtedly will be justified by developed and less-developed countries on the basis of offering services that could not be offered as efficiently and effectively and in the desired time via terrestrial distribution systems.

Other factors such as geography, population density and educational objectives may serve as major determinants in choosing distribution modes. In locales where population is concentrated in a few areas microwave, cable or video tape could prove a more practical solution to the communication problem. However, in large countries such as India or Brazil, where populations are scattered and geography and transportation problems would probably render the use of video tape and microwave impractical, a satellite might help in filling missing links in the communication network.

The following chart indicates the possible value of the four basic types of distribution as they relate to certain criteria, suggesting that the selection of broadcast distribution systems is a complex undertaking involving a multitude of variables and trade-offs. In actuality, the selection process becomes a function of a mix of objectives which somehow must be compatible.

Other considerations will have to be taken into account, in particular, the results of technico-economic studies. Up to what point, for example, is there interest in utilizing tape recordings rather than messages from a satellite? At what point are the latter more advantageous than any other system? As an example, the following diagram established for Columbia reveals that in that country the circulation of tape recordings became more expensive than recourse to the satellite, if one wanted to reach more than 60 percent of the pupils.<sup>12</sup>

COST-EFFECTIVENESS OF TWO ETV DISTRIBUTION SYSTEMS FOR COLUMBIA



The satellite may also be used for regional development, as for example in Europe.

Communication-satellite service, with demand-assigned multiple access, may provide efficient and flexible exchange of wide-band information among various groups of higher education institutes with gradual development according to actual needs. Broadcasting-satellite service, e.g. with twelve narrow-beam satellites each illuminating a different part of Europe and operating in a semi-direct mode through community receivers supplying individual homes by cables, can furnish educational television programs to a continental audience and separate national or regional program supply, too. The community receivers may also serve as the nucleus of video-phone network development. Satellite service costs compare favourably with terrestrial systems."<sup>13</sup>

Thus the satellite can be inserted into a communications system involving network broadcasting and distribution by video or audio tapes. The combining of these various components will provide the optimum system.

DEVELOPMENT OF BROADCASTING SATELLITES

The first experiment with an artificial communications satellite was made when Echo 1 was launched on August 12, 1960. Echo 1 was a gas-filled plastic balloon 100 feet in diameter which orbited the earth at altitudes ranging from 945 to 1,049 miles. In both instances cited above, the satellite was passive, i.e., it served as a reflector.<sup>14</sup> Once the technical feasibility of artificial communication satellites was established, American Telephone and Telegraph Company and Bell Telephone Laboratories developed the first active communication satellite, launching TELSTAR I into a low-altitude elliptical orbit on July 10, 1962.<sup>15</sup> NASA provided Delta launch vehicle and tracking facilities on a reimbursable basis. In addition to transmitting telephone messages, facsimile and telephotos, the first live monochrome and color television transmission took place between Europe and the United States of America. TELSTAR I "died" less than a year later because of a technical error, and on May 7, 1963 TELSTAR II was orbited.

The National Aeronautics and Space Administration, drawing upon TELSTAR technology, initiated the RELAY satellite program - launching RELAY I on December 13, 1962 and RELAY II in January 1964.<sup>16</sup> This program demonstrated the feasibility of two-way transmission of long distance color television via satellite, and of other types of information as well. Included in these early demonstration experiments in television distribution were the first satellite communications between North and South America, the first transpacific television transmission from the United States to



Japan, and transmission of electroencephalograms to specialists in the United States. RELAY I was also used to telecast to viewers in Europe, Japan and the Soviet Union, the events surrounding President Kennedy's assassination, thus proving the utility of satellites for international networking. The RELAY satellite program proved the feasibility of low and medium altitude communications satellites, and provided the impetus for development of satellite communications earth terminals throughout the world.

The high cost of a satellite communication system using non-synchronous orbit added impetus to the effort to realize Arthur Clarke's predictions concerning synchronous satellites. On February 14, 1963, SYNCOM I was launched and achieved the correct orbit, but its electronic equipment failed within minutes. In July of the same year, SYNCOM II was placed into synchronous orbit and demonstrated the practicality of synchronous communications satellites. Although SYNCOM II was not designed for television transmission, there was interest in using it, or another such system, to relay the 1964 Olympic Games from Japan. To determine the feasibility of this, SYNCOM II was used to conduct an experiment to evaluate audio-video quality. Television network officials judged the quality satisfactory for rebroadcast and SYNCOM III, launched in August, 1964, was put into orbit over the Pacific Ocean in time to relay portions of the 1964 Olympics from Tokyo to California.<sup>17</sup> From there the program was distributed throughout the United States to Canada, Mexico and Europe. RELAY II was used to retransmit live portions directly to Europe, thus

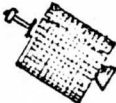

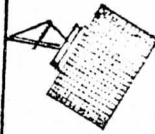
demonstrating the feasibility of the simultaneous global television distribution. The SYNCOM satellite provided the basis for an international telecommunication satellite system.

The first international attempt to exploit satellite technology for international communications purposes was initiated in 1964 with the establishment of the International Telecommunications Satellite Consortium (INTELSAT). By 1967 it had placed four satellites in geostationary orbit and within the next two years three more were added.

INTELSAT I (Early Bird) was put in orbit on April 6, 1965 over the Atlantic Ocean relaying signals to the northern part of the Atlantic basin via 240 voice circuits. It was followed shortly thereafter by the INTELSAT II series, launched throughout 1966 and 1967, which also carried 240 voice circuits, but covered larger geographical areas. INTELSAT III represented a new generation of satellites, with 1,000 voice circuits and a mechanically despun earth coverage antenna. Seven of that series were launched; two were unsuccessful.

In January of 1971, the INTELSAT IV satellite was launched, with a unique antenna system that can transmit searchlight beams of concentrated power onto particular earth areas, and handling 6,000 voice circuits and 12 television channels. The system became operational over the Atlantic area in mid-1971. The following chart compares the characteristics of the INTELSAT satellites.

# INTELSAT SATELLITE CHARACTERISTICS 18

PROFILE	INTELSAT I	INTELSAT II	INTELSAT III	INTELSAT IV
				
SIZE	28.4 inches diameter 23.25 inches length	56.0 inches diameter 26.5 inches length	56.0 inches diameter 41.0 inches length	93.7 inches diameter 111.0 inches solar panel height 208.0 inches overall height
WEIGHT (lbs)	150 at launch 85 synchronous	357 at launch 190 synchronous	647 at launch 334 synchronous	3,058 at launch 1,544 synchronous
DESIGNED LIFE	18 months	36 months	60 months	84 months
DISTRIBUTION	Point to point only	Multipoint	Multipoint	Multipoint
ACCESS CAPABILITY	No multiple access	Multiple access	Multiple access	Multiple access
CAPACITY	240 circuits or one TV channel	240 circuits or one TV channel	1,200 circuits, 4 TV channels or combination thereof	3-9000 circuits or 12 TV channels or combination thereof
LAUNCH VEHICLE	McDonnell/Douglas Three-Stage, Thrust Augmented Delta	McDonnell/Douglas Three-Stage, Thrust Augmented Improved Delta	McDonnell/Douglas, Three-Stage, Long- Tank Delta	General Dynamics, Convair Division Atlas/Centaur
SATELLITE MANUFACTURER	Hughes Aircraft Co.	Hughes Aircraft Co.	TRW Systems, Inc.	Hughes Aircraft Co.

In April 1971 NASA and the Canadian Government's Department of Communication signed a formal agreement for a Cooperative Application Satellite project (CAS-C). A Communications Technology Satellite (CTS) is to be developed and flight-tested by 1974 with the objectives of advancing the state-of-the-art in spacecraft and related ground technologies, relevant to future educational broadcasting and remote-area communications, and developing technologies above 10 GHz.

In 1965, the Soviet Union launched MOLNIYA I, which is an active repeater (amplifies the power of incoming messages) and handles voice, television, teletype, and facsimile information. The ORBITA communication system, based on this satellite system, became operational in the USSR in November 1967. Unlike the INTELSAT system, ORBITA did not have a synchronous orbit. Its orbit is elongated-elliptical, thus ensuring that the satellite spends a major portion of its time within broadcast distance of the USSR. Six MOLNIYA satellites are required in orbit above the earth in order to provide continuous service to all areas of the Soviet Union.

Parallel with the INTELSAT satellite program, NASA initiated the multi-disciplinary Application Technology Satellite program (ATS) in 1965 to provide the basis for flights which would lead to new operational systems capabilities. The ATS-1, launched in December 1966, demonstrated the feasibility of using electronically-despun antennas<sup>19</sup> on geostationary, spin-stabilized spacecraft.

The 1967 ATS-3 satellite demonstrated the mechanically despun antenna, and this improvement in directivity, coupled with its

higher power transmitters, permitted television transmission to terminals considerably smaller than those used in the INTELSAT system.

In June 1967, ATS-1 satellite was used in a worldwide two-hour television program sponsored by the European Broadcasting Union (EBU). The ATS-1 and the two INTELSAT-II satellites connected Europe, the Americas, Japan and Australia. The ATS-I and -III satellites have been made available to organizations for experiments demonstrating new applications and providing experience in the applied uses of satellites. The following chart illustrates the progression of U.S. experimental satellites.

An ATS-Alpha satellite program has been initiated, and the first in the series - the ATS-E - was a failure (millimeter-wave propagation experiment). But the ATS-F and -G, are being developed to test the deployment of an antenna thirty feet in diameter, and to pointing accuracy, hopefully, of 0.1 degree. Because of their large-aperture deployable antenna and associated multiple-frequency feed they can transmit powerful, highly directional television signals to relatively small and inexpensive ground receivers. Satellite technologies will be further tested to determine the feasibility of improving mass instructional broadcasting in developing and developed regions of the world.

Objectives of the ATS-H class of satellite (possible first launch in 1976 or 1977) will be to develop and demonstrate space technology required for future information systems. It is anticipated that such systems will require high-powered transmitters,

U.S. EXPERIMENTAL COMMUNICATION SATELLITE LAUNCHES 20

Satellite	Year												
	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
SCORE	▼												
ECHO I			▼										
COURIER			▼										
TELSTAR I					▼								
RELAY I					▼								
SYNCOM I					▼								
TELSTAR II					▼								
SYNCOM II					▼								
RELAY II						▼							
ECHO II						▼							
SYNCOM III							▼						
ATS- 1									▼				
ATS- 2										▼			
ATS- 3										▼			
ATS- 4											▼*		
ATS- 5												▼*	

\*Unsuccessful

and multiple beams for multiple-link communications for broader dissemination of the signals, in order to reach the total spectrum of users.

#### INHERENT ADVANTAGES TO RURAL AREAS OF SATELLITE COMMUNICATION

An evaluation of communication satellite technology favors the direct-broadcast type of satellite. The ATS Alpha program is the forerunner of the operational system, and such satellites will, if it is desired, transmit signals directly to inexpensive home television receivers. Because of the potential of satellite technology for rapidly modernizing developing countries, the underdeveloped countries are the prime target for proving the value of direct broadcast satellites.

Direct reception via satellite on community receivers has inherent advantages for isolated areas where microwave or other terrestrial means would prove too costly. Distance is no longer a factor in the communication system pertaining to the establishment of rates and tariffs. Coupled with the realization by various international bodies that developing countries should be given every assistance in developing satellite technology, it becomes apparent that preliminary studies should be undertaken to demonstrate the satellite's potential. The benefits to be obtained will narrow the development gap and will benefit all concerned.

While in the traditional model there has been mass media development in urban areas first followed by limited

expansion into rural areas, the utilization of satellite technology can provide overall development in rural areas without a time lag. The costs would be identical no matter where in a given country the reception took place. Regional integration and varied educational activities could take place which would benefit the country.

The problems faced by developing countries concerning illiteracy could be greatly alleviated by an educational satellite system which could supplement and in some cases supplant the local educational experience. A secondary problem concerning inadequate teacher training could also be remedied by a satellite system which could aid in the actual teaching experience and could also be used for special teacher training programs.

The following section illustrates the above premises and demonstrates the feasibility of educational satellite systems to benefit rural and isolated areas.



FOOTNOTES

1. Delbert D. Smith, International Telecommunication Control 170 (1969).
2. Jaffe and Silverman, "Satellites for Television Distribution," Office of Space Science Applications, NASA, Washington D.C. Paper presented at Geno, Italy, June 3, 1971.
3. James R. DuMolin, Background Report on the Basic Software Needs and Considerations of an Educational Satellite, unpublished paper: Washington University, Saint Louis, Mo., International Development Technology Program.
4. Hinchman, "The Technological Environment for International Communication Law," in The International Law of Communications 27 (1971).
5. Id. at 28.
6. Panel 10, Broadcasting, Washington, D.C.: National Academy of Sciences, 1969, at 75.
7. DuMolin, op. cit. note 3.
8. Herbert Ohlman, "Communications Media and Educational Technology: An Overview and Assessment with Reference to Communication Satellites," Washington University, Report No. T-71/1, May, 1971.
9. Panel 10, Broadcasting, prepared by the National Academy of Sciences for the National Aeronautics and Space Administration, Washington D.C. at 67-74 (1969).
10. Id. at 72.
11. Schramm and Platt, "Satellite-Distributed Educational Television For Developing Countries," Prepared for USAID Contract AIP/CSD-1901-SRI Project 7150.
12. Platt, "Education by TV Satellite in Developing Countries," UNESCO, International Institute for Educational Planning, at 17.
13. "Requirements of European Higher Education for Communication Satellite Services and Frequency Band Allocations," Council of Europe, Strasbourg, 1970, Summary Report, at 2.
14. Mitchell R. Sharpe, Satellites and Probes: The Development of Unmanned Space Flight 123 (1970). The first communication satellite used by man was in fact a natural satellite: the moon. In 1958 voice communications were first relayed, via the moon, from Holmdel, New Jersey to Goldstone, California. However, the moon had already been used early in the 1950's by the United States Army for radio contact between Washington, D.C. and Honolulu.

15. The 1966 Aerospace Yearbook 381 (1966).
16. Aeronautics and Space Report of the President, Transmitted to Congress, January 1970, Washington, D.C., at 108.
17. Jaffe and Silverman, op. cit. note 2.
18. Communication Satellite Corporation, Pocket Guide to the Global Satellite System, Washington, D.C. (1970) 3-5.
19. "A despun antenna is one in which the antenna beam or the antenna itself is caused to rotate at the same rate that the satellite is spinning but in the opposite direction. Using this technique, one can keep a highly directional pencil beam directed toward the earth, thus concentrating all the available power toward the earth and increasing the communication capacity of the satellite." Jaffe, International Experimentation with Communication Satellites, U.N. Dkt. No. A/CONF.34/VIII.2; June 3, 1969, at 9.
20. Ibid.

## III

BASIC ALTERNATIVES IN EDUCATIONAL AND NATIONAL DEVELOPMENT  
SATELLITE PROGRAM CONTENT AREAS

It is apparent that the various communication satellite system alternatives mentioned above produce a need for innovative educational methodology. Traditional methods simply will not be adequate. This assumption raises a challenge to the educational community to creatively utilize the available and projected technology.

It has been said that "educational centers throughout the world have been left behind" - compared with the assimilation of new methods over the last 30 years in other fields of human endeavor. While scientific research and progress have constantly revolutionized industrial and other (medical) activities, the science of education has progressed at a snail's pace. It is difficult to conceive of a human activity that has not been transformed by technology. In spite of the fact that history is rife with struggles - often violent - to reject technical innovations, in the end innovation has won out in practically every field. On the other hand, education, until now the least technified of all the professions, has yet to introduce new instruments to facilitate its operations and make them more efficient. Doctors do not reject the contributions of technology; they are aided by them and by assimilating them enhance their speciality and their profession. Educators - specialists in curing ignorance, the worst human illness - should likewise be open to new technical tools which increase their capacity.<sup>1</sup>

While advances in satellite telecommunication technology promise to revolutionize global communication, it is not certain that educational uses of such a satellite system will develop concomitantly. They may, in fact, be lost in the speed with which our society utilizes the more spectacular and commercially viable facets of the medium.

The relevant question for satellite development becomes: What if the medium really is the message? What if the communication satellite - which is a tremendous new medium - becomes the ultimate message? To avoid this outcome it is suggested that there is an ethical responsibility to be assumed by those charged with the development and utilization of the communication satellite and also by those in our universities who must apply the knowledge obtained from their respective disciplines for optimal use of communication satellite technology. It is necessary to examine the various ramifications of the technology, while resisting the temptation to plunge ahead in technological development without a full understanding of the software problems and possibilities that should, in fact, establish prerequisites for hardware design.

As our technological capacity grows, the exciting potentialities of telecommunication satellites seem more certain than ever before. In fact, it is not uncommon to speak today of the "inevitability" of the widespread utilization of satellite telecommunication without specifically considering the impact of such technology in humanistic terms. The growing measure of enthusiasm generated by the new technology is merited, but it is essential that this enthusiasm be tempered by an equal measure of caution. First of all, if satellite technology is to fulfill its promise, its development must be guided by carefully defined humanistic purposes and priorities. There is the danger that in the allocation of satellite broadcast frequencies and system design strong pressures will be exerted

to force the premature establishment of guidelines and operating procedures which would militate against the subsequent effective use of satellites for educational and national development purposes.

There must be an objective assessment of the limitations and capabilities of the new communication satellite technology in meeting our expectations. Often we proceed under the illusion that, merely because it is technically feasible to develop a given satellite system, it is reasonable to expect that the system will function successfully in pursuing the goals we have set for national development. There are many components of any major technological system, and usually the least complex of these is the technical one. Perhaps most often overlooked is the question of social feasibility, and particularly of users' needs. Assuming that the system can be built, will it be accepted and used as anticipated by the people for whom it is intended?

Another vital problem relates to the effectiveness of the system once it has been accepted and is being used. For example, if you wish to design a satellite system to serve a specific segment of the educational community, to what extent will this means of communication effectively replace, supplement, or improve the conventional techniques of the face-to-face educational experience? The question of effectiveness applies to most educational and social communications processes which have been suggested as communication satellite activities, and can be determined only by conducting in-depth feasibility studies

in particular discipline areas. We need to learn more about the consequences of utilizing communication satellites. To do otherwise would be, at best, irresponsible and, at worst, disastrous.<sup>2</sup>

Within this discussion the word "education" is considered in its broadest context. As the UNESCO Mission to South America stated:

"Education is in this report used in the largest possible sense covering formal, systematic education on all levels, and teacher training: 'in-service,' vocational and professional training; all aspects of adult education from literacy campaigns and basic education to extension and information activities related to such economic and social development activities as agriculture, animal husbandry, fishery and forestry, community development, promotion of co-operatives, mutual aid societies, unions, youth and women's associations, public health, environmental care, better use of natural resources, etc."<sup>3</sup>

### Primary and Secondary Education

In many countries, a very sizeable proportion of educable students do not go to school, for lack of schools and lack of teachers. A satellite system can provide for the creation of instruction points in villages which would allow for guidance via monitors and would give basic instruction under conditions that the experiences of both Niger and Samoa have shown to be effective.

The example of India and the results expected from satellite use is significant on the plane of reinforcement for school instruction.

In a country where 70% of the population is still illiterate, but where 2/5th of the population is under 15 years old, it is obvious that in the long range, the best way to eradicate illiteracy is to give good elementary education to all children. At this point only 70% of the children 6 to 11 attend elementary school, and there are no schools in villages of less than 300 inhabitants. The Fourth Plan calls for 85% school enrollment in four years and 100% in an additional five years.

It seems to the mission that widespread use of radio and television could accelerate the enrollment and improve teaching.

Experience has shown that effective radio and television programmes can give good elementary education even if only relatively inexperienced teachers are to be had. If radio and TV sets are given to the many small villages without schools and if these villages are provided with teaching assistants quickly trained for the specific tasks imparted to them, children of these villages will not have to wait years for, or even forego, fundamental education.

This use of TV could be considered as provisional in order to give time to build adequate schools and to train qualified teachers. Furthermore, the Mission feels that the schooling of 30% of the children in this way may, after a few years of experience and careful study, lead to another kind of distribution of responsibilities between the mass media and the teacher and have bearing on the evolution of the whole educational system.

It has been said that the actual teaching in elementary schools is quite strict and formal and lacking in motivation. Even for the elementary schools having qualified teachers, radio and even more, TV would be a great and new motivating force both to the teachers and the pupils.<sup>4</sup>

The above argument would apply with equal force to French-speaking Africa, Argentina, and Brazil where primary teaching can be greatly improved through the use of technology. Certain African countries plan to leave first stage instruction,

at least the first three years, dependent on televised programs with monitors, in such a way as to be able to retrain the teachers as instructors for the second stage. Direct instruction by satellite will be necessary in order to make progress rapidly in this area.

In South America less than 30 per cent of the population have terminated their primary studies.

Enrolment in the medium level school in many Latin American countries is growing at the rate of 10% to 13% - per year - or three to five times the rate of population expansion. This growth generally reflects social pressures for more education, and in particular, the emergence of a constantly growing middle class. However, the rural areas, are not involved in this process, and few young people from lower income group families in the urban area ever enrol in high schools.<sup>5</sup>

This indicates the beneficent role that the satellite could have in rural areas. For example, in Argentina it is hoped within five years to move from 24.9 percent of the educable population at this level to 40 percent, and to 90 percent five years later for adolescents of 14 to 16 years of age. In India,

much of what has been said about the extension of elementary education could be said about secondary education. Of the 70% of the pupils attending elementary schools, only one-fifth attend secondary schools for three years (age 11-14). The Fourth Plan calls for an increase of the percentage of enrolment of population in the corresponding age-groups from 19.1% in 1965-66 for classes VIII-X to 46.0% in 1985-86, from 7.0% in 1965-66 for classes XI-XII to 30.4% in 1985-86. New revolutionising educational methods associating Radio and TV teachers with the classroom teacher will certainly make it possible to accelerate the rhythm of enrolment of pupils at this school level.<sup>6</sup>



## Higher Education

There are many possibilities for the development of satellite educational programs for college level courses. In India, for example,

It would seem that satellite time could be usefully employed to reinforce and generalize correspondence courses for the teaching of arts and sciences at the college level. These courses lend themselves to broadcasting. The mass media should not be used as a mere supplement as is the case now for the courses given by the University of Delhi. The radio-TV courses should be the heart of the teaching supplemented, of course, by books and other printed materials and by educational exercises. They should also be supplemented by short workshops and seminars in local universities or other higher education institutions.

Given the fact that the students taking correspondence courses usually are more motivated than the counterparts in regular university classes, such radio-TV courses might soon be for many men and women the only way to receive good higher education.

Another contribution of the television facility at this level of education would be the post-university training of people in many professions whose university work is some years behind them and who need to be kept informed and sometimes retrained. For example, programmes for doctors and engineers could be envisaged here as is the case already in many countries.<sup>7</sup>

There are precedents for this type of course preparation to be found in the programs presently being carried by Instructional Television Stations in the United States.

## Teacher and Professional Training

In addition to improving student education there are also possibilities for teacher and professional training. In Brazil, 44 percent of the school teachers are not qualified; in India this proportion varies from 16 percent to 93 percent

according to the state. Much is thus expected from the satellite to help in qualifying teachers. For example, in India,

The plans for education call for a great number new institutions for training or retraining in the form of seminars and accelerated courses. But this is not enough and experience has shown that retraining is a daily process. TV could contribute much to it by special programmes aimed at teachers which would be given outside of school hours. They could consist of model lessons, courses to increase the teachers' competence in his own field, demonstrations, information on new educational methods and studies in comparative education. They would guide teachers in all aspects of their work, including in the necessary readings to be undertaken.

Besides programmes that the teacher would receive in his own school alone, or with a few colleagues, other programmes could be seen collectively and discussed at the block (block is an administrative district comprising roughly a hundred villages) level under the chairmanship of a local educational authority.<sup>8</sup>

Educational training should not only be used for professional teachers, but also for the training of professional staffs of all types which the country needs: such as classroom monitors, rural agents, village heads, and nurses. It is mainly as a means for reaching large numbers of adults, the great majority of whom are illiterate, that the satellite will prove its value, for it will provide them with significant and motivating pictures even in the most isolated villages.

A certain number of rules must be respected, such as those expressed by the UNESCO Mission to Pakistan:

Adult Education, by nature, is non-compulsory. In this context, no adult can be forced to accept orders. He must be persuaded to accept suggestions and advice. In order to persuade, Adult Education

- must be practical and contribute directly to better living.

- it must take into account attitudes and experiences gained in formal education.
- it must accept a basic need for diversion and entertainment.
- it must give credit for success and achievement in the adult's professional and personal life.
- it must take into consideration reluctance to accept advice and orders from outside authorities.
- it must speak to the adult at times when he is free, willing and capable of listening.
- it must use a language understood by the recipient.<sup>9</sup>

Pakistan counts 80 to 86 percent illiterates, India more than 75 percent. These percentages are quite a bit higher in most African states. India has set as a first objective the use of the satellite in the fight against illiteracy.

It is noteworthy that in the rural areas of India, where a communications satellite can be the pre-eminent service instrument for reaching people, 81 percent of the population is illiterate, and another 13 percent is literate 'without educational level'. Furthermore, out of a rural population of 360 million people, nearly 72 million (20%) are youth in the age group of 15 to 25 years which is considered to be India's most potential human resource. Tragically, 78 percent of this group is illiterate.<sup>10</sup>

But in India as elsewhere, massive methods of inculcating reading and writing to adults will encounter difficulties. To be effective this instruction must be functional and related to the needs of daily life and work. General programs for the whole population of India will have to be invented which are sufficiently motivating and others will need to be prepared that are better adapted to certain regions, languages, and trades. Agricultural and sanitary education will also have to be included.

While it is not within the province of the satellite to multiply the teachings in various trades, it can and must educate those in rural areas who constitute the great majority of the populations of developing countries. Given basic problems of illiteracy, it is fitting to present by picture, information, advice to follow, and models to imitate. Agricultural education will be much easier to present when the area concerned practices identical methods of cultivation, as for example in the Andean zone of South America. In the case of Brazil or India, countries with diverse methods of cultivation, educational activity also must be diversified, which is a handicap for mass instruction. The village television set, with guidance from a monitor who will put into practice the televised lessons, at this level constitutes the most viable solution.

The Mission of UNESCO to India noted, for example, that programs relating to the country's agricultural production should be brought within the comprehension of some 50 million farmers. According to these conclusions, at best, the specialists of population and the centers of demonstration and instruction will reach less than one-tenth of the Indian villages. Films will reach still fewer, and even radio broadcasts were not received in more than two-fifths or so of the villages. The mission estimated that of all the media of information, television was the most striking. It is in fact a direct means which informs by procedures both visual and auditory, which is important in the rural zones of India where 81 percent of the population is illiterate and 13 percent literate but without instruction. A program of communication by satellite would permit the diffusion of broadcasts which would be picked up by individual and collective receivers in each village. 11

### Sanitary and Family Planning Education

Developing countries are affected more than others by epidemics and endemic illnesses. In the disadvantaged regions, particularly the rural areas, sanitary services are scarcely or not at all developed; for the completeness and importance of these services depends on the income of the inhabitants.

The satellite can be a remarkably effective tool to support campaigns for sanitary education and to propose solutions which will benefit both the population and the sanitary engineers who are thus constantly informed and retrained. This is one of the goals to be achieved in the Brazilian Project.

Of the priority measures foreseen in the ten-year plan, some are of particular interest in the present context. Such objectives as 'improvement in the qualifications of the professional personnel and intensified training of medium-level and auxiliary staff' and 'organization of campaigns to eradicate or control contagious diseases' would demand the use of information media for direct education and training as well as for dissemination of knowledge and the conduct of campaigns. Since the need is greatest in the rural areas a satellite system would make it possible to reach all those whom these priority measures are designed to help.<sup>12</sup>

Birth control, since several states attach great importance to it, merits particular mention. In India, thanks to the improvement in health services, mortality has fallen, and each year 20 million births are recorded for 8 million deaths, an annual gain of 12 million in the population. But agricultural production is not increasing in proportion, and from 1951 to 1966 the amount of food available per inhabitant diminished -

from 12.8 to 12.4 ounces. The Indian Government has therefore given absolute priority to the problem of birth control and has appropriated \$30 million in the Fourth Plan.

The success of this programme will depend in great measure on creating an awareness of Family Planning and on motivating people to practise birth control. This communication task is extremely difficult. Information and knowledge must be made to flow throughout the country, to the cities and towns, to the 560,000 villages and to every one of 90 million couples in the reproductive age group. The job must be done through the mass media, through group communication, and through face to face personal contact. Important steps have been taken to spread awareness and interest concerning family planning; all available media are being utilized, and some new approaches have been evolved. However, at present, in India, the mass media are inadequate for taking the necessary messages to the large target audiences in the rural areas. Suffice it here to point out that press, radio and films do not cover most of the rural areas where 80% of the population lives.

In this critical aspect of Indian life, any and all innovations that can establish or improve communication channels with the people will have value beyond price. Of any and all, the communications satellite is most promising.<sup>13</sup>

### European Development

Communication satellites already bring to these countries obvious contributions, particularly in the areas of information and entertainment. In the years to come it will also be possible to use them in the service of education, the resources of which will be expanded through two successive stages that Dieuzeide has defined thus:

Distribution satellites - the most important difference will reside in the number and variety of messages susceptible of being received, and

consequently, in the truly systematic character of this use of television. The fact that, at the stage of the distribution satellite, the development technique reduces the public to communities possessing the means to group themselves around collective receivers, must not mask the originality of a pedagogy utilizing television, no longer as a rare material but as a constant presence to be referred to. This is an entirely new conception. For the first time, it is possible to envisage educational saturation of a given geo-cultural area. This saturation would be facilitated by calling upon satellites for the broadcasting of simplified audio-visual messages of the slow scanning type television, thus permitting the further multiplication of utilizable messages.

Direct broadcast satellites - this forward leap in technique which will have to take place in a dozen years or so, will pass from collective reception by the group, controlled by monitors (leaders, animators and investigators), to individual reception, isolated but generalized with home recording of the message as the ultimate stage, and its indefinite repetition. One moves here from saturation of the group, to universalization of the individual message. No longer is there control of the message on arrival, but total liberty for the spectator in front of the pedagogical message.<sup>14</sup>

Point-to-point satellites already permit the interconnection of existing regional or national systems. At certain hours, the national systems of TV-instruction could pre-empt the satellite hook-ups which broadcast programs of common interest with special programs in modern mathematics, languages and science.

With satellites of the second and third generation, it is possible to conceive of "TV schools" of continental scope allowing a choice at each school of tuning in the national broadcasts, broadcasts from other countries, or international broadcasts. A European TV-school would, for example, be

able to offer language programs, modern mathematics, science and civics courses, which educational institutions would receive. Such programs would supplement national programs.

Schoolroom reception of such messages could be followed or preceded by reception at home, guided by the teachers in the setting of an organized "parallel school" favorable to individual work and complementary to collective or group work done at school.

In Europe the European Common Council for Economic Development (OCDE) has calculated, for seventeen European countries, that the number of students has risen from 970,000 in 1950 to 2,600,000 in 1965-66, and the projection is for 4 million in 1970-71, 9 million in 1980-81, and 13.5 million in 1985-86.<sup>15</sup> Obviously, it will not be possible to cope only through traditional methods. The extension of television systems to higher education will take place, permitting students to receive audio-visual messages at home and instruction by correspondence, and allowing them to go regularly to local universities for practical work, consultations or group work. It is possible to imagine a student combining teachings from his local university, regional university and national university. The English Open University, and the French centers of televised university instruction, give some idea of what the future will hold. University education will no longer be reserved only for students. Former university graduates will constantly be able to up-date their training and take suitable courses.



The European satellite project thus evaluates the total enrollment of students and former students subject to university and post-university education in 1985, as follows:<sup>16</sup>

Period	Total number of enrolments in 1,000 s
1960 - 1970	20, 000
1970 - 1980	65, 000
<u>1980 - 1985</u>	<u>56, 000</u>
Cumulative total	141, 000
<u>Enrolments in 1985</u>	<u>13, 000</u>
Graduates 1960-1985	127, 500
Deceased, disinterested, drop-out, etc. (70%)	<u>89, 500</u>
Actively parti- cipating in post- graduate education (30 %)	38, 000

Given these large numbers, education must be distributed between several complementary forms as suggested in the following table.<sup>17</sup>

Service	Users in 1,000s	Note
Classroom and group education  Individual education	8, 900	66% of all enrolled students
General home instruction	23, 600	33% of all enrolled students and 50% of all active post-graduates
Educational TV	70,000	50% of all students and graduates
Professional information service	12, 500	33% of all active graduates

If study in groups and classes utilizes primarily taped audio-visual media, work at home and professional training will require recourse to television. The demands that university and post-university education will make on communications by radio and satellite will thus be substantial. As this education itself will involve large numbers of people, such recourse will be justified, since it will have numerous objectives. For example, in Europe:

Our objectives in the introduction of new technology as an aid to higher education in Europe can be summarized as follows:

- to improve the quality of education, e.g., by making the outstanding European educators available to the students, by helping the better education of teachers;
- to increase the quantity of available education, e.g. by providing a greater variety of courses (diversification) on different subjects, and on different levels;

- to increase the efficiency of learning, e.g. by providing multi-media presentation to students, by enabling training, repetition and refreshing facilities;
- to reduce the cost of providing educational services, e.g. reduce need for new school building, for many more new teachers, new textbooks, etc.;
- to improve European co-operation in the planning and realization of a new educational system.<sup>18</sup>

More and more, European adults will seek to assure their personal and social advancement, either in the setting of leisure-time or within the framework of active employment. Whatever their profession, they will need to perfect their written and oral expression in their native language, to learn one or more foreign languages, or to increase their mathematical knowledge. It will also be possible to develop programming for professional improvement and job re-training.

FOOTNOTES

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15. Requirements of European Higher Education for Communication Satellite Services and Frequency Band Allocations. Council of Europe, Strasbourg, 1970 at 4.4.

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18. Id. at Chap. II, 5.

## IV

COMPLEMENTARY SOFTWARE FOR EDUCATIONAL AND NATIONAL  
DEVELOPMENT PROGRAMS VIA SATELLITESYSTEM DESIGNS AND ALTERNATIVES

Every application of communication satellites depends on various configurations of software and interconnection with terrestrial communication systems. Consideration of these alternatives is significant to the selections to be made by countries considering national development goals. The interaction between the learner and the technology can be of extreme importance in the design of an operational system. A major experimental variable which is important both for theoretical and for cost-feasibility reasons, is the type of learner interaction with satellite-related elements of the instructional system. This might be referred to as the instructional technology (or system delivery) variable. It breaks into three major categories, and each of these can be subdivided.

One-Way Transmission

The first major possibility involves one-way transmission of information from the satellite. For the most part, this limits the satellite-controlled instructional component to stimulus presentation. It should be noted that, in instructional system design, learning tasks are usually classified according to stimulus, response, reinforcement, and feedback characteristics. This in turn allows an informed choice of system components, providing the components have been similarly classified.

Conventional Television -- The first option in the one-way transmission category is conventional television. However, TV must not carry the complete instructional load. The problem is to determine how television can best be used as a component in a satellite-related instructional system in different sets of circumstances. Television has a number of desirable characteristics, and these have been utilized in dramatic fashion on occasion to demonstrate television's potential.

As for limitations, present single channel broadcast capability is limited to serving needs common to large numbers of students at any one time. A result is that instructional TV in its present single-channel mode is usually an uneconomical way to concentrate on what may be the hypercritical needs of relatively small target populations. However, the strengths of television are that it can concentrate on needs common to large numbers of students, cover a wide geographic area at relatively low cost, and span time and distance carriers and present events simultaneously with their occurrence, thus providing a level of excitement and realism impossible through other means. Further, as demonstrated in numerous commercial applications, it has great motivational effects and can stimulate a child to want to learn and to behave in predetermined ways. Its greatest efficacy appears to be in the affective domain -- in the formation and modification of attitudes toward self, toward others, and toward institutions. It has some efficacy in the cognitive domain, but only in those instances when stimulus presentation alone is sufficient. There is undoubtedly information gain, and certain

low-level skills such as vocabulary acquisition, serial recitation, and elementary number and relational facility are developed.

Television therefore appears to have an essential role in a satellite-based instructional system, but the strategy should be to capitalize on its strengths in using it in combination with other system components. The usual TV restriction of serving only broad-based common needs may be somewhat mitigated through the satellite because of the ability to transmit multiple channels of material at slight incremental cost.

Single Channel Video, Multiple Channel Audio -- A satellite with four audio or voice channels associated with each video channel is feasible. This makes it possible to vary what is heard in association with a single video presentation. Possibilities here include:

Continuous motion visual presentation, as in conventional TV, but with audio varied according to the language background of the audience. Some of the preliminary questions related to this type of variation, e.g., what proportion of the audio should be off-screen narrative to accommodate the language difference, what change in television production methods is needed, what is required to assure similarity in meaning conveyed in spite of language differences, could be answered in preliminary laboratory research.

Single audio presentation, audio varied according to difficulty level. This would require some type of



response mechanism for students to use, and it would require some type of simple switching capability which would cause audio channel selection to depend on past performance. If a child (or group of children considered as a single unit) missed a particular item, or so many in a series of items, or went beyond a certain error rate, the level of difficulty in the audio could be lowered, and similar decision rules could be employed to automatically increase difficulty level. Substantive content as well as difficulty level might be changed according to response pattern. This option, like the previous one, would require preliminary laboratory research. It should be noted that this option provides an interactive system with one-way transmission.

Other One-Way Transmission Possibilities -- At least two other one-way transmission alternatives are possible and might be considered, though they do not seem on the surface to hold as much promise as those discussed above. One is use of the satellite for educational radio; that is, for audio presentation only. The second is to transmit print, through teletype, verifax, or some other means. While print alone is of limited interest, the possibility of combining print with some of the other alternatives should not be excluded. A system developed by RCA, for example, allows the transmission of print simultaneously with video information on a single channel and could be used at no cost in satellite transmission capability.<sup>1</sup>

The use of the satellite for radio presentations does raise a number of interesting possibilities. The use of FM radio can involve the multiple channel capability of FM sub-carriers. The subcarrier multiple channel technique, Subsidiary Communications Authorization (SCA), is applicable only to FM radio. This is an economical technique for making up to four independent additional channels available on a conventional FM station through the mere addition of low-cost multiplexing equipment. Through the addition of subcarrier generators, an ordinary FM station is capable of providing either:

1. A pair of channels (the main program channel plus one additional channel) for stereo operation plus up to two additional SCA channels, or;
2. The main program channel plus up to four additional SCA channels.

Perhaps the most significant factor about SCA channels is that an aural or visual signal can be transmitted. The only constraint is that the information signal does not exceed a bandwidth of approximately 50 Hz to 15,000 Hz, a bandwidth range required for high-quality speech and music channels.

Visual materials can be transmitted over radio or telephone circuits by merely relinquishing the characteristics of high-speed motion. It is well known among educators that a series of still pictures accompanied by suitable audio commentary can provide highly effective learning experiences. However, not so well known among educators is that during the electronic transmission of visual material (television, for example) the illusions of

smooth motion may be exchanged for a dramatic reduction in transmission spectrum space, without reducing the resolution or quality of the reproduced images. Furthermore, the reproduced images can be displayed as a sequence of still pictures on a standard classroom television receiver or as a series of hard-copy illustrations. Standard television, which is capable of providing the illusion of smooth motion in the reproduced image, utilizes a frequency range or bandwidth of approximately 4 MHz to transmit 30 complete pictures per second at an average resolution of approximately 400 lines over the entire picture. The relationship between resolution, the rate at which images are reproduced, and the bandwidth or required spectrum space on the transmission channel can be summarized by the following algebraic expression:

$$\text{Image Resolution} + K\left(\frac{B}{N}\right),$$

where K is a constant depending on the type of transmission system involved, N is the number of complete pictures transmitted per second, and B is the frequency bandwidth in cycles per second or Hz.

It can be readily seen that bandwidth B can be scaled down by the same factor that the number of complete pictures per second N is scaled down without affecting the image resolution. Applying this principle of "tradeoffs" to electronic transmission systems reveals that if the picture transmission rate is reduced from 30 per second to one per minute (a factor of 1800), the bandwidth requirement can be reduced from 4 MHz to a mere  $4,000,000/1,800 = 2220$  cycles per second. This

bandwidth requirement is well within the range of an ordinary voice-grade telephone line and considerably less than the bandwidth capability of a 15,000 cycle per second FM audio channel.

Therefore, slides, film strips, overhead transparencies, etc., can be transmitted at the rate of one each minute over an FM radio station subcarrier (SCA) channel with a resolution comparable to that of television. If higher resolution is required, the transmission rate could be reduced, for example, to one picture each two minutes to achieve a line resolution twice that of television. The terminal equipment required to achieve this bandwidth-picture rate trade-off consists of either a scan converter, if television type displays are desired, or ordinary facsimile transmitters and receivers, if hard-copy displays are required.

The complete audiovisual presentation can be transmitted over an FM station equipped with SCA equipment by carrying the audio portion on the main program channel and the visual portion on one of the SCA sub-channels. Actually, a single FM station equipped with three SCA sub-channels is capable of broadcasting two separate audiovisual instructional programs simultaneously. The use of four SCA sub-channels would release the main program channel for conventional public broadcasting use and still permit the transmission of two audiovisual instructional programs to all homes, schools, and other institutions within range of the FM station.

## FM Media Capability

The following list and brief description constitute a partial inventory of the techniques available for the transmission of still (or slow scan) visuals on FM sub-channels and other instructional applications of FM multiplexing.

### Facsimile Transmissions

Facsimile transmissions offer a means of distributing hardcopy visual materials from a central source. Facsimile equipment permits the transmission (or broadcasting) of photographs or illustrations characterized by multiple shades of grey, as well as line drawings. Most facsimile devices are designed to operate over a transmission channel intended for speech applications such as telephone lines or radio channels encompassing a bandwidth of as little as 3 KHz. For such applications, a single facsimile transmitter is required at the origination point, a device which can be connected to the input of the FM-SCA channel almost as simply as an ordinary microphone.

### Teleprinters

Each teleprinter channel requires a frequency range of only a few hundred cycles per second. Consequently, one SCA channel with the appropriate interface equipment could handle up to 12 or 15 separate circuits on the SCA channel.

Teleprinter systems are generally conceded to be the most efficient method of electronically transmitting hard copy information from one point to another or to multiple points. Of course,

such systems are limited to the transmission and remote reproduction of printed text.

### Electrowriters

Electrowriters are devices which permit remote reproduction of handwritten material such as sketches, mathematical formulae or anything which can be written on a classroom blackboard. Using an overhead projector with an electrowriter receiver to permit group viewing on a standard projection screen constitutes a form of the "remote multiple electronic blackboard" or whiteboard. The commercial version of such a system is known as VERB, which stands for Victor Electronics Remote Blackboard. Experiments utilizing this technique on the satellite are presently being carried on by the EDSAT Center of the University of Wisconsin.

### Blackboard-by-Wire

Blackboard-by-wire is a form of "electrowriter" device which provides a reproduction of sketches directly on the screen of a standard television receiver. The blackboard-by-wire system is essentially a pair of slow-scan devices which are interconnected by a voice-grade transmission circuit, even though the quasi-stationary display takes place on the screen of a standard TV receiver. Blackboard-by-wire systems are marketed by the Sylvania Division of the General Telephone Company.

### Slow-Scan Television

Slow-scan television differs from electrowriters and blackboard-by-wire in that either a standard TV camera coupled

with a scan-converter or a special slow-scan TV camera is used as the pickup device. As a result, live scenes or any other subject matter that can be televised by a standard TV camera can be transmitted over a voice-grade transmission circuit and reproduced on a standard TV receiver. Terminal hardware capable of exploiting sampling techniques to permit multi-channel slow-scan transmissions over a single narrow-band (voice-grade) transmission circuit is now available.

#### Applications of FM Sub-Channels

##### Specialized Audio Programming for the Blind

Specialized programming for handicapped minority groups such as the blind is a challenging application of FM sub-channels. The use of the new Harmonic Depressor designed by Bell Laboratories and manufactured by the American Foundation for the Blind permits the intelligible transmission of speech at normal pitch at rates up to 400 words per minute. Such an application would be a miracle come true for the blind who could "speed-hear" their books, periodicals, and news events at the same rate--or even faster--than many unhandicapped people read.

##### Specialized Visual Programming for the Deaf

Just as specialized audio programming can be transmitted over FM sub-channels for the blind, specialized graphics or visual materials can be transmitted for the benefit of the deaf. The terminal equipment could consist of either teleprinters, facsimile devices, electrowriters or the various forms of slow-scan television.

It is certainly not beyond the realm of possibility that one of the multiple sub-channels could be used for the transmission of information that could be perceived by the deaf through tactile transducers or "sound" through bone conduction devices in place of the so-called speaker.

It is also possible to use an FM sub-carrier to transmit "subtitles" for television programs so that the deaf could view television programs in the same manner that motion picture audiences view "subtitled" foreign language motion pictures. Essentially, the technique for transmitting the subtitle information is the same as that used for teleprinter transmission, except that the "receiving" device is not a teleprinter, but a modified television receiver used in conjunction with a character generator, a device which provides a video signal from a teleprinter code input.

#### Educasting

Educasting is a programmed-student response learning system developed by the Tutor Tape Laboratories and originally promoted by the International Correspondence Schools. Educasting in its simplest form requires five separate audio channels. One channel is used to present the lecture material, and the remaining four channels are used to provide multiple choice testing of the students during the lecture. The use of an educational FM station equipped with four SCA sub-channels to supplement the main program channel is an almost ideal application of FM sub-channels. A further exciting possibility is the coordination of an educational FM station equipped with Educasting hardware with a non-commercial TV station to transmit up to four images using split-screen



techniques to supplement the aural portion of the Educasting system with visuals. Alternatively, a second educational FM station could be used to transmit the accompanying visuals using narrow-band techniques already described on the FM sub-channels.

#### An FM Audiovisual CADAVERS System

Of particular interest to the educational community is the exciting possibility of developing an FM station based audiovisual Computer Assisted Dial Access Retrieval System (CADAVERS) developed by the Display Systems Corporation of St. Paul, Minnesota, for use in conjunction with non-commercial TV stations. The CADAVERS system attempts to find a solution to the problem of scheduling instructional TV programs over a TV station for a large school system or systems, as well as the compatibility problem created by the many different brands of helical-scan video tape recorders currently in common use.

Briefly, the technique employed by the CADAVERS system, that of selectively activating video tape recorders scattered throughout a school system by preceding the program to be recorded remotely for later utilization by a unique address code, can be adapted for use with instructional FM stations as well. Furthermore, techniques and hardware could be readily developed to transmit conventional TV programs over an FM station at slow-scan rates to be recorded at slow-scan rates throughout the night which could be reproduced at high-scan rates, when needed, to recover the illusion of smooth motion. Such a technique would be another example of exchanging bandwidth requirements for time.

### Two-Way Transmission, Delayed Interaction

A further recent development in education is the computer managed instruction (CMI). In this system, the computer is used largely as an information processing device, with indirect use of its decision ability. CMI can be used only with a carefully developed, individualized instructional system. The general idea in individualized instruction is that a person's learning experiences are tailored according to his needs. An individualized (or "adaptive") instruction system must be based in some theory or conceptual framework which indicates the type of learning experiences needed by a learner with particular background characteristics to reach a standard on a particular learning task. The decision rules for this complex system must be clearly specified, and, in the case of CMI, they are placed on a computer. Relevant information about the individual's background - perhaps his learning potential, his past performance in different subject areas, and his performance in the particular instructional system - must be analyzed and used in application of the decision rules.

True individualized instruction places an enormous information processing and decision burden on the classroom teacher. With 25 or 30 or more individual students to manage, in fact, the task is all but impossible. In CMI, the computer is used as an aid to the teacher in handling this task. The decision rules are placed in the computer, along with the necessary past information about each learner. Each day, the learner's performance that day is fed into the computer, and,

based on the conceptual framework (represented by the decision rules), the computer prints out a statement of where the learner stands relative to system learning objectives and suggests what his next experiences should be. This is given to the classroom teacher, who has been trained in the relevant theory and in use of the system, and the teacher decides what the learner is to do. The system is usually structured so that learners are on their own a good part of the day, engaging in their assigned activities, and the teacher has more time to interact with each on a one-to-one basis.

CMI has a number of apparent advantages. It is theory based and thus has a strong rationale for the individual's learning experiences. It is structured and thus eliminates a good bit of the haphazardness which characterizes much of current in-school experience. It provides daily individual attention for each learner, requires regular overt responses, and provides necessary feedback. It also frees the teacher for more one-to-one contact and for more professional activity.

The teacher does retain the decision role in the system, however, so that the application of theory to instruction could be short-circuited. Also, feedback is delayed, and there are sharp differences in theoretical positions as to the effects of this delay on learning.

The best-known CMI system is Project PLAN, which was developed by the American Institutes of Research and is being marketed nationally by Westinghouse Learning Corporation.

One of the problems with CMI is the high line charges for transmission to and from a computer. Mainly because of this problem, the system is not economically feasible in isolated areas, and its effectiveness with a number of population groups is unknown. ATS-F provides an ideal vehicle through which to test this approach because the voice channels can be used for the two-way transmission of digital information.

#### Two-Way Transmission, Real-Time Interaction

Computer Assisted Instruction - A third major category of the instructional technology variable involves two-way transmission, with the learner interacting directly with the system on a real-time basis. The most interesting possibility is use of computer assisted instruction (CAI). Here the learner is connected directly to a computer, which makes decision relative to his instructional experiences.

CAI has at least two theoretical advantages over CMI, though the effects of these on learning have not been checked empirically to date. In the first place, the computer handles all of the instruction in certain areas, and there is no slippage; the underlying theory is applied in every instance (at least to the extent that it is operationally defined by the decision rules given the computer). In the second place, feedback is immediate, and a regular pattern of stimulus, immediate response, and immediate feedback is maintained throughout the instructional period. As with CMI, each learner is actively involved in instruction a significant portion of

the time, and teachers are freed for more face-to-face counseling, advisory, and diagnostic types of activities. Early results on CAI have been promising, with some highly dramatic reductions in time required to reach mastery in a number of subject areas. A major factor preventing more widespread use of CAI has been very high transmission charges. Also, additional software is needed.

There can be little doubt that the computer is destined to play a major role in education in the future. The information revolution is in its infancy, and the present generation of computers has evolved in little more than 20 years. Given the progress achieved in this short period, the possibilities for 10, 20, 30 years, and beyond are obviously fantastic. The computer's ability to help make a scientific approach to education possible and its capability for applying instructional theory directly to instructional practice make its central role inevitable.

There are varied opinions as to when the computer will be introduced into operational school systems. It is suggested that it will be introduced on the post-secondary school level in the latter part of the 1970's, and that this will be followed by its introduction into secondary and primary levels.<sup>2</sup> The following figure illustrates this progression.

The argument for first application at the post-secondary level follows from the fact that the financial resources per student are generally greater at this level, that high capacity computers are widely available at this level, and that there

SCHOOL LEVEL	%	70-75	76-80	80-85	86-90	91-99	LATER	NEVER
Primary	20		██████ M					
	55			██████ M ██████				
Secondary	20		M ██████					
	55			M ██████				
Post Secondary	20	██████ M						
	55		██████ M					

The Adoption of C.A.I.

is a wide group of graduate student labor available for programming at this level.

In the timing and usage of computers in the general computer-assisted instruction role in the school systems, drill and practice would be the first general use of such systems, but there would be expansion into tutorial systems, simulation systems, socratic dialogue systems and instructional games in roughly the time frame presented in the following chart.

The computer will be utilized in computerized learning systems or computerized library systems for information storage and retrieval. The computer probably will be generally introduced into this aspect of the education system at the post-secondary level only slightly later, as the following figure on information retrieval indicates. Geographic integration of these systems will take place, moving from systems serving just one school to those serving entire nations at all levels of education by 2000. These predictions are shown in the following three charts on the geographic integration of post-secondary schools, secondary schools, and primary schools.

The computer may serve in the educational system as an Information Retrieval Television Service (IRTV), which would consist of a central retrieval center housing a large library, and a coaxial cable distribution system linked to television sets in individual classrooms or teaching areas. Essentially, this system is a computerized extension of the current

SCHOOL LEVEL	SYSTEM	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
Primary	DP		M █████					
	T			M █████				
	S			█████ M				
	SD				█████ M █████			
	IG			█████ M				
Secondary	DP		M █████					
	T		█████ M					
	S		█████ M █████					
	SD				M █████			
	IG			█████ M █████				
Post Secondary	DP	█████ M █████						
	T		M █████					
	S	█████ M █████						
	SD			M █████				
	IG		M █████					
<b>LEGEND:</b>		<p><b>T</b> = Tutorial systems: those which take over the main responsibility of developing skill in a specific area. The instructions permit freely constructed responses on the part of the student and will analyze each student's comprehension in greater depth and detail than is possible for a teacher with a classroom of twenty or thirty students.</p> <p><b>S</b> = Simulation systems: the student can change the inputs and vary the parameters.</p> <p><b>SD</b> = Socratic Dialogue systems: participative programs where the student helps develop the course. These systems would need extremely large branching facilities.</p> <p><b>IG</b> = Instructional Games systems: creative thinking games perhaps used for group as well as individual learning experiences.</p> <p><b>DP</b> = Drill and Practice systems: a supplement to the regular curriculum taught by a teacher. The computer can relieve the teacher of the burden of routine work by reinforcing learning and at the same time provide practice work for a student at his own pace and level of complexity.</p>						

Usage of C.A.I. Systems in 20% of Schools <sup>4</sup>



SCHOOL LEVEL	% ADOPTION	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
Primary	20			██████ M				
	55				██████ M			
Secondary	20		██████ M					
	55			██████ M ██████				
Post Secondary	20		██ M ██					
	55			M ██████				

Information Retrieval - Computerized Library Systems <sup>5</sup>

CHARACTERISTIC	%	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
One School Systems	20		■ M ■					
	55		■ ■ ■ ■ ■ M					
Integrated Systems Serving a District	20		M ■ ■ ■ ■ ■					
	55			M ■ ■ ■ ■ ■				
Integrated Systems Serving a Region	20		■ ■ ■ ■ ■ M					
	55			■ ■ ■ ■ ■ M				
Integrated Systems Serving a Province	20		■ ■ ■ ■ ■ M ■ ■ ■ ■ ■					
	55			■ ■ ■ ■ ■ M ■ ■ ■ ■ ■				
Integrated Systems Serving a Nation	20			■ ■ ■ ■ ■ M ■ ■ ■ ■ ■				
	55				■ ■ ■ ■ ■ M ■ ■ ■ ■ ■			

Geographical Integration of Post-Secondary Schools<sup>6</sup>

CHARACTERISTIC	%	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
One School Systems	20		██████ M ██████					
	55			██████ M ██████				
Integrated Systems Serving a District	20		██████ M ██████					
	55			██████ M ██████				
Integrated Systems Serving a Region	20			M ████████████████				
	55				M ██████████			
Integrated Systems Serving a Province	20			██████ M ██████				
	55				██████ M			
Integrated Systems Serving a Nation	20				██████ M ██████			
	55					██████ M		

Geographical Integration of Secondary Schools <sup>7</sup>

CHARACTERISTIC	%	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
One School Systems	20			██████ M ██████				
	55				██████ M ██████			
Integrated Systems	20			██████ M				
Serving a District	55				M ██████			
Integrated Systems	20				M ██████			
Serving a Region	55				██████ M ██████			
Integrated Systems	20				██████ M ██████			
Serving a Province	55					M ██████		
Integrated Systems	20					██████ M		
Serving a Nation	55						██ M ██	

Geographical Integration of Primary Schools<sup>8</sup>

manual dial access system. The following chart on the system features of IRTV is an indication of the type of features visualized for this type of system. These computer systems probably will be introduced in the early 1970's at the post-secondary and secondary school levels and will have been introduced at all school levels by 1980, as illustrated by the chart on usage of IRTV systems. By the year 2000, these systems should be integrated on a geographical basis as depicted in the chart on the integration of IRTV systems.

FEATURE	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
Still Pictures	M █████						
Remote Player Control	█████ M						
60" x 60" Wall Screens		█████ M					
3 Dimensional Colored Pictures			M █████				
Mechanized Video Tape Retrieval		M █████					
Mechanized Tape Segment Search		█████ M █████					

SCHOOL LEVEL	% USAGE	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
Primary	20		■ M ■					
	55		■ M ■					
Secondary	20	■ M ■						
	55	■ M ■						
Post Secondary	20	■ M ■						
	55	■ M ■						

Usage of IRTV Systems<sup>10</sup>

LEVEL	SYSTEMS WILL SERVE	70-75	76-80	81-85	86-90	91-99	LATER	NEVER
Primary	4-6 School Groups		██████████ M ██████████					
	6-10 School Groups		██████████ M ██████████					
	School Districts		██████████ M					
	School Regions			M ██████████				
	Provincial Pool				M ██████████			
Secondary	4-6 School Groups		M ██████████					
	6-10 School Groups		██████████ M ██████████					
	School Districts		██████████ M					
	School Regions			M ██████████				
	Provincial Pool				██████████ M ██████████			
Post Secondary	One Campus Instit.	██████████ M						
	Multi Campus Instit.		██████████ M					
	Several Institutions			M ██████████				

### Computer Satellite Interface

The main problem that exists when the computer is linked via a communication satellite for educational purposes stems from the necessity for increased propagation times. Given retransmission error control, existing CAI terminals would be severely reduced in efficiency by the delay in signal reception. Therefore, a transmitting machine must make allowance for sufficient storage of the message blocks until responses are received. Still another current problem occurs with other than teletype CAI terminals. Cathode Ray Tubes (CRT) cannot currently be employed for retransmission purposes, since the CRT must be linked directly to the computer to periodically refresh the legibility of the presented information. Solid-state CRT's now under development will alleviate this problem. It is probable that the transmission problem could be eliminated by designing new terminals which provide high transmission efficiency changing the logic of error control.

The real-time interaction of computer systems could be enhanced by adding concentrators at transmission points and by developing new polling techniques such as the "hub technique." The "hub technique" enables a negative answer from a terminal having nothing to send back to the computer, but the polling message is passed by one terminal location to the next until a machine is found that does have something to send. This is then immediately sent. A negative poll response is only returned to the computer if none of the locations which the lines connects has any traffic.<sup>12</sup> These techniques should shortly



make computer education by satellite feasible. The utilization of time-sharing techniques would also minimize hardware procurement costs and would encourage regional cooperation. It is further argued that the initial costs involved for CAI/CMI is equivalent to the start-up costs for television.

### CAI Evaluation

Of particular importance is the utility of CAI in disadvantaged areas. Jamison, Fletcher, Suppes, and Atkinson utilized three arithmetic drill-and-practice programs in California, Kentucky, and Mississippi. They reported that they had found strong and consistent achievement gains by disadvantaged students when they were given computer-assisted instruction over a reasonable fraction of a school year, and that the cost of computer-assisted instruction seems to have decreased to the point that computer-assisted instruction is now quite attractive compared to alternative compensatory techniques with roughly similar performance. This was found to hold true whether one considered computer-assisted instruction as an add-on cost, or as a substitute for teacher time.

It is also reported that computer-assisted instruction does not have to rely so heavily upon the creative abilities of the programmer, compared to TV, nor does the computer necessitate a large emotional involvement of the students. Computer programmers should be highly creative in the matter of student motivation, since CAI's assets include the capability of infinite patience and practice in rote learning situations, absolute privacy especially in the face of repeated and

potentially publicly humiliating error, individualized instruction, better motivation, and a learning environment complete with feedback. In these ways, CAI approaches the achievement of total individually-adapted instruction. Instructionally, computers can control audiovisual devices, interact with each other in games, keep detailed performance records, provide remedial training, encourage development of critical thinking skills, simulate experiments, and aid teachers in improving course content, designing better learning strategies and planning more advanced computer-assisted instruction systems.<sup>13</sup>

While the breakthroughs in CAI cost reduction are becoming impressive, the cost reduction associated with the computer as a manager of instruction are magnitudes greater. Nations concerned with national development communication systems utilizing satellite interface could individualize their educational programming and provide flexibility for multi-purpose uses of the system.

#### Additional Software Components

There are several technological developments which will determine the ways in which the satellite can be used for national development and educational purposes. When discussed together with the need for innovative educational methodology they provide a context for satellite development.

#### SelectaVision (SV)

The video cartridge systems by RCA appear to be the most technically innovative of the systems considered. The

system uses phased holograms embossed on inexpensive vinyl tapes. In order to convert from regular motion picture film to tape requires a five-step process. First, a master is developed and converted by a laser to a series of holograms. Next the holograms are recorded as a positive photoresist on a Chronar tape base. The soft areas of the resist are washed away in a developing cycle. The holograms appear as corrugations on the surface of the developed tape. From the tape, a hologram master tape is produced using a plating process similar to the one used in the production of ordinary phonograph records. Copies are manufactured on an embossing machine by rolling the vinyl tape and the nickel-plated master tape together under pressure.

RCA, however, does not plan either industrial or educational use for this system, but will emphasize the home market. A silent black-and-white system was demonstrated in the fall of 1969, and the system was originally scheduled for introduction in late 1972. However, industrial sources reported scheduling slippage, and RCA may first introduce an interim cartridge television system. This particular system, therefore, may be a possible candidate for the middle 1970 period. However, there have been some serious design and financing problems which may curtail the system's marketing.<sup>14</sup>

### Cassette Systems

During the 1971-1976 time period, a number of companies have announced plans for the introduction of cartridge-loading

video recorders. As early as 1969, the Sony Corporation demonstrated a new half-inch tape TV cassette color system. The system should be commercially released in 1972, although originally scheduled to be released in 1971. Three-quarter inch, high quality chromium-dioxide tape is expected to be used in the system. The tape should sell for thirty dollars per blank cassette.

A two-reel magazine loading system capable of recording and playing back both color and black and white images on one-half inch videotape magazines has been announced by Panasonic. Introduction was tentatively set for 1972.

The Ampex Corporation is developing a system known as Instavision. Instavision will be the smallest cartridge-loading video recorder currently under development. The Instavision system will include a choice of recorder/players operating on batteries or household current in either color or black and white. The recorder/player for this system uses standard one-half inch videotape which is enclosed in a small circular plastic cartridge 4.6 inches in diameter and seven-tenths of an inch thick. Of potential importance is the fact that the system is intended to be compatible with all other conventional reel-type recorders. The Instavision system should be commercially available in 1972. This type of player, of course, has tremendous implications in the education process of less-developed countries, since it will make possible the use of video techniques and video educational programs in areas where electricity is not even available.

Finally, the Avco Corporation is developing a system known as Cartrivision. The principal Cartrivision component consists of a solid-state combination receiver/recorder playback unit. This unit houses the cartridge video tape deck and a full size color television receiver. Cartrivision uses three video heads which will read one-half inch tape running at 3.8 ips. Cartrivision was first demonstrated in 1970 and production was scheduled to begin in 1971. Production, however, has slipped to 1972. The cassette systems, in general, have the same dramatic implications for educational purposes as the previously discussed cartridge TV systems.<sup>15</sup>

#### Video Disc

In 1970, AEG-Telefunken (Teldec) demonstrated a new technique of video recording on a flat phonographic-like disc. The new disc was able to reproduce clear black and white and color pictures with sound on a TV screen.

The traditional phonograph record in the past has been restricted in its frequency range to about 15 kHz, which is too low for video recording. Consequently, the major obstacle for video usage resides in the fact that the frequency range of the disc must be extended to about 3 MHz, a two hundred-fold extension. Teldec accomplished this feat by the development of a vertical recording method. This method enables 130 to 150 grooves per millimeter to be cut into a disc in contrast to the 10 to 13 grooves per millimeter, the storage density capability of current phonograph records.

The Teldec system also uses a much higher rotational speed than ordinary phonograph recording, coupled with frequency modulation (FM) rather than lateral recording (because side-to-side excursion of the grooves is the critical limiting factor in the process). For example, ordinary long playing (LP) records rotate at 33-1/3 revolutions per minute (RPM) with a microgroove density of up to 250 lines per inch across the record. The Teldec system uses approximately 3,500 lines per inch, 15 times the groove density of LP's. An eight-inch video disc will hold up to seven minutes of television program material, and a twelve-inch disc, up to fifteen minutes. Full color discs and color compatible players have been announced as being available in 1972.

The video disc system has, of course, tremendous possibilities for the application of video educational techniques to developing countries. The simplicity of the system coupled with the economy of plastic discs, puts this system into reach of most developing countries. The problem again becomes one of developing appropriate educational software.

Teldec production models are slated for January 1973. This model will play five minutes per disc; the first-run costs of discs, depending on software costs, will be \$2.50 to \$4.00; the player, about \$250; the changer, about \$400. Meanwhile, an unidentified firm in Germany was reported to be developing a process of producing such a video disc on a thin plastic sheet for about eight cents apiece, as compared to the current rate of approximately two dollars apiece.

### Audio Tape Improvements

In the audio tape area, a new kind of tape is in the laboratory stage. This tape, known as Crolyn tape, uses chromium dioxide as the magnetic medium and is expected to reduce the tape speed in audio recorders by approximately one-half. During the next few years, improvements in the frequency range can be expected for tape.

Automatic audio cassette changers will probably become part of the commercial market during the 1971-76 period. This development will allow an individual to listen to an entire "session" without the need for rewinding or changing. This system has been tried in fairly limited educational uses, but it is not really considered state-of-the-art at this time. Continuous loop cassettes will be used more and more for single concept presentations, for presentations to dynamically changing audiences, and other applications. This type of cassette will decrease tape handling problems; for example, for dial access retrieval systems.

### Costs

A summary of costs involved in satellite-assisted communication systems is contained in the following chart.

COST ESTIMATES OF SELECTED AUDIOVISUAL SYSTEMS

TYPES OF SYSTEMS	COST (1971)		COST (1976)		MAINTAINABILITY/ RELIABILITY
	APPROXIMATE		APPROXIMATE		
<b>Videotape Recorders Color</b>					
Low Cost	\$2,000		Slight decrease	Moderate	
Mid-Range	\$5,000		Slight decrease	Moderate	
Top of the Line	\$13,500		Slight decrease	Good	
<b>Videotape Recorders Monochrome</b>					
Low Cost	\$1,600		Slight decrease	Moderate	
Mid-Range	\$4,500		Slight decrease	Moderate	
Top of the Line	\$11,000		Slight decrease	Good	
<b>Audiotape Recorders</b>					
Low Cost	\$ 190		No Change	Good	
Mid-Range	\$1,000		No Change	Excellent	
Top of the Line	\$2,500		No Change	Excellent	
<b>Audio-Video Cassette Recorders</b>					
Video Cartridge	\$1,000		\$ 500	Unknown	
EVR	\$ 800		\$ 300	Unknown	
SelectaVision	\$ 400	Available 1972	\$ 280	Unknown	
<b>Audio Cassette Recorders</b>					
Low Cost	\$ 30		Little change	Moderate	
Mid-Range	\$ 150		Slight decrease	Moderate	
Top of the Line	\$ 300		Slight decrease	Moderate	
<b>Dial Access Retrieval Systems (200 students capacity)</b>					
Scheduled Audio Distribution	\$91,000		Little change	Moderate	
Scheduled Audio-Video Distrib.	\$275,000		Little change	Moderate	
Scheduled Audio Reception	\$57,000		Little change	Moderate	
Scheduled Audio Video Recept.	\$110,000		Little change	Moderate	
<b>Electrowriters (per unit)</b>	\$1,350		No change	Minimal	
<b>Student Response Systems (200 student capacity - 4 complete systems)</b>					
Audiovisual Control	\$84,000		Little change	Moderate	
Teacher-Student Feedback	\$68,000		Little change	Moderate	
Individual Feedback (per unit)	\$ 25		Little change	Minimal	



FOOTNOTES

1. "Plan for a Satellite - Related Educational Systems Experiment," U.S. Department of Health, Education and Welfare, Office of Telecommunications Policy, October, 1971.
2. Frank J. Doyle and Daniel Z. Goodwill, "An Exploration of the Future in Educational Technology," Research Report of Bell Canada, January 1971, at 84.
3. Id. at 17.
4. Ibid.
5. Id. at 23.
6. Id. at 29.
7. Ibid.
8. Id. at 28.
9. Id. at 35.
10. Id. at 32.
11. Id. at 33.
12. James Martin, Telecommunications and the Computer (1969) at 359.
13. See D.I. Bitzer and D. Skaperdas, The Design of an Economically Viable Large-Scale Computer Based Education System (Urbana, Ill.,: Computer-Based Education Research Laboratory [CERL], University of Illinois, February 1969), and Sherwood Kohn, "The New Instructional Technologies: Are They Worth It?", Two Years Beyond the CIT Report: The Developing Dimension of Cost-Effectiveness (Washington, D.C.: Academy for Educational Development, Inc., 1971), at 35.

"Preparing a good CAI (computer-assisted instruction) course is roughly equivalent in effort to writing a good textbook. Most good authors are quite willing to produce textbooks at 10-15 per cent royalty rate which have at least 40 hours of classroom instruction. The cost of royalties, reproduction and distribution of lesson material total to \$1.20 per student, and when used for 40 hours of instruction yield an eventual cost of approximately 3 cents per student hour of instruction. The reproduction and distribution of materials for

computer-assisted instruction terminals promises to be very expensive (approximately 40 cents per student for visual and audio materials).

"The main frame cost of a computer meeting (Bitzer's and Skaperdas') requirements (a third-generation computer of the Control Data 6000 class) is approximately \$2.5 million. The additional cost for a million words of memory and other input-output equipment is approximately \$2 million. An estimate for the system software, including some course development programming, is another \$1.5 million. The total of \$6 million, amortized over the generally-accepted period of five yields \$1.2 million per year.

"Assuming that (a) 4,000-terminal system will be in use eight hours a day for 300 days a year, there are approximately 10 million student contact-hours per year. The system cost; excluding the terminals is thus 12 cents per student contact hour. In order for the equipment cost to be comparable to a conventional elementary classroom of approximately 27 cents per student contact hour, the terminal costs must be limited to 15 cents per student contact hour, or to a total cost of about \$7.5 million over a five-year period. The cost for each of the 4,000 terminals, which included a digitally-addressed graphical display device and its driver, a keyset, and a slide selector, must therefore be a maximum of approximately \$1,900. Present indications are that this cost can be met.

"Using newly-developed technological devices, it is economically and technically feasible to develop large scale computer-controlled teaching systems for handling 4,000 teaching stations which are comparable with the cost of teaching in elementary schools. The teaching versatility of a large-scale computer is nearly limitless. Even while simultaneously teaching 4,000 students, the computer can take advantage of the 50 per cent idle time to perform data processing at half its normal speed. In addition, 16 hours per day of computer time are available for normal computer use. The approximate cost of 12 cents per student contact hour pays completely for the computer even though it utilizes only one-sixth of its computational capacity. The remaining five-sixths of its capacity are available at no cost." Id. at 34.

14. Herbert Ohlman, "Communication Media and Educational Technology: An Overview and Assessment With Reference to Communication Satellites," Report No. T-71/1 (St. Louis, Mo.: Washington University, May 1971). The technical characteristics of the tape player of this system is described by Ohlman as using:

a laser operating at 632.8 nanometers with an output power of approximately two milliwatts. The laser beam is passed through the holograms which are embossed on half-inch wide one-mil thick vinyl tape, running at 7-1/2 inches per second (ips.). The resulting image is then picked up by a vidicon camera and the video signal is radio frequency modulated and transmitted to a conventional TV set through its antenna terminals.

15. Lawrence Lessing, "Stand by for the Cartridge TV Explosion," Fortune (June 1971), at 81.
16. J. Tirrell, Educational Specialist, General Electric Company, Washington, D.C.

## V

SATELLITE BROADCASTING PROGRAM CONTENT IMPLICATIONS AND LEGAL  
CONSIDERATIONS

Any satellite system used for education, cultural exchange and national development will encounter problems relating to program content. The degree to which international cooperation or even international co-production succeeds will relate in no small part to the agreements reached relative to program content control. In some cases there may be a question of the legality of a broadcast under the domestic law of the transmitting or the receiving State. In other cases, it may be a situation involving basically cultural or political socialization questions.

One basic problem with program content is that satellite broadcasts which may be legal and accepted in the country of origin may, in fact, turn out to be illegal in the receiving country or in some third country that the broadcast passes through on its way to the receiving country. The legal problem with this situation is that there are different legal, cultural and social standards in various of the nation states, and these divergent standards create difficulties. For example, the domestic laws of libel, slander, right to privacy, defamation and other legal concepts vary from country to country. Additionally, even if the domestic laws are the same, political differences between the countries involved or other questions

of diplomacy may arise which make it impossible for an amicable agreement to be reached having to do with something as controversial as international broadcasting.

A difficulty which also finds expression here has to do with the domestic protection of the artist's or performing person's rights to his creation. In the developed nations, it most often occurs that there is good protection for the artist, whereas in developing countries it is seen as more important for material to be disseminated to the people than for the artist to be protected. So there is a significant divergence between developed and developing countries in trying to deal with the very difficult subject of international television broadcasting by satellite.

Additionally, there is the question of advertising being included in the international broadcast. In some countries the commercial sponsorship of programs is a legal and accepted activity. In other countries it goes against their domestic laws, and therefore would have to be eliminated. If there is an external broadcast coming in with commercial content, there will be difficult problems of national policy.

#### Problems Areas

There are a number of areas in which legal problems arise, some of which are technical in origin and others which are political.

1. Program Content Control: There is a need to prevent unwanted programs from entering the communication systems of countries that do not desire them. This is essentially a problem of political origin which can be solved by political or legal means. It could also be solved by technical means, if efficient devices could be developed to restrict program dissemination.
2. Copyright: The protection of legitimate ownership rights of the artists and producers of broadcast material is a problem that depends largely on individual national commitments to action based on reciprocal protections which themselves are subject to international agreements.
3. Spillover: This is a technical problem of program dissemination control which is amenable to technical controls and international technical coordination. This problem is related to the above one on copyright.
4. Protection of Signals: This is a technical problem which involves protecting the technical integrity of satellite signals and avoiding harmful interference. This is basically the responsibility of the ITU.

Though the above divisions can be made for analytical purposes, it remains for the researcher to select a major division

and then attempt to bring in the other areas by reference. When propaganda broadcasts are considered, it may prove difficult to develop effective legal controls, given the political nature of the goals of the broadcasting country. However, with educational satellite broadcasts, it may indeed be possible to obtain bilateral or regional agreements. Copyright, program content, and the protection of signals will pose problems for the transmitting and receiving States and spillover difficulties will have to be resolved with the inclusion of neighboring States.

Probably the problem that will determine the amount of cooperation to be obtained in related areas is the one of program content control. If this issue can be resolved in an educational context, the related matters of spillover, protection of signals and copyright may prove capable of solution. Though the INTELSAT system is an earth station-satellite-earth station system and, therefore does not create unresolvable problems of spillover or program content, there may be copyright problems because unauthorized use of signals from the satellite by uncleared stations would be possible. Since it is unclear as to the development of the technology for international educational satellite broadcasting, it may be that future developments will lead to a system different from INTELSAT and thus the matter of program content control would be of primary concern.

PROGRAM CONTENT REGULATION PROBLEM

International problems associated with program content regulation are of such importance internationally that it would appear disastrous to allow international legislation to develop which would severely limit the use of satellite technology for broadcasting. That this is possible can be seen from the French suggestion at the 1963 space conference, which was to prohibit completely broadcasting from satellites in the same way that the ITU radio regulations prohibited broadcasting from objects outside national territories. Recently France also suggested, in lieu of a prohibition of space broadcasting, a detailed code to govern program content and other proposals that would prohibit satellite broadcasting without the explicit prior consent of those governments that are to receive the transmission. France also urged the formation of a new international regulatory body.

Even though these proposals will probably not receive international acceptance, it is significant that one of the major countries of the world has suggested this type of restrictive legislation and activity. In this respect, the USSR supports the French position, with the added view that any receiving State which objects to external satellite broadcasting has the right to eliminate by any means possible the offending satellite. The fact that the 1971 WARC provided for space broadcasting makes some of these proposals moot, but increases anxiety over desire for controls to prevent abuse; however,



it is an indication of the type of further regulation that individual countries might try to promulgate for regulating satellite broadcasting.

Thus, it would appear that one solution to the problem of protecting broadcast content would be to draft an internationally acceptable document, which would protect television and radio programs, or teleconferences, transmitted for broadcast via satellite. This protection would have to be against retransmission, public utilization of the program without authorization, and other related matters. This type of protection could be provided in an international document, totally separate from the protection of copyright and/or neighboring rights. Because it would appear that the protection of copyright and neighboring rights is going to be a long and arduous task, it is suggested that a more general document would be acceptable to the nations at this time. This type of work is presently being undertaken by UNESCO in its consideration of the "Draft declaration of guiding principles for the use of space communication for the free flow of information, the spread of education and greater cultural exchange."

#### Site of Regulation

One question that arises in the regulation of broadcast satellites is whether the regulation should be manifest at the source of the broadcast, or at the point of reception. If there is regulation at the source, then various problems

present themselves. In the United States this would include the possibility of the application of the First Amendment to the United States Constitution protecting freedom of speech. This section will use the United States as an example of the domestic law problems surrounding the site of regulation.

The United States has the right to license international broadcasting that originates within the boundaries of the country in the public interest, but it is questionable whether this right extends to the use of the licensing activity to, in fact, censor programming that is intended for an external audience. Though United States broadcasting law contains many examples where stations were curtailed by the Federal Communications Commission for types of broadcasting that were contrary to the public interest, convenience and necessity, this would probably not extend to programming that was contrary to national policy on a particular issue. But what if the divergence with national policy were being raised by a receiving country external to the United States? What type of action should be taken by the United States to limit or curtail such broadcasting? In such cases, the offended country may file a diplomatic protest. The United States State Department would usually transmit notice of and content of the protest to the broadcaster. In exceptional circumstances, the State Department could request the broadcaster to desist on foreign relations and United States national interest grounds, but that would be an exceptional action.

One policy solution to this type of problem would be to enter into bilateral or multilateral treaties with the nations concerned, but this would raise the possible conflict between the right of free speech and the primacy of treaties within the United States. One opinion on this matter is that

...in sum, the constitutionality of any limitation on the content of international broadcasts would have to be determined in the context of the international situation at the time, and of the nature of the limitation. Absent special considerations, it appears that a broad prohibition in the kind of terms already suggested by several other countries would raise serious constitutional questions and would probably not be sustained.

Two points made above should be emphasized: (1) That 'a treaty in conflict with a specific constitutional limitation upon the power of the government cannot stand;' and (2) that the impact of the international context upon the power to regulate specific content, or to 'proscribe... categories of programs,' may not work significant changes in the strictures of the First Amendment except in extreme cases in which the security of the United States might be endangered.<sup>1</sup>

If one assumed that the First Amendment will control the extent to which the content of international satellite broadcasting will be regulated, then the next question becomes one of determining the international political context within which the legislation will be drafted.

Consideration of this question should proceed from several hypotheses: (1) it is only the 'scarcity' of broadcasting that permits the existing scope of its regulation; (2) Americans will be subject to the regulatory jurisdiction of the United States, and will be protected by its Constitution, even though they broadcast through devices in outer space beyond United States jurisdiction; and (3) courts will make an independent evaluation of the impact of such

broadcasting on foreign affairs problems, without regard to existing international agreements or the advice of the executive pro or con as conclusive.

It is entirely possible, indeed probable, that the courts will assess the impact of the First Amendment upon the range of regulatory measures that may legally be applied to international direct broadcasting from satellites by almost exactly the same standards as apply in purely domestic cases.<sup>2</sup>

Thus it could be that domestic courts in the United States could apply domestic broadcasting law to programs that were being broadcast to foreign countries through the satellite, rather than applying a broader standard since it is the public interest of the receiving State that is being affected.

A judicial approach of this kind might easily be prompted by some international act prohibiting or limiting, in some objectionable way, whole categories of broadcasts, such as political commentary or popular culture. Narrow kinds of limitations might, of course, create greater prospects that courts would consider the foreign 'public interest' in permitting different kinds of regulations. But, regardless of the kinds of limitations in an international act, and assuming that serious foreign-relations problems short of war could be demonstrated credibly to courts, courts would seem to have little motive to empower the Executive or Congress to narrow First-Amendment rights. They are much more likely to leave restrictions to the options open to the foreign countries themselves to control what their people receive by jamming or by regulating the capacity and use of community and home receivers.<sup>3</sup>

Thus one question might be the extent to which a country should specify in its domestic legislation its approach to external satellite broadcasting.

Content Control at Point of Reception

Another problem for United States policy is the question of program content control at the point of reception of the broadcast. One solution is to develop, possibly through the United Nations Working Group on Direct Broadcasting, an international convention which simply prohibits direct broadcasting via satellite without the consent of the receiving government. It should be noted, however, that the Working Group has recessed subject to recall by the COPUOS. It is questionable as to how many States would be willing to sign such a document and whether effective sanctions could be provided. Further, should the receiving country's consent be prior or subsequent to the event?

It is questionable whether beam shaping can be accomplished that will allow for transmissions that can be limited solely to the intended receivers, and whether directional antennas will prove to be economically feasible. Thus while technological developments may partially solve regulation problems they cannot be relied upon fully. A receiving country could resort to jamming to protect its interests, but this would raise additional international legal problems. If technical equipment could be devised to screen out unwanted satellite broadcasts, it could be argued that it should be the responsibility of the transmitting State to furnish this equipment to the receiving State without charge.

The above problems would be solved if the following conditions prevailed:

First, where the technical characteristics of the system are such that the objecting state could rather easily prevent reception, as for instance, if specialized, expensive, or visible antennas were required. Second, where the spillover onto the objecting state is so small as to be de minimis under some internationally agreed upon criteria.<sup>4</sup>

While the above situations would require intricate questions of judgment and the development of some regulatory machinery, there are further questions of policy raised. For example, why should a receiving country be asked to police the reception capability of its citizens? Should this country not be able to complain to some international body as opposed to buying the electronic detection gear that would be required to ferret out unlawful receivers?

Further, the development of the technology is such that the size and intricacy of the antenna required for satellite reception is decreasing in cost and size. It is also doubtful whether the quantity of spillover is as important as the content involved in the broadcast and thus standards would be extremely difficult to establish. This would be particularly true if the transmitting nation were following a conscious policy of broadcasting to a primary reception State with the intent of having the spillover reach into a third State. It would simply require appropriate timing and content condensation to achieve maximum effects.

Another alternative for legal control would be to establish a prohibition based on power intensity which would allow for community reception, but not direct reception.<sup>5</sup>

This again, however, would require observation and enforcement within the transmitting State which might prove impossible from a legal or political point of view. The policy recommendation made by Chayes and Chazen pertaining to program content control is as follows:

(2) Prohibition against broadcasting into the territory of another state without its consent. The prohibition might be embodied in an international convention, in which case the general rule should be subject to two exceptions: (a) Where the spillover into the complaining state's territory is de minimis, and (b) where the characteristics of the transmitting system are such that the complaining state could prevent, with relative ease, its own residents from receiving the signal. An alternative formulation could limit the prohibition to transmissions in excess of a designated power threshold, designed to permit direct broadcast to community antennas, but not to home receivers. Here, too, a de minimis exception would be desirable.<sup>6</sup>

The basic difficulty in dealing with spillover is that the difficult problems related to propaganda are always present. Governmental control of receivers, bargaining between the foreign relations components of governments, and other possible remedies most always run counter to the propaganda goals of various nations.

Propaganda control is difficult to achieve because some nations regard it as a good alternative to military intervention while others fear its power to coerce countries and endanger peace. Among the approaches to propaganda control open to policy makers are the prior consent rule, codes of conduct, specific prohibitions, and the contestual approach.<sup>7</sup>

The degree of control that a country wishes to exercise will depend for a great part on its goals in foreign policy

and the degree to which it wishes the use of the satellite for international broadcasting to develop without undue hinderance. If education, national development and cultural exchange are basic goals then a policy of minimal controls might be expected.

Another option might be to have the transmitting State provide the necessary technical equipment to each State receiving its broadcasts to decode them. By sending all transmissions in code, spillover problems would be eliminated. It is possible that this will prove economically prohibitive, plus it creates problems concerning the development of low cost receivers for use in developing countries.

Whether regulatory action is taken by the transmitting State, the receiving State, or some international body, there remains the issue of determining the conditions under which any action is to be taken.

#### HARMFUL EFFECTS DOCTRINE

Assuming the desirability of the control of international telecommunication within the framework of international law, it becomes necessary to consider the alternatives for implementation of the "harmful effects" doctrine. One level on which this could be done would involve the enlargement of the concept of "harmful interference" as contained in Article 48 of the ITU Convention<sup>8</sup> and defined in Annex 2 of the Convention.<sup>9</sup> This limited concern with harmful interference to other telecommunication services could be broadened



to include concern over harmful effects caused to a State. To accomplish this enlargement, an additional paragraph could be added to Article 48 of the ITU Convention, which would read:

All stations, whatever their purposes, must be established and operated in such a manner as not to produce a harmful effect in any State where the transmission is capable of being received.

Thus the situation would be covered where a transmission damaged the interests of a receiving State, but did not necessarily affect any other telecommunication transmission, and provision would be made for the "simple passage" of transmissions which were intended for reception in a third State and had no measurable effect on the intermediate State. The overall result of this addition would be to facilitate international telecommunication by increasing the predictability level regarding situations in which an international transmission would be restricted by affected States.

The development of criteria for determining the existence of a harmful effect on a receiving State could come about in several ways.<sup>10</sup> An attempt could be made to outline the criteria in a United Nations General Assembly Resolution, or alternatively, the ITU could initiate a study into the subject.

Determinative Criteria for Evaluating Satellite Broadcasting

Source of the Satellite Broadcast

The Location of the Transmitter

1. Can the location be determined from the broadcast itself? Is the announced source of the broadcast the actual source?
2. Is the point of origin of the broadcast in a foreign State, on the high seas, in the airspace over the high seas, or in outer space?

The Source of Control Over the Broadcast

1. Is it a State-controlled broadcast, or is it privately controlled?
2. Is it an official State broadcast?
3. Is it a broadcast from the official communications agency of a State?
4. Is it a broadcast emanating from an international or regional organization?
5. Is it a private commercial broadcast?

The determination of the location of the transmitter is significant inasmuch as this nominally indicates the source of responsibility for the broadcast, if not the source of control. If the transmitter is located beyond national territory, the source of control will be more difficult to locate and consideration will be given to the implementation of the legal vacuum doctrine or the objective territoriality principle.<sup>11</sup> In any event, the determination of the control source requires a judgment as to the degree of official governmental control as opposed to governmental acquiescence. Further, the answers to the above questions will enable a partial evaluation to be made concerning the intent of the broadcaster.

### Content of the Satellite Broadcast

#### The Language in Which the Broadcast was Transmitted

1. Would the broadcast be understood by a majority of the people in the transmitting State?
2. Would it be understood by the population of the receiving State? Would it be understood by any other neighboring State?

#### The Program Format

1. What percentage of the broadcast consisted of: music, news neutral information, children's programming, drama, political commentary, or educational material?
2. Was there any evidence of clearly defined propaganda?

The difficulty with this section will center around attempts to define and qualify "propaganda," inasmuch as the usual definition is insufficient for any meaningful determination of desirability to be made. Propaganda is generally defined as "the art of influencing, manipulating, controlling, promoting, changing, inducing, or securing the acceptance of opinions, attitudes, action, or behavior."<sup>12</sup> To be effective, propaganda must secure the attention of the audience, have a high credibility factor, consider the predispositions of the audience, and suggest feasible alternatives.<sup>13</sup> The point at which a persuasive program becomes coercive must be determined, and this cannot be done through the use of any general formula or on a nonspecific basis.<sup>14</sup> It must be determined within the context of a specific situation, that is, within the context of a specific satellite broadcast or group of broadcasts.

Through an examination of the content of the satellite broadcast, the outside limits of propaganda programming can be determined, and while the obvious cases of propaganda will be easy to isolate, the actual dividing line between persuasion and propaganda will depend on the subject matter, method of presentation, and effect of the broadcast. Put another way, it will depend on an analysis of all the factors discussed in the above section. The importance of this analysis is that since there is no international law rule making all hostile propaganda illegal, a case-by-case approach would allow for the eventual building up of criteria that would be generally accepted by States acting in their own self-interest.

### Extensiveness of Satellite Broadcast Reception

#### The Nature of the Broadcast

1. What was the length of the broadcast?
2. What frequency was used for transmission? Was this frequency in use in the receiving State? Was it in use in the Transmitting State? Was the frequency altered during the broadcast?
3. If a series of broadcasts is being considered, with what regularity were they repeated? What was the complete program log for the time period in question?

#### The Nature of the Reception

1. Within the receiving State, what geographical area was covered by the broadcast? What was the area of coverage within the transmitting State?
2. What percentage of the population within the receiving State had access to the broadcast? What percentage had access within the transmitting State?

3. Were any attempts made to alert the population of the receiving State to the availability of the broadcast?
4. Did the strength of the signal or any of the above factors indicate that the primary intent of the broadcaster was to reach a substantial portion of the population in the receiving State?

The answers to the above questions will provide a good deal of information regarding the possible harmful effects of external broadcasting. It is important to consider the extensiveness of broadcast reception inasmuch as it would be preferable to avoid a situation where a broadcast was condemned when it was intended for primary reception within the transmitting State, or was such that it covered only a small area of the receiving State, and therefore did not pose any serious threat to that State's interests. Though it is significant to know the extent of coverage in a receiving State that has raised a complaint, it may be that the intent of the broadcaster is to present an educational program to a third State, and therefore the fact of the availability of reception in the complaining State may be of only secondary importance.

In order to understand fully the context of an international satellite broadcast, it is necessary to consider a number of facts concerning the social and political conditions within the receiving State and their relation to the transmitting State, and therefore the following are offered as criteria for decision.

Relevant Conditions Within the Receiving State

## The Credibility Factor of the International Broadcast

1. Is it likely that the content of the program will be believed?
2. Is it likely that some form of direct action will be stimulated by the broadcast?
3. Has the broadcast created any noticeable effect on the receiving State? Have there been any specific responses to the broadcast?
4. Have political, moral, or social opinions been significantly altered?

## The Nature of the Communications Structure Within the Receiving State

1. Is there a communication monopoly?
2. Are international broadcasts generally available?
3. Are there broadcasts similar to the one in question available within the State?
4. What forms of broadcast censorship are practiced?
5. Are the receiving sets owned individually or supplied by the State to specific groups?

If a communications monopoly exists within a State - resulting in constant exposure to only one set of views - this would constitute a situation of "monopoly propaganda," which may justify an attempt to provide external broadcasts to the citizens of such a State which would be in keeping with the basic principles of Article 55 of the U.N. Charter, Article 19 of the Universal Declaration of Human Rights, Article 10 of the European Convention for the Protection of Human Rights and Freedoms, and Article 19 of the U.N. Covenant on Civil

and Political Rights. The existence of such a duty to broadcast has yet to be proven, but it is possible that it could develop in special circumstances and could be carried to the extreme that even a coercive broadcast would be permissible, providing that the objectives of the broadcast were approved by the majority of Member States of the ITU. Such objectives could include furthering world peace, securing conformance to world order, promoting self-determination, supporting the interests of minorities, or protecting human rights. For example, one of the means by which human rights could be protected would be through the broadcasting of news and information to a State that had a monopoly on communication and was denying basic human rights to its citizens.

It is also necessary to consider the ways in which information concerning an international broadcast could be obtained, and also the political stability of the receiving State.

### Interpretative Factors

#### Sources of Opinion in the Receiving State

1. What factual reports can be obtained from the audience?
2. What information can be obtained from impartial observers?
3. What information can be obtained from international or regional organizations?
4. Are there any indirect indicators that can be relied upon?
5. What reactions are indicated in the other available channels of mass communication?

The Responses of the Government in the Receiving State to the Satellite Broadcast

1. What official action has been taken to curtail the broadcast? Is the broadcast being jammed, and if so, what form of jamming is being used?
2. What action has been taken against citizens who received the broadcast?
3. Have any formal diplomatic protests been lodged with the transmitting State? Has any protest been made through the channels of the United Nations?

The Degree of Political Stability Within the Receiving State

1. Is there a possibility of internal revolt? Is there political repression within the State?
2. Is there significant racial or other discrimination or denial of rights?
3. Is the security of the State threatened? Are any other vital interests being threatened?
4. Would the broadcast in question be likely to cause further initial instability?

Inasmuch as the complaint concerning the international satellite broadcast would be lodged by the receiving State, it seems logical to inquire into the relevant conditions within that State. The circumstances under which the broadcast was received may determine the seriousness of the complaint and the degree of action to be taken.

INTERNATIONAL SATELLITE BROADCASTING LICENSING PROCEDURES

One solution to the above problems would be to implement an international licensing procedure. Provision for licensing regulations could be embodied in an international agreement, made a part of the function of the ITU, or entrusted to a



newly developed international body. Licensing would ensure knowledge of the source of authority over the transmitting facilities and the programming, and would facilitate the implementation of regulatory measures. The standards developed for the granting of a license could include consideration of the determinative criteria for evaluating international satellite broadcasting as a part of the procedure. The refusal of a license could result in the denial to the broadcaster of any protection by the ITU Convention or the Radio Regulations. Where an unlicensed transmitter continued in operation, consideration could be given to imposing effective interference on all transmissions, extending State jurisdiction to control the activities at the transmitter, or applying other mutually agreed upon sanctions. By subjecting private international broadcasting organizations to a licensing requirement, it would also be possible to more effectively control the commercial unauthorized broadcasting stations that have created substantial difficulty in Europe through broadcasts from the high seas. The complexities of international corporate ownership and responsibility could also be resolved by this technique.

The desirability of the international licensing transmitters presents itself on another level when consideration is given to the problem of broadcasting by international or regional organizations. For example, the U.N. Radio Service, while at present providing only broadcast material for re-transmission by State agencies, could develop into a first

impression broadcasting service. Even if such a service were within a State's boundaries, the problem of program content control would remain. Determining the responsibility for programs originated by the European Broadcasting Union or a similar regional grouping might also arise, and inasmuch as there is doubt as to the source of responsibility for broadcasts that originate from international organizations, it would seem desirable to consider a licensing requirement that would specify liability and responsibility for such activities. The adoption of this procedure could thus lead to an orderly development of international satellite broadcasting.

FOOTNOTES

1. Frank Ruddy, "American Constitutional Law and Restriction on the Content of Private International Broadcasting," International Lawyer 103 (1971).
2. Id. at 109.
3. Id. at 110.
4. Abram Chayes and Leonard Chazen, "Policy Problems in Direct Broadcasting from Satellites, V Stanford J. of Int'l Studies 15 (1970).
5. Ibid.
6. Id. at 19-20.
7. Geoffrey L. Thomas, "Approaches to Controlling Propaganda and Spillover from Direct Broadcast Satellites," V Stanford J. of Int'l Studies, 198 (1970).
8. "All stations, whatever their purpose, must be established and operated in such a manner as not to cause harmful interference to the radio services or communications of other members...", International Telecommunication Convention (Montreux, 1965), Art. 48, para (1). (Emphasis added).
9. "Any emission, radiation or induction which endangers the functioning of a radio navigation service or of other safety services, or seriously degrades, obstructs or repeatedly interrupts a radio-communication service operating in accordance with the Radio Regulations," International Telecommunication Convention (Montreux, 1965) Annex 2, No. 414.
10. See D.D. Smith, International Telecommunication Control, 190-195 (1969).
11. Id. at 47, 63, 71 and 47-51.
12. L. Martin, International Propaganda (1958), at 10.
13. Daniel Lerner, "Effective Propaganda: Conditions and Evaluation," in W. Schramm (ed.), The Process and Effects of Mass Communication (1961), p. 482. See also Richard T. Davies, "The American Commitment to Public Propaganda," 31 Law and Contemporary Problems 452 (1962); Arthur Larson, "The Present Status of Propaganda in International Law," 31 Law and Contemporary Problems 439 (1966); Sir Hersch Lauterpacht, "Revolutionary Activities by Private Persons Against Foreign States," 22 American Journal of International Law 58 (1940);

George Arthur Coddington, "Jamming and the Protection of Frequency Assignments," 49 American Journal of International Law 384 (1955); John Boardman Whitton, "Propaganda and International Law," 72 Recueil des Cours 570 (1948 I); Lawrence Preuss, "International Responsibility for Hostile Propaganda Against Foreign States," 28 American Journal of International Law 649 (1934).

14. B. Murty, Propaganda and World Public Order 286 (1968).

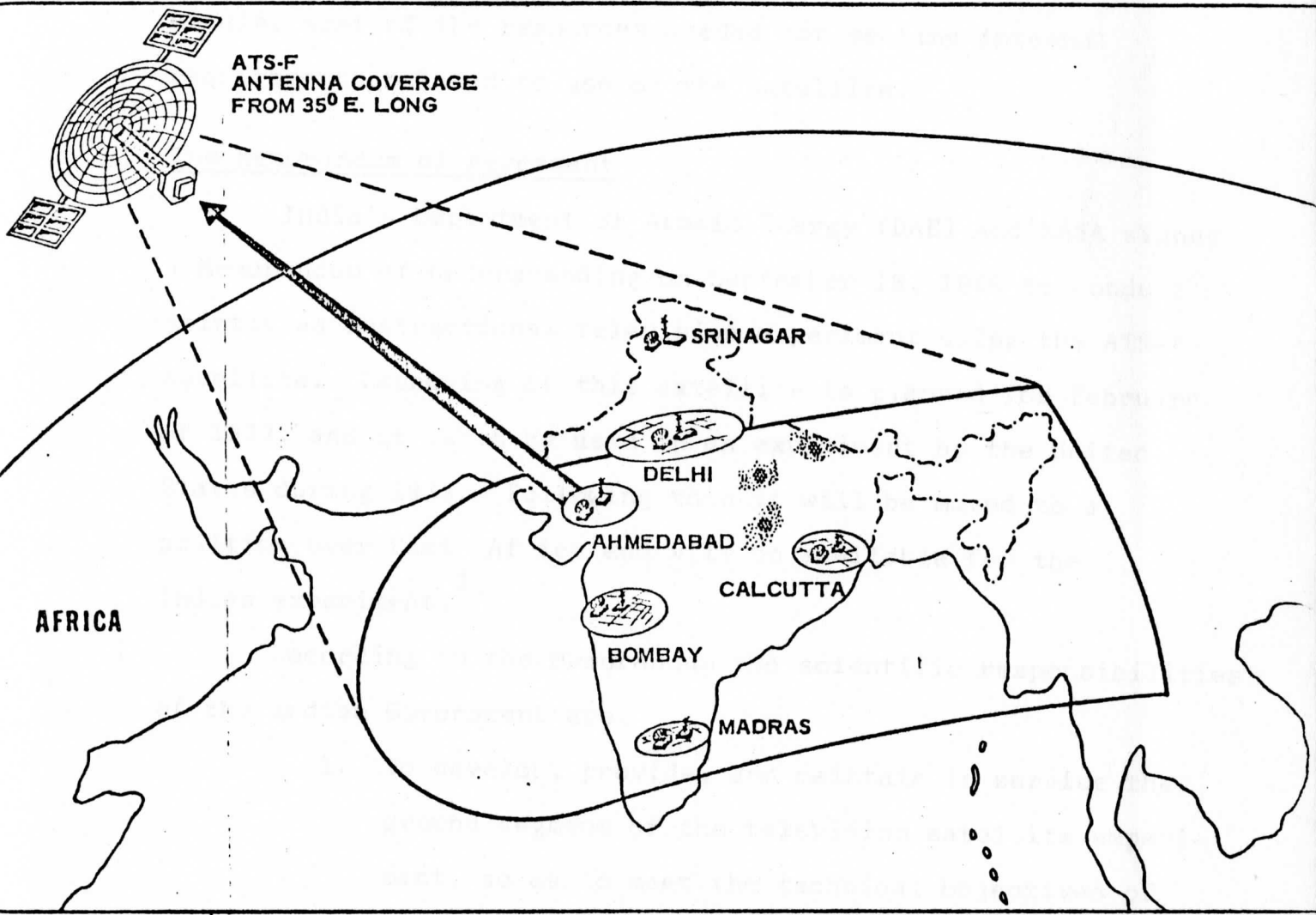
COMMUNICATION SATELLITE SYSTEMS FOR EDUCATIONAL  
AND NATIONAL DEVELOPMENT

There are a number of experiments in the planning stages and underway which will be responsible for shaping the uses of satellites for education and national development for decades to come. Thus it is extremely significant for us to understand the scope of these experiments and their implications for the international educational community. The stated objectives of each experiment should be examined and evaluated so that an optimum use of educational satellite technology will result.

THE INDIAN EXPERIMENT

India had indicated a definite interest in becoming a partner in a satellite experiment to realize one of the potentials of satellite direct broadcasting of television programs: transmissions from satellites to home receivers. India is a good experimentation site because of the size of the subcontinent, which matches the satellite's antenna pattern as is shown in the following illustration. Further, India has as yet no television distribution network, and the population seems to be distributed fairly evenly over the country rather than confined to a few large urban areas, such as could be reached by conventional television methods.

Furthermore, despite the fact that it is considered a developing country, India is highly developed technically, possessing an electronic sophistication that is demonstrated



India/U.S. ITV Satellite Experiment

by its domestic radio manufacturing capabilities and electronic research institutes. In addition, India possesses, or could obtain, most of the resources needed for meeting internal requirements related to use of the satellite.

#### The Memorandum of Agreement

India's Department of Atomic Energy (DAE) and NASA signed a Memorandum of Understanding on September 18, 1969 to conduct jointly an instructional television experiment using the ATS-F satellite. Launching of this satellite is planned for February of 1973, and it is to be used in an experiment by the United States during 1973. Following this it will be moved to a position over East Africa and will be available for the Indian experiment.<sup>2</sup>

According to the Memorandum the scientific responsibilities of the Indian Government are:

1. To develop, provide, and maintain in service the ground segment of the television satellite experiment, so as to meet the technical objectives of experiment; and,
2. To develop and utilize instructional television program materials that will fulfill the instructional objectives of the experiment.

The DAE-NASA experiment has the following instructional and technical objectives:

1. Indian Instructional Objectives

Contribute to family-planning objectives.

Contribute to teacher training.

Improve other occupational skills.

Improve agricultural practices.

Improve health and hygiene.

Contribute to national integration.

2. Indian Technical Objectives

Provide a system test of broadcast satellite television for national development.

Enhance capabilities for design, manufacture, development, installation, operation, movement and maintenance of village TV receivers.

Gain experience in design, manufacture, installation, operation and maintenance of broadcast and/or distribution facilities.

Determine optimum receiver density, distribution, scheduling, techniques of audience attraction, and organization. Solve problems involved in developing, presenting and transmitting television program materials.<sup>3</sup>

India's contribution "includes the use of the existing ground terminal at Ahmedabad; developing and conducting of television programs; procurement, deployment, and maintenance



of receivers; local community organization and support; and evaluation of the results of the experiment.<sup>4</sup>

The Experiment: An Overview

The experiment will require approximately one year, starting in mid-1974, and will involve broadcasting of instructional television programs to an estimated 5,000 Indian villages. The following table provides information about the satellite and the experiment. The languages to be used in this experiment are: Hindi, Kashmiri, Bengali, Oriya, Marathi, Gujarati, Tamil and English. About 2,000 villages will receive programs rebroadcast from a ground station. Theoretically, villages in any part of India will be able to receive the television signal by augmenting a conventional television set with a ten-foot mesh antenna, and a front-end converter.

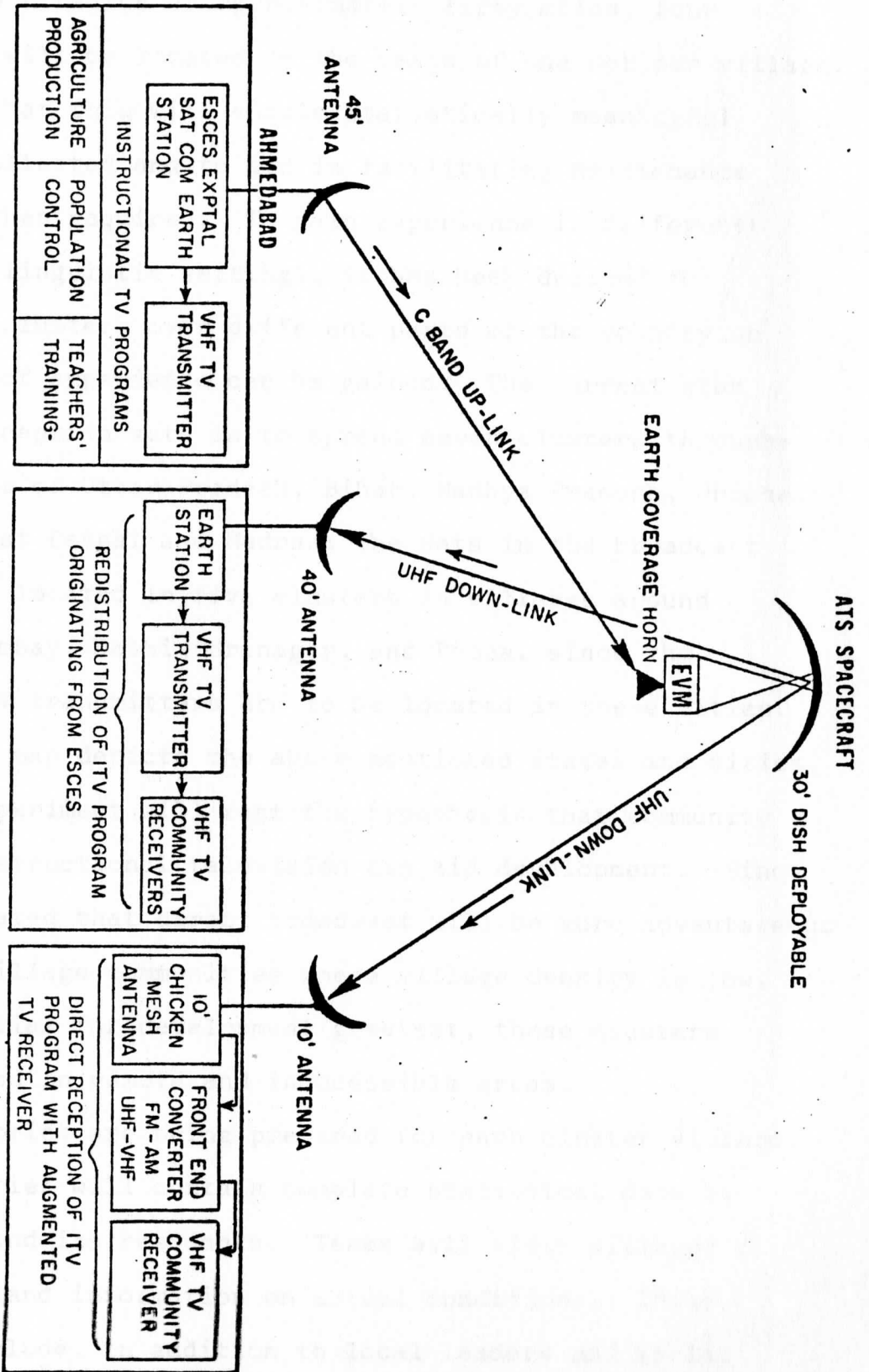
SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT (SITE)<sup>5</sup>

CHARACTERISTICS	PARAMETERS
ORBIT	- GEOSYNCHRONOUS
LOCATION	- 35°E
START DATE	- MAY 1974
PERIOD	- ONE YEAR
ITV PROGRAM	- 4 HOURS A DAY
TOTAL PROGRAM TIME	- 1460 HOURS
CHANNEL	- ONE TV AND TWO AUDIO
SERVICE	- DIRECT BROADCAST TO VILLAGE COMMUNITY TV SETS AND TO RE- BROADCAST CENTERS

More specifically, the instructional television programs will attempt to use "new methods to increase agricultural productivity, promote general education, and disseminate information about population control."<sup>6</sup> These programs will be transmitted to the satellite from the earth station at Ahmedabad, received by the satellite and retransmitted, as is illustrated in the following figure. These satellite-relayed programs will be capable of being received directly by antennas in village schools or community centers.

Antennas will have front-end converters to convert from UHF to VHF, and from FM to AM. In addition, the satellite's signals will be received by earth stations located at Delhi, Bombay and Srinagar, and redistributed to community receivers via VHF conventional transmitters. Thus, a hybrid system involving direct reception as well as rebroadcasting will be tested.

Some of the 5,000 TV sets for Satellite Instructional Television Experiment (SITE) will be fully transistorized models, to be operated on batteries. The battery-operated sets are critical to the experiment because some 80% of Indian villages do not have electricity. Approximately 2,000 sets will be augmented for direct reception, while the remainder, located in rural areas, will be serviced by the rebroadcast method. Receivers of the direct-reception-type are to be located in clusters of about 400 each. These clusters will be so selected as to obtain the widest possible range of meaningful experience from the experiment.

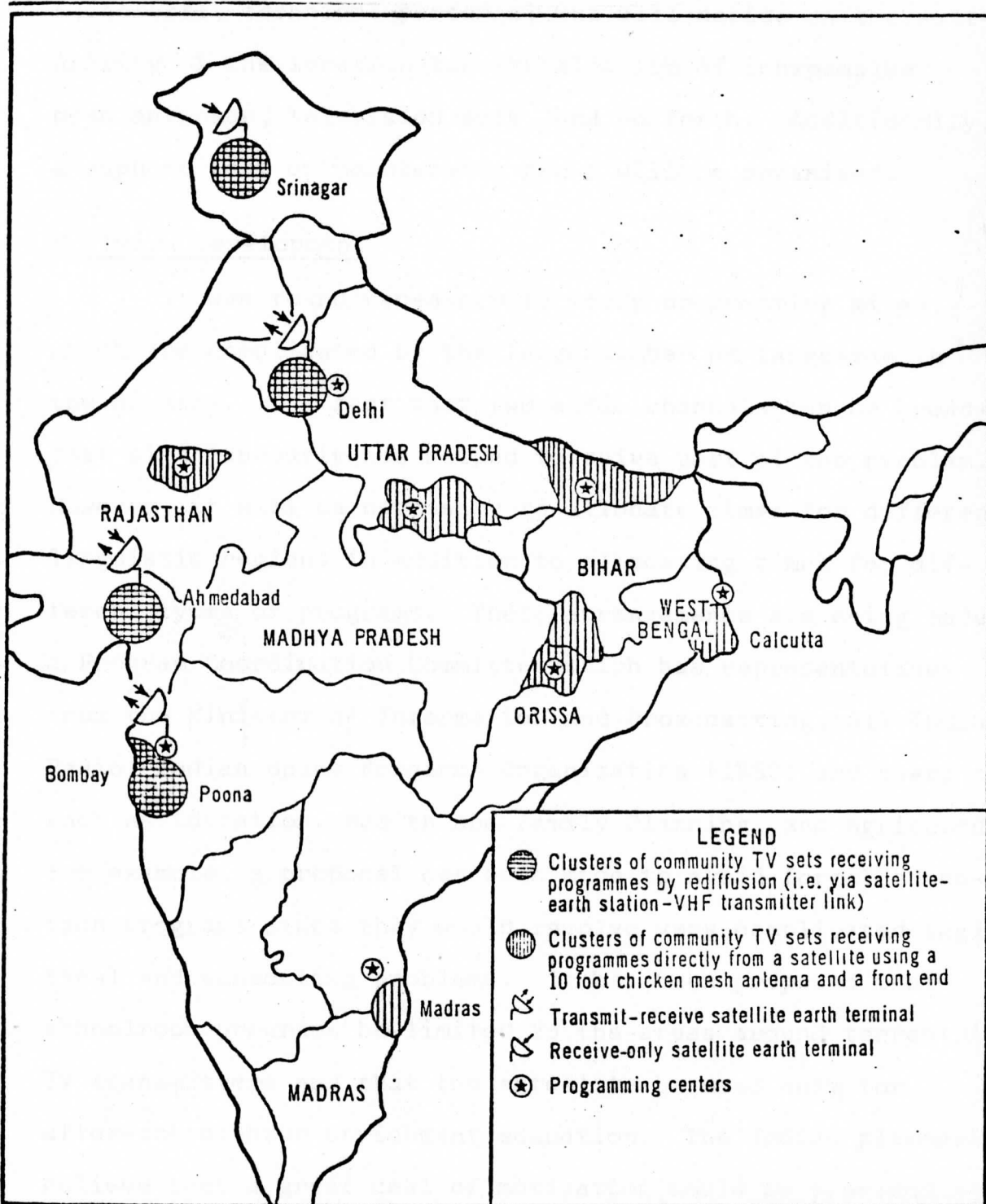


Satellite Distribution System - Indian Experiment

Within a radius of approximately fifty miles, four hundred sets will be located on the basis of one set per village. It is hoped that this will enable statistically meaningful data to be collected and to aid in facilitating maintenance of the sets when required. To gain experience in different cultural and linguistic settings, it has been decided to spread these clusters over different parts of the country so a wide range of experience can be gained. The current plan for direct reception sets is to spread seven clusters throughout the states of Uttar Pradesh, Bihar, Madhya Pradesh, Orissa, Rajasthan, West Bengal and Madras; the sets in the broadcast areas will be located in five clusters in villages around Ahmedabad, Bombay, Delhi, Srinagar, and Poona, since the terrestrial TV transmitters are to be located in these cities. The following map depicts the above mentioned states and cities.

The experiment will test the hypothesis that community viewing of instructional television can aid development. Since it is anticipated that direct broadcast will be more advantageous in isolated village communities where village density is low, and the potential for development greatest, these clusters will be located in remote and inaccessible areas.

Directories are being prepared for each cluster village. These directories will contain complete statistical data on each village and its residents. Teams will visit villages to obtain first-hand information on actual conditions. These teams will include, in addition to local leaders and social



SITE Cities - States

scientists, technical personnel who will decide on the suitability of the location for installation of inexpensive mesh antennas, television sets, and so forth. Additionally, a support team or maintenance group will be organized.

### Software Development

It was found necessary to study programming mixes, which are complicated by the large number of languages in the country. The fact that two audio channels can be broadcast simultaneously has helped to solve part of the problem. However, it will be necessary to allocate times for different linguistic regions in addition to allocating times for different types of programs. These arrangements are being made by a Program Coordination Committee which has representatives from the Ministry of Information and Broadcasting, All-India Radio, Indian Space Research Organization (ISRO) and users such as Education, Health and Family Planning, and Agriculture. For example, a proposal has been made to avoid formal education programs since they would involve very complicated logistical and scheduling problems. It has been proposed that schoolroom programs be limited to the areas around terrestrial TV transmitters and that the satellite be used only for after-school-hour enrichment education. The Indian planners believe that a great deal of motivation would be provided and a much larger target audience reached if program efforts were aimed at after-school-hour audiences. Also, planners believe that tying programs to a strict curriculum reduces programming

freedom and inhibits the development of interesting and relevant programs. In agricultural programs some experience has already been gained as a result of the experimental Krishi Darshan project which involved broadcasting of agricultural programs to community TV sets in villages around Delhi.

Since the experiment will involve broadcasts for about four hours every day, a total programming time of approximately 1,460 hours will be available. It has been proposed that approximately 1,000 hours of programs be pre-tested and "canned" before the start of the experiment, with the recognition that the programs may have to be modified later. However, the Indians do realize the importance of having a large proportion of the programs ready for use before the start of the experiment. Furthermore, they recognize the necessity for these programs to be thoroughly pre-tested so that their impact will be understood and maximized. This is of special importance since broadcasts via satellite will be reaching a large number of viewers and a bad program could have wide repercussions. In order to have these programs ready, a number of steps have been taken to include establishing a TV training institute at Poona, and a training institute for TV teachers at Delhi, both with aid from UNDP. On the hardware side, the UNDP is assisting in the expansion of the Experimental Satellite Communication Earth Station (ESCES) at Ahmedabad which will be used as the primary earth station during SITE.

### Evaluation

The effectiveness of this program will be evaluated in a systematic manner, on a pre-test/post-test basis.<sup>9</sup> Exact criteria for the evaluation have not yet been completely determined. However, the design of the evaluation scheme will permit measurement of the influence of various environmental parameters on the effectiveness of the program. The overall experiment will be constantly reviewed as it progresses. It is anticipated that immediate feedback on the experiment will be made available through: social service organizations operating in the cluster areas; pre-testing, which will be carried out in the eight program-generating centers spread throughout India; and taping roughs before final transmission. Long-term evaluation will be accomplished by a consortium of Indian social scientists.<sup>10</sup>

### Costs

The original hardware costs for the Indian experiment were estimated at approximately \$50 million United States dollars. The estimates shown in the following table were provided to a UNESCO Expert Mission by the Indian government in November and December 1967, and do not include insurance, freight or import duties.<sup>11</sup> These figures may not be representative of actual costs, since revisions have been made in the original plan, the costs of materials have increased, and the information available for calculating the costs was limited. In addition, software costs should be represented to include



such things as the money that UNDP, ITU and other organizations will spend, and the total costs of program-design development, testing and presentation.

ESTIMATED COST OF SITE<sup>12</sup>

ITEM	COSTS IN U.S. MILLIONS
Satellite (development plus procurement costs)	10.0
Launching and launch support costs 25% for launch failure	6.5 4.1
Four receive and broadcast terminals (\$5,000,000 <sup>x</sup> )	2.0
Two transmit and receive stations (Ground station at Delhi and additional investment at Ahmedabad)	1.5
50,000 conventional television receivers at 200 dollars each	10.0
Additional equipment for 15,000 direct community receivers (requires further study)	8.0
Spares for maintenance (20%) items 3-6	4.0
Contingency	4.0
	49.1

Background Preparation

The Experimental Satellite Communication Earth Station (ESCES) was established with the idea of providing first hand experience and training for Indian engineers. This was done

with the view that when new technology became available for practical application, India would not have to rely on foreign experts. ESCES was established with the assistance of the UNDP and the ITU. An agreement was signed on December 15, 1965 to undertake the earth station project at Ahmedabad, and it became operational in August 1967 and has been useful in the training of Indian engineers and engineers from many developing countries in Asia and Africa.

#### Krishi Darshan Program

In order to gain insights into the ways in which television can be used as a direct instrument for promoting developmental tasks set by the Indian government, a number of software pilot studies have been undertaken. The Krishi Darshan program was organized in 1967 by the Indian Space Research Organization (SRO), in collaboration with All-India Radio, India Agricultural Research Institute, and the Delhi Administration. Community television receiving sets were placed in eighty villages in the general vicinity of Delhi, and half-hour rural-oriented programs are being broadcast three times a week. Experience to date indicates that it may be possible to make relevant changes in the development of isolated communities.

These programs have been on the air for more than four years, and have provided valuable experience in the design of rural broadcasts, interdisciplinary interaction, and problems relating to media management, utilization, research and feedback.

Cost/Effectiveness Study

Parallel to the Krishi Darshan program and with the help of NASA officials, the Indian government conducted a cost comparison of deploying four alternative systems for providing national television. The following four systems were compared: Conventional rebroadcast stations with terrestrial microwave; satellite broadcasting exclusively; conventional rebroadcast stations with satellite interconnection; and a hybrid system with five rebroadcast stations.

The following table provides a summary of the cost estimates gained in the course of this study. System four (a hybrid one with five rebroadcast stations) was found to be optimal for India involving the least cost solution with a total cost of of \$224.04 million, including the satellite.

COST COMPARISON OF ALTERNATIVE  
COMMUNICATION SYSTEMS<sup>13</sup>

Systems	U.S. \$ in Millions	
	Initial cost	Annual Maintenance
Conventional rebroadcast stations with terrestrial microwave interconnection	393.60	26.28
Satellite broadcasting exclusively	225.05	9.50
Conventional rebroadcast stations with satellite interconnection	325.15	21.78
Hybrid system with 5 rebroadcast stations	224.04	9.78

Therefore, the hybrid system, involving direct broadcast to some areas and five rebroadcast stations for the densely populated regions, would be only one-third as costly as conventional re-broadcast stations with terrestrial microwave connections.

#### Audio-Visual Educational Communication (AVEC)

To determine how to make a developmental message interesting and entertaining to the people of India, a pilot project called AVEC - Audio-Visual Educational Communication - was begun. Its primary objective is to conduct broad research in the audio-visual field in order to develop suitable prototypes for instructional purposes. The work has been undertaken by an interdisciplinary team composed of Indian artists, writers, dramatists and sociologists.

#### Future Plans

The Indian government has already made plans to follow up SITE with a domestic satellite system. If SITE is successful the national system will include a hybrid television system for direct reception and rebroadcasting. Consequently, the last eight years of work have been leading to a system now known as Indian National Satellite for Television and Telecommunications (INSAT).

The present plan is to install one television set in each of India's 550,000 villages over the next five to ten years. The satellite to be used will be multi-purpose and will be used for television as well as telephone facsimile

and other services. Television capabilities would include three video channels, each accompanied simultaneously by fourteen audio channels. Thus, SITE is considered as a possible forerunner of a national system. The estimated hardware costs for the INSAT system are shown in the following table. The national system is to be developed over ten years and divided into two development phases.

Phase I, from 1969 to 1973, is the preparation phase, in which the foundation for implementing the program is developed. In this phase Indians will learn the appropriate skills for design, development and fabrication of equipment, how to develop software, how to establish management systems, and so forth. The practical experience is to be gained through the DAE-NASA ITV experiment. Using the skills and expertise developed in Phase I, Phase II (1974-1979) will involve coverage of an additional 100,000 to 150,000 new community reception centers each year.

The Indian experiment will provide the answer to many of the questions that communications experts, educators, engineers, and others, have asked about the operational feasibility of using satellites in less-developed countries. The value of the experiment extends beyond the dollar investment, because the results will provide guidelines for policy, design of hardware and software, and the economics of system development, implementation and operation.

**COST ESTIMATE FOR THE INSAT SYSTEM<sup>14</sup>**  
 System with 5 rebroadcast stations  
 (All figures in millions)

Description	U.S. \$	
	Initial cost	Annual maintenance
1. Earth Stations (2) (Transmit & receive capability)		
(a) Land (50 acres @Rs.60,000 each)	0.40	..
(b) Buildings @Rs.500,000 each	0.13	0.01
(c) Equipment @Rs.5.7 M each	1.52	0.15
2. Satellite in orbit (Hughes Estimate)	10.30	..
3. VHF Transmitters (5)		
(a) Land @Rs.600,000 per station	0.40	..
(b) Building @Rs.800,000 per station	0.53	0.01
(c) Equipment including air conditioning	4.06	0.45
4. *Earth Stations Receive capability (3) @Rs.750,000 each	0.30	0.01
5. TV receivers (616,000) @Rs.1,800 each	148.00	7.40
6. +Receiver front-ends @Rs.787.50 each 559,625 (508,750 + 10%)	58.40	1.75
	224.04	9.78

\*Two more receive stations would be located along with the two transmit stations. As the receive-only stations would be located at the rebroadcast stations, no separate amount is shown for land and building for these.

+When the cost of a receive-only and rebroadcast station is \$1.1 million and the cost of a front-end is \$105, the cross-over point works out to 10,450 receivers per service area. The five rebroadcast stations would cover 57,475 conventional receivers and the remaining 508,750 villages would have direct receivers.

THE BRAZILIAN EXPERIMENT

Brazilian interest in an educational satellite began with the 1967 Stanford University "Advanced Systems for Communication and Education in National Development" Report (ASCEND), which covered the results of a study of satellites for developing countries. The potential of the concepts stated in that report prompted the Brazilian National Commission for Space activities (CNAE) to present the idea of a Brazilian satellite to the National Research Council in 1967. CNAE issued a completed feasibility study for such a system in May, 1968.

At the request of the Brazilian Ministry of Foreign Relations, a mission of UNESCO experts went to CNAE and prepared a report entitled "Preparatory Study of the Use of Satellite Communication for Educational Development in Brazil." A year or so after the Indian proposal was submitted to the United States, Brazil submitted its own proposal for the use of an experimental satellite.<sup>16</sup>

This proposal required extensive revision because of assumptions made about the use of radio frequencies. In May 1970, a revised Brazilian proposal was submitted to NASA requesting aid in an experiment that would use the same ATS-F satellite as the Indians were to use. To date the United States and Brazil have not concluded any formal agreement for the use of a U.S.-made satellite or launch vehicle.

## Project SACI

The proposed ATS-F experiment is part of a larger effort on the part of the Brazilians to use modern technology to upgrade its educational system. The project is called Satellite Avancado de Comunicacoes Interdisciplinares (SACI).<sup>17</sup>

...the central objective of Project SACI is to achieve, in a reasonably short time, a radical improvement in the national system of education, from the point of view of dimension, penetration, quality and efficiency, providing equal opportunities of learning for all citizens, without distinction, independent of their geographic location.<sup>18</sup>

The SACI Program is comprised of three general phases. Phase I involves Brazil receiving selected broadcasts from Stanford University, and Brazil transmitting programs on Brazilian culture to Stanford University via ATS III satellite. Phase II consists of demonstrations of the use of new technologies, in ways directly benefiting the people of Brazil, and developing, on a small scale, the equipment, organizations, and programming that will lead to a technically and economically feasible nation-wide telecommunication education system. Phase III would see Brazil with its own satellite which would cover the entire nation for telecommunications and educational purposes.

## Experiment Objectives

Primary objectives of the Brazilian ATS-F experiment are:

1. To demonstrate a total system prototype of the ultimate SACI operational system.

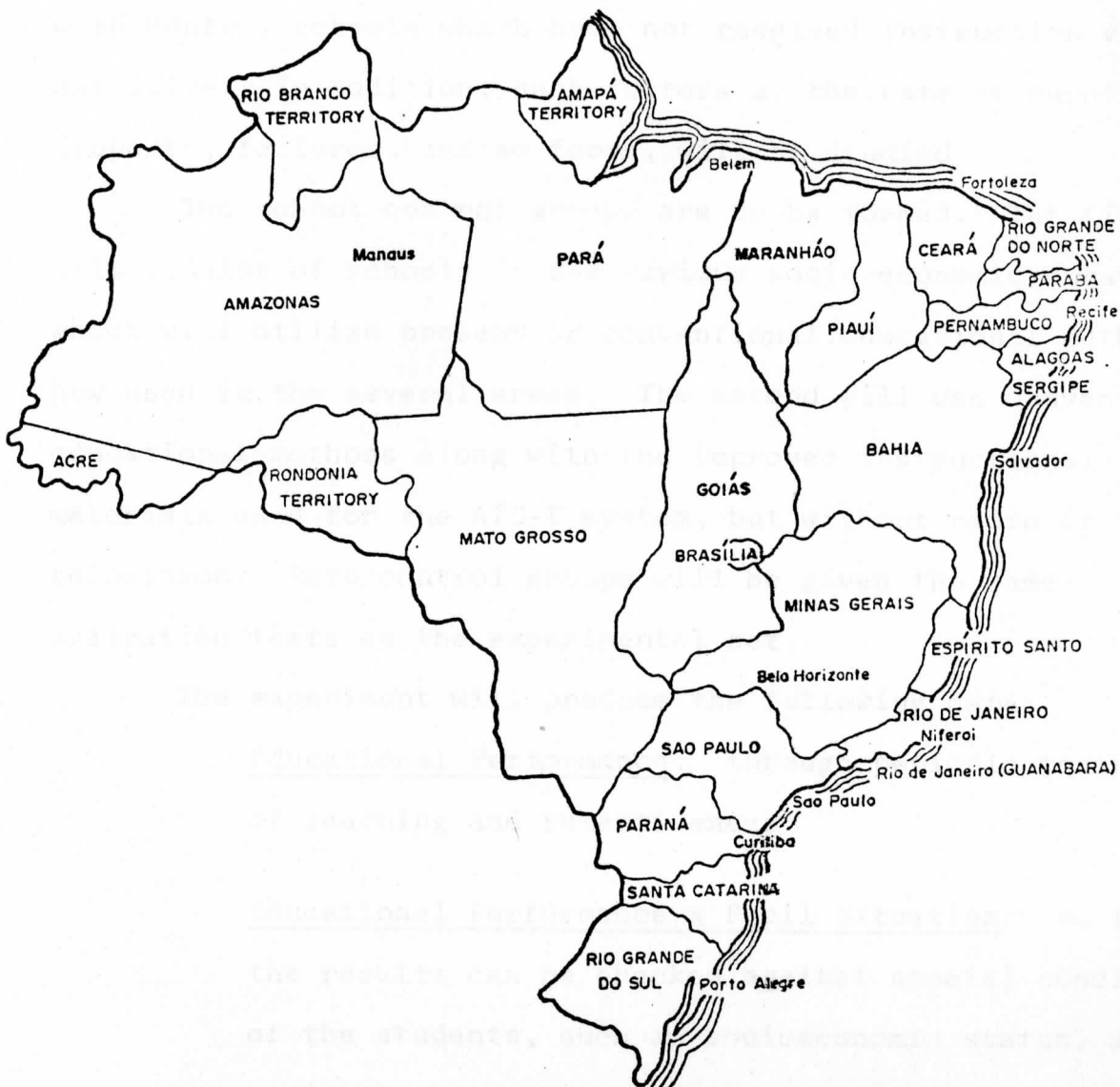


2. To develop, demonstrate, and quantitatively evaluate a balanced mix of television and radio for education, each used to its greatest instructional advantage.
3. To develop satellite-compatible ground hardware (with the participation of Brazilian industry) as a prototype for operational hardware.
4. To develop an installation and maintenance organization to serve as a prototype for the ultimate operational system.<sup>19</sup>

The educational objectives of the Brazilian experiment differ from those of India. While India is concentrating on an adult audience in remote areas, providing instruction in agriculture, health and birth control, the Brazilians are emphasizing testing of satellites for central broadcasting, using a balance of television and radio to upgrade classroom instruction, teachers, and measure pupils' retention, as a function of different broadcast media, which ultimately would facilitate rapid expansion of the educational system.

The Brazilians are hoping to use the ATS-F at the beginning of the 1973 Brazilian school-year. The experiment is planned for the state of Rio Grande do Norte, located in the northeast part of Brazil. The following map delineates the states and territories of Brazil. Differences in environment, and among native groups present a wide range of problems concentrated

in a region small enough to be used for a controlled experiment. Educational programs to be presented will use one television channel and eight radio channels. These will be combined and transmitted to the satellite for broadcast to five hundred school sites. Additional capabilities built into the equipment may eventually be used for facsimile and slow-scan television experiments.



**Brazilian States and Territories**

Planned educational programming will provide up to three hours of television, and six or more hours of radio per day, and will cover one year of grade school. Subjects to be covered are Portuguese, social studies, science and mathematics. The experiment will concentrate most of its effort on formal grade-school-level education, with additional subject emphasis as authorized by the state's educational authorities. This will permit comparison of different media, as well as with control schools which have not received instruction via satellite. In addition, such factors as the rate of enrollment, dropouts, failures, and so forth, will be studied.

Two school control groups are to be formed. The first will consist of schools in the various socio-economic strata which will utilize present or conventional educational methods now used in the several areas. The second will use conventional educational methods along with the improved instructional materials used for the ATS-F system, but without radio or television. Both control groups will be given the same evaluation tests as the experimental set.

The experiment will produce the following data:

Educational Performance: through periodic tests of learning and retentiveness.

Educational Performance x Pupil Situation: so that the results can be checked against special conditions of the students, such as socioeconomic status, and available study time. To these ends, a questionnaire

will be completed by each student at the beginning of the school year.

Educational Performance x Teaching Media: whereby the three school groups will be compared:

Conventional school.

Conventional school plus improved classroom materials.

Schools in the ATS-F Experiment.

Local Leadership Participation: through the assignment of specific tasks to local inhabitants and periodic checks on their performance.

Cost/Benefits: as noted elsewhere, the ratio of "cost/benefit" will be computed for the three groups of schools, taking into account investments made and educational performance.

### Evaluation

Selection of the school sample for the experiment is on the basis of selected significant parameters. This includes both the schools to be included in the experiment and the control schools in Rio Grande do Norte. During 1970 and 1971 integrated teams of statisticians, educational technologists, sociologists, teachers and computer personnel will refine the evaluation measures from the standpoint of educational performance of pupils, cost/benefit ratios, and community improvement, i.e., local leadership participation.

Pre-testing of methods and measurement procedures, resulting from this work will be made possible through the use of a closed-circuit radio-TV link from the studios at CNAE, operated by the Brazilian Foundation Center for TVE, to a nearby municipal school, under the terms of a CNAE/Sao Jose dos Campos County cooperative scheme (PLAMCA).

### Project Cost

The cost of the Brazilian experiment is estimated at between eight to ten times less than the Indian experiment. The highest estimate for the Brazilian experiment is approximately \$7,500,000, whereas India's effort will cost close to fifty million. The 1971 cost estimates for the Brazilian experiment have been placed at approximately \$24 million by Fernando de Mendonca, Scientific Director, CNAE. The following tables depict estimated costs for the Brazilian software and hardware. The software portion will cost about \$4.5 million, including the programmed instruction texts, whereas hardware and engineering costs will be slightly more than \$3 million.

The magnitude of Brazil's effort is considerable less than that of India's. Brazil has confined its experiment to a relatively small geographical area, and has limited ground components to one ground transmission terminal and 500 receiving terminals. Additionally, although the effort does not focus on television alone, it plans to devote only a maximum of three hours

SOFTWARE AND PROGRAMMING COST SUMMARY <sup>20</sup>

Software and Programming Costs	U.S. Dollars
Studio including equipment (Brazilian Center of ETV Foundation at CNAE)	210,900 (a)
Salaries and training of planning and integration personnel at CNAE	144,000 (b)
Programming of:	
Primary Education Courses	603,000
Literacy Instruction Courses	45,000
Vocational Training Courses	45,000
Teachers Training	147,600
Administrative Instructions	45,000
Total Programming Costs	885,600 (c)
Administrative Costs	
Classroom Workbooks	75,000
Supervisory & Evaluation Personnel	114,800
	189,800 (d)
TOTAL SOFTWARE COSTS (z) + (b) + (c) + (d)	1,430,300

NOTE: An additional \$3,000,000 will be spent for preparation of "programmed instruction" texts, as part of the studies in the application of new educational technologies to the Brazilian school system.

HARDWARE AND ENGINEERING COST SUMMARY <sup>21</sup>

Hardware and Engineering Costs	U.S. Dollars	
	Low	High
<b>Transmit Station</b>		
Prime Equipment	84,500	95,050
Back-up Equipment	37,000	47,000
UHF Monitor Equipment	3,710	7,850
Test Equipment	15,000	
Transportation, insurance, etc. (to site)	22,430	26,370
Building	10,660	
Salaries	5,050	10,100
<b>Total - Transmit Station</b>	<b>(178,400</b>	<b>212,002)</b>
<b>Receive Site Equipment</b>	<b>(742,500</b>	<b>2,812,500)</b>
System Engineering, Design, Integration and Installation	300,000	500,000 (est)
<b>HARDWARE - TOTAL</b>	<b>920,900</b>	<b>3,024,530</b>

a day for television broadcasting, while the remainder is to be used for radio broadcasts. In addition, not all of the 500 reception sites will be receiving television signals. Only approximately 150 will be equipped for such reception. While the Indian cost estimates include the satellite as well as yearly maintenance costs, the Brazilian estimates do not include the latter.

### Analysis

The ATS-F experiment is planned to serve as the developmental prototype system for the SACI project which will eventually make educational opportunities available to all Brazilians by means of a government-owned geostationary satellite broadcasting to the entire country carefully-prepared television and radio instructional materials. The SACI project will not be ended merely because a satellite is not immediately available, and the potential benefits of the satellite experiment are so significant that most of the planning and initial experimental design efforts are satellite-oriented in anticipation of an agreement with NASA.

The use of a satellite system to provide nation-wide educational opportunities is an increasingly attractive possibility. From the economic standpoint annual costs should add up to only a modest fraction (estimated between 5% and 10%) of all funds devoted at present to Brazilian education.

In spite of the considerable progress made in recent years, the expansion of education via a terrestrial system



tends to favor areas having better communication infra-structures and higher living standards. Those regions where needs are the greatest are the hardest to reach. The satellite system, by its very nature, helps to create uniform conditions of opportunity and provides a base for a unified national effort.

THE ROCKY MOUNTAIN EXPERIMENT

In the United States the ATS-F satellite will be used for approximately eleven months for two hours a day in the Rocky Mountain area.<sup>22</sup> Experimentation with the ATS-F is part of a long-range research, development, evaluation strategy intended to culminate in the early 1980's in an operational educational telecommunications system. There are questions of system configuration - how different components can be put together so that the strengths of each are capitalized on, the parts integrated into a single articulated whole, and the performance of the whole optimized; and questions of utilization - the specific individual and organizational roles which must be adopted to assure real world utilization of the instructional system which is produced, and steps necessary to have these roles understood and accepted.

The instructional area for the ATS-F experiment will be early childhood education, with a focus on language development, communication skills, and reading readiness. In line with the two-way transmission capability of the ATS-F, five alternative technological delivery patterns will be tried. The five alternatives are:

- a. Television alone (one-way transmission)
- b. Two-way interactive, delayed feedback
- c. Two-way interactive, immediate feedback
- d. TV plus two-way interactive with delayed feedback
- e. TV plus two-way interactive with immediate feedback.

In the television transmissions, the audio portion will be varied according to the language background of the learner. ATS-F will have four voice channels associated with each video channel, and separate audio will be provided for learners whose first language is English, Spanish, and American Indian. Two-way interactive transmissions will involve digital information only and can be handled simultaneously with the TV broadcasts through the satellite's separate voice channels. Delayed feedback will be accomplished through a variation of computer assisted instruction.

There will be four target audiences in the experiment. The principal audience will be young children in the three years prior to beginning school. Secondary audiences will be parents, professional educators (certified teachers), and paraprofessionals. Parents will be involved in all experimental groupings, and professionals and paraprofessionals will be involved in alternate groupings. Special television presentations will be prepared for the adult audiences, with direct person-to-person interaction (talkback) used in some segments.

The television-alone condition will be used only with parents and children in the home. The eight other conditions, illustrated in the diagram below, will require local learning centers which serve ten or more children. The centers can be in homes, schools, churches, or other suitable fixed locations, or in mobile vans.

Child & Parent & Professional				
Child & Parent & Paraprofessional				
	Two-Way Delayed	Two-Way Immediate	TV + Two- Way Delayed	TV + Two-Way Immediate

The nine experimental conditions will be tried with a number of different population subgroups, defined according to three background characteristics: first language spoken, geographic location, and income level. Categories for first language spoken will be English, Spanish and American Indian. For geographic location, they will be urban, suburban, rural dense, rural isolated and migrant. Stratified random sampling within these categories will produce a meaningful range on income level. One purpose of the experiment will be to check on treatment (system configuration) by subgroup interactions, i.e., to determine if different combinations are more effective with different subgroups.

A substantial portion of the evaluation effort in the experiment will be formative in nature. This means focusing on process, on the working of the system and articulation of the different components, and on securing utilization among all participating groups. Problem areas will be identified and suggestions for solutions developed. This kind of effort lays the groundwork for later redesign and further experimentation, and it is an essential step in the long-range research and development strategy. Formative evaluation depends heavily on

qualitative data, consisting mainly of the judgments of observers and participants. Systematic methods of securing this data will be planned and implemented.

Performance outcomes will also be checked, and this necessitates either developing or securing suitable measuring instruments. Outcome variables will include information gain, cognitive skill development, effective development, and development of social skills. Per pupil costs for different configurations and different population subgroups will be determined and cost-effectiveness ratios computed.

A major planning and programming effort will be necessary prior to the start of ATS-F operation on June 1, 1973. It will begin with a survey of early childhood education models, particularly those which have been evaluated in the Head Start-Follow Through program. One or some combination of models will be chosen as the conceptual foundation for instructional elements of the system. Complementary, articulated components which together operationally represent the conceptual model will be planned and developed. This effort will obviously require very close coordination. Components will include television, technologically delivered interactive experiences, professional and paraprofessional training and activities, parent training and activities, and other independent pupil activities.

Terminal Type or Experimental Equip.	Number	Location	Experimental Purpose
Control Terminal	1	Ottawa	a) Experiment Control b) Engineering Measurements
Instrument Terminal	1	Various (Transportable)	Engineering Measurements
T.V. Mobile Terminal	1	Various (Transportable)	T.V. Transmission from selected locations
Beacon Terminals	3	M.O.T. & University Sites	Propagation Measurements
8' - Receive Only	4	Not Decided (Partially Dependent on Cooperating Agencies)	a) Evaluate technical features of television broadcast b) Evaluate viability of satellite broadcasting television
8' - Receive & Two-way Voice	2		a) As for receive only terminals b) Evaluate telephony for ETV
4' - Two-Way Voice	6	Portable, Within Coverage for TV Exp's	Evaluate technical and operational aspects of two-way voice, using FDM
2' - Receive Only	10	a) Within coverage for TV Exp's b) Northern Canada	a) Evaluate technical features of sound broadcast b) Evaluate viability of satellite sound broadcast services

THE CANADIAN EXPERIMENTS

Canada has an impressive record being the third nation in the world to have a satellite in space, beginning with Allouette I which was launched in 1962 and which is the oldest operational satellite orbiting the earth today, up to a 1971 launch of ISIS-B which is Canada's fourth experimental satellite.<sup>23</sup> To date, Canada's four satellites have been research satellites surveying space in order to conduct scientific experiments, particularly in the ionosphere. More recently Canada entered the broadcast satellite area with an act of the Canadian Parliament in 1969 establishing Telesat Canada. This corporation is unique in that it is jointly owned by the Federal Government, telecommunications common carriers, and eventually the general public. Telesat is responsible for the management of Canada's domestic satellites. Canada's first broadcast satellite will be called Anik I and it is to be launched in the Fall of 1972. The satellite is currently being constructed by Hughes Aircraft Company of California under a \$30 million contract with the contract calling for Hughes to eventually deliver three 12-channel satellites. Each satellite will have 10 channels for commercial use and 2 back-up channels with the commercial channels being capable of carrying one color television signal each, or, in terms of message traffic, 160 one-way voice channels. To complement the orbiting satellite there will be series of earth stations to feed the signal to the traditional

terrestrial telecommunications systems. At present, 35 earth stations are planned of six different capacities.

Some of the major benefits of the satellite broadcasting will be to make available both official languages - French and English - to any point in Canada. It will permit the introduction of telephone services in isolated communities and the transmission of data between remote areas and central computers in major cities. According to the 1970 Telesat annual report:

The Canadian Domestic Satellite Communications Systems, the first domestic system in the world using satellites in synchronized earth orbit will permit broadcasters to provide live-networks in Canada's far North.

Isolated communities which at present rely on air-lift, video-tape recorded segments of the CBC's network programming will be able to receive the full network offerings of the English and French CBC network live via satellite.<sup>24</sup>

Anik I has a seven-year life expectancy and will be stationed approximately the longitude of Winnipeg, Manitoba. From this position it will be able to send a signal from coast to coast. The orbital speed of the satellite will be such as to equal the earth's rotation so that the satellite will appear to be stationary relative to the earth.

A cooperative venture between Canada and the United States is the Communications Technology Satellite (CTS). It is designed to advance satellite broadcasting and transmission capabilities. The Canadian input is controlled by the Federal Department of Communications which contains within it a



Communications Research Centre that is considering various experimental proposals for the CTS that fall into three areas:

- a) demonstrations having socio-economic impact on satellite communication systems planning,
- b) experiments relating to advanced space communications technology, and
- c) research programs on radio noise environment, propagation, advanced ground terminal and communications systems research development.

In general, there are six categories of experiments that appear to be those most likely to become part of the payload when it is launched in 1975. A listing of the six is as follows: 1) television broadcast to community receivers, 2) broadcast to portable receivers, 3) two-way voice channels, 4) IRTV (television broadcast plus two-way voice, 5) sound broadcast, 6) data transmission. The following chart describes the various experiments contemplated.

Rather than elaborating on the tentative technical experiments, it is of more use to concentrate on the implications of this experimental broadcast satellite. The present generation of broadcast satellites requires ground stations to pick up the signals and retransmit them. The CTS will not need a ground station but rather with sufficiently strong antennas, the signal will be able to be picked up directly, for example, in various community centers. This provides another step toward the concept of direct broadcasting where the signal go directly

from the satellite to the home. Today, the major vehicles of socialization in industrialized societies are the family, education, and the mass media. Within the mass media spectrum television dominates in terms of both saturation and average number of hours of viewing time. Given the pervasive role of television in the socialization process, the impact of direct broadcast satellites may have substantial sociological implications.

THE NATIONAL LIBRARY OF MEDICINE BIO-MEDICAL EXPERIMENTS

The EDSAT Center of the University of Wisconsin is a participant in the Experimental Satellite Communications Project of the Lister Hill National Center for Bio-medical Communications. The Lister Hill Center is part of the National Library of Medicine of the National Institute of Health. The Lister Hill project is a two part activity.

Part I of the project is a set of experiments to determine the technical feasibility of several means of transmitting medical information via the ATS-1 satellite with low-cost, small terminal base stations. A major objective is to examine the potential medical applications of technical capabilities that are demonstrated in actual satellite tests. The emphasis is on providing health care and educational communications from medical centers to remote areas in Alaska. Results will have more general application.

The University of Wisconsin is working jointly with Stanford University and the University of Washington at Seattle on Part I of the project. Each school heads up one or more experiments with the other for providing support as necessary in actual satellite test activities. Wisconsin is the lead school on the Slow-Scan Television and Electrowriter Experiments. These experiments involve feasibility tests of the narrow-band transmission of data, i.e., pictures and hand-written messages, together with voice communication. Stanford University and the University of Washington are leading satellite experiments

with teletype, facsimile, ECG and remote computer accessing for medical information retrieval.

Part II of the NLM project is a continuation at Wisconsin of an experiment initiated on Part I of the project, the X-Ray Image Processing Experiment. The objective of this experiment is to provide a basis for design of low-cost equipment to be used in transmitting x-ray information from remote terminals to a medical center where experts in interpreting x-ray images are located.

There will be further bio-medical experiments on the ATS-F satellite with the emphasis being on Alaska and health care problems.

#### THE ALASKA EDUCATIONAL SATELLITE DEMONSTRATION

In 1970 UNESCO sent an expert mission to Alaska (1) to determine the feasibility of using satellite communications for television and radio transmission and/or reception of instructional and educational materials in remote isolated villages of Alaska; (2) to recommend specific program series which might be undertaken in both radio and TV via satellite transmission in order to meet the instructional and professional development needs of teachers in rural areas and in order to make a concerted attack on problems facing the native rural peoples of Alaska - problems which satellite communication might significantly alleviate.

There are a number of specific problems which are faced by the people of Alaska which can be alleviated by the satellite.<sup>25</sup>

One example is the remoteness of many of the Alaskan villages. Small vilages, scattered throughout the State near the coast and navigable rivers, are inaccessible by roads, causing reliance on bush planes, dog sleds, small boats or snow mobiles. Natives lack common language and often cannot understand other natives. The Alaskan native also faces civic isolation. His village is often so isolated from the authorities of government that he feels he is ignored and the government does not understand his problems. Teachers also feel a professional isolation from their colleagues and from the mainstream of educational advance. Long winters with no television, no movies, no theater, no libraries add to this isolation.

There is also poverty and unemployment which must be dealt with. The Alaska native population - Eskimos, Indians and Aleuts - comprise roughly one-fifth of Alaska's total population. They are among the most poverty-stricken groups in the United States. Their economy for generations had been based essentially on subsistence fishing and hunting. With the coming of the white culture, the wants and needs of the native population have been substantially expanded, and the native must obtain cash to satisfy these wants and needs. The majority of native Alaskans are unemployed or only seasonally employed and are forced to live on welfare checks from the State or Federal Government. Virtually no jobs are available in the villages, and the Eskimos must leave the villages to find work. Rarely is the native self-employed.

Health problems are common in this State. Until very recently, tuberculosis had been a serious threat, but due to the efficient work of the Alaska Native Health Service, it is now almost nonexistent. Accidents, influenza, pneumonia, diseases of early infancy and suicides are the principal causes of death of the native population. Alcoholism and mental illness are widespread. The mental health problem is aggravated by the separation of children from their parents over long periods of time while the children are at boarding schools or during hospitalization of either the parents or the children in a regional hospital not easily accessible to the parents. Eighty percent of housing of native Alaskans is substandard. Most natives live in small, dilapidated, substandard housing, usually one-room shacks. The problems of sanitation and safe water supply remain on top of the list in most villages. New homes designed to alleviate the situation are burning down due to furnace overheating and explosion. Proper methods of heating and ventilation are lacking. Fire prevention is thus of prime importance. The non-native Alaskan needs information on the precautions and safety measures that should be practiced while living and traveling in the Alaska bush country.

Teachers work under severe hardship conditions in one-room school houses. Teachers are frequently new to Alaska, new to the ways of life in the remote north, and new to teaching - all at once. New teachers coming to Alaska are given little or no orientation to life in the villages in which

they are to teach. There are virtually no native Alaskan teachers. Frequently, education in the villages has little or no application to the way people live. It has little to do with the jobs people will be engaged in. There is also need to teach the Eskimo language and history in order to preserve the rich culture of the Eskimo and to increase his pride in his heritage.

There is a definite need for increased communication at all levels. Three-fourths of Alaska consists of open rural marshes and vast wasteland, including rugged terrain, harsh climate and sparse population. In this region, communication facilities are virtually nonexistent. Television is available only in the cities. Problems of access for maintenance and installation, power availability and limited financial support in the rural areas argue against on-the-ground solutions to the State's communications problems. A communications satellite could link each part of Alaska to the rest of the State and link all of the State to "the lower 48."

The UNESCO mission considered all of the above problems and made a number of suggestions concerning satellite applications. Audio experimentation has been carried on using the ATS-1 satellite and television experiments are being considered for ATS-F.

The mission urged that pilot radio demonstrations using the existing satellite be undertaken immediately to help solve many of the problems associated with future ETV satellite communication systems. Two-way radio transmission is very

feasible and could provide an innovative way for isolated teachers, health aides, and others to communicate with one another. The mission felt strongly that the present audio signal, however, is of insufficient quality to undertake such demonstrations on a regular basis. Present estimates by knowledgeable engineers indicate that the terminals needed to provide high quality two-way transmission could be constructed for approximately \$5000 to \$6000 each, and an experiment could be conducted, using four to six terminals at selected locations. Such an experiment would give valuable data on the use of a satellite for educational purposes and also test the ability of the educational community to gear up to such an experiment, identifying problems and roadblocks before a permanent experiment is undertaken.<sup>26</sup>

Further audio and video tape exchange services were recommended, and it was felt that other technologies such as CATV and ITFS could be used. Suitable provisions should be made for community reception of radio programs in the villages so that full benefit may be drawn from the educational potential of the medium. The mission urged that transport and field recording equipment be provided so that field-based programs can be produced which truly reflect the life and aspirations of the village. Suitable production and distribution facilities within the State are urgently needed so that programs can be made that are relevant to the needs of the people.

For all of the above activities production staffs need to be provided. A specific mission request was for in-service programs for teachers to orient them to rural Alaska. Along with this it was apparent that there was a need for programs



which would reinforce native culture and help solve pressing social problems.

The U.S. Office of Education has made a suggestion for a satellite project which would include pre-school television. The objectives for this experiment are to:

- (1) demonstrate a two-way radio satellite telecommunications system which would also be replicable in other isolated rural areas such as the Rocky Mountains and Appalachia, linking teachers in remote poverty-stricken villages with one another and with a central source of experts;
- (2) establish statewide requirements for educational telecommunications services;
- (3) design an innovative telecommunications system which would provide as minimum software the Sesame Street series through videotape, broadcast, cable, film, or other appropriate means to virtually all remote Alaskan villages.<sup>27</sup>

This would be a two-way radio demonstration which would combine in-service teacher training in addition to the pre-school plan.

#### THE PAN-PACIFIC BASIN EXPERIMENT

This project which has been named "Peacesat" (Pan-Pacific Education and Communication Experiments by Satellite) is an effort to interconnect institutions of higher education in the Pacific by means of satellite. Regular instruction via ATS-1 was undertaken in the summer of 1971 when speech-communication classes on two college campuses in Hawaii engaged in two-way communication using voice and facsimile. The transmissions were simplex. Experiments in peer teaching between students at separate locations was also undertaken.

There are varied ethnic and cultural problems in this region which were considered. A study of the performance of native and non-native speakers of English both face-to-face and utilizing the satellite was undertaken.

This regional satellite program will eventually link Hawaii, Wellington, New Zealand and other South Pacific islands.

### EVALUATION

The primary value of all of the above experiments is that they are attempting in a logical fashion to utilize a new and expanding technology for a variety of purposes. It is impossible to tell which of the experiments will be successful, but that in and of itself is immaterial since detailed evaluation of each experiment will show the way towards the optimum system for each region. The response of the users of the systems will be of critical importance inasmuch as it is the user that ultimately benefits from the system. The satellite in a sense provides the linking function between the body of knowledge to be conveyed and the user. The economies of scale and other cost benefits that accrue from satellite utilization make this a viable alternative even though the initial costs may be high.

In all of the experiments there are attempts made to find the least costly hardware since this will increase the ultimate utilization of the system. It may be that some of the equipment used for early experiments will need to be replaced,

but even so, the knowledge gained by the experiment makes it worthwhile. This writer would hope that there would be a means to bring these very diverse experimenters together at some time in the future to compare the results of their various experiments. From this type of a meeting, some type of coordination for future satellite programs might develop. On the commercial level the INTELSAT consortium is acting as the guiding and coordinating body. A similar organization is needed in the educational and national development area. Perhaps UNESCO could undertake initial steps in this direction, and could even set up such a body within its own organization.

FOOTNOTES

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4. Satellite Broadcasting: Implications for Foreign Policy, Hearings before the Subcommittee on National Security Policy and Science Developments of the Committee on Foreign Affairs, House of Representatives, 91st Congress, First Session, 13, 14, 15, and 22 May 1969 (Washington, D.C.: U.S. Government Printing Office, 1969), at 34.
5. K.L. Sondhi, et al., "Indian Project: Satellite Instructional Television Experiment (SITE)," paper presented at the International Conference on Educational Satellites, Nice, France, May 3-7, 1971.
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13. Rao, op. cit. note 9 at 10.
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17. "ETV by Satellite," a report submitted to Florida State University, by a Joint Brazilian - Florida State University study team, 1970, at 1.
18. "A Satellite System for Educational Transmission with National Coverage--Project SACI," CCIR Doc. M/59-E, 5 November 1970--CCIR Special Joint Meeting, Geneva, 1971, at 8.
19. CNAE Experimental Proposal, op. cit. note 16 at 18.
20. Brazilian Experiment, op. cit. note 16 at 78.
21. Id. at 79.
22. The material on the Rocky Mountain experiment is taken from the "Plan for a Satellite-Related Educational Systems Experiment," U.S. Department of Health, Education, and Welfare, Office of Telecommunications Policy, October 1971.
23. The material in this section is from Thomas L. McPhail, "Communication Broadcast Satellites: Some Sociological Implications," Paper presented to the SCA 57th Annual Meeting, San Francisco, California, December 27-30, 1971.
24. Telesat Canada, Annual Report (1970) at 14. See also, "Instant World, a report on Telecommunications in Canada."
25. In 1969, the State of Alaska submitted to the National Aeronautics and Space Administration a proposal for a satellite demonstration to transmit both television and radio programs into three remote native villages in the State: Kodiak, Fort Yukon, and Nome.

After a thorough study of the technical feasibility of such a demonstration, NASA in early 1970 approved Alaska's proposal in principle and made space available on ATS-1 for the experiment. In the months that followed, various groups in Alaska made considerable effort to move forward with their parts of the demonstration. The Alaska Native Health Services and the Alaska Public Health Service began a series of audio experiments via ATS-1 to determine the capability of ATS-1 to deliver narrowband communications, such as voice communications, from the National Library of Medicine in Bethesda, Maryland (a suburb of Washington, D.C.)

to a relatively simple and inexpensive audio ground terminal in Fairbanks. The Alaska Educational Broadcasting Commission selected the National Association of Educational Broadcasters to design an overall plan for the development of educational telecommunications in the State. At the same time, the Alaska Education Association asked its parent organization, the National Education Association in Washington, to undertake a study to determine the potential of satellite communications for meeting the needs of peoples in the rural villages, especially teachers. In carrying out its task, the NEA requested expert consultative help from UNESCO through UNESCO's Participation Program. The Request, transmitted through the U.S. National Commission for UNESCO, was approved and UNESCO made available the services of Dr. Henry R. Cassirer in August 1970 to assist in the implementation of a mission to Alaska. ["Alaska, Implications of Satellite Communication for Education," by H.R. Cassirer and H. Wigren, UNESCO, Aug.-Sept. 1970, Serial No. 2198/BMS.RD/MC. See also, Wigren, "Alaska Educational Satellite Project..." in Les Satellites d'education, Colloque International, Nice, France, 3-7 May 1971, at 89-99.

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## VII

THE EDUCATIONAL, COOPERATIVE AND CULTURAL EXCHANGE ASPECTS  
OF A SATELLITE COMMUNICATION SYSTEM: A MODEL

Any plan for the comprehensive use of a communications satellite system must involve both hardware and software considerations. The emphasis for systems development however must be on software development and the organizational aspects within a region contemplating a multi-purpose satellite system.<sup>1</sup>

## AN ANALYSIS OF OBJECTIVES: NATIONAL AND REGIONAL OPTIONS

Within a given nation, planning must be undertaken which considers not only the Department of Education but other agencies as well. The technology to be employed must be considered in detail and this must be related to the mass communication system of the country.

National plans and programmes in the field of education and information often seem to have been established without regard to the new mass communication media or without recognition of their potential.

For this reason, national priorities as expressed in these plans do many times not provide an appropriate basis for the evaluation of a country's requirements in terms of a mass communication system. There has sometimes been a tendency to propose models for educational broadcasting or for satellite systems making requirements match the characteristics of these models.

The mission believes in a different approach. A definition of mass communication media requirements and of an appropriate system configuration should be based on a reexami-

nation of the relevant problems and objectives of each country concerned. This can only be undertaken by individuals and institutions in charge of policy formulation who should be clearly informed about the alternatives and possibilities offered by different available models for mass communication systems.

There obviously are constraints and limitations. These will, however, mainly be of a non-technical nature and relate to such matters as economic considerations, regional and international agreements, programming capability and changes in the educational system.<sup>2</sup>

There is a long lead time for any communication satellite development and the various investments to be made must be considered. These investments are of great diversity: satellite, launching, ground stations, receiver equipment, production equipment, school installations, training of instructors, and monitors and specialists in production and implementation. In all these fields, the planning must begin several years before the launching. Based on experiments in progress, five years constitutes a minimum delay.

The preparation and management of the satellite requires putting new structures into service. Several departments and administrations must participate in this.

The need to prepare these enterprises with care has generally been recognized. Several countries have established interdepartmental groups in order that all the governmental sectors fully realize the need for coordinated action to overcome the difficulties inherent in the introduction of the new technology and to take full advantage of all the possibilities that educational broadcasting by satellite offers.<sup>3</sup>



In India, a committee was set up which includes representatives of the Prime Minister, the Ministries of Information, Education, Agriculture and Community Development, TV-Communications, Population, Industry, Tourism and Civil Aviation, and representatives of the Atomic Energy Agency. The UNESCO mission to Brazil recommended "that in view of the vital importance of coordination and cooperation between all the Brazilian ministries, and other bodies involved, a coordinating body on a sufficiently high level be established, and that an overall plan of implementation be drawn up covering the technical aspects as well as all other relevant aspects related to the system."<sup>4</sup>

For all developing countries, satellite operations, even if they are national, require international help on the technical level and on the educational and financial levels. As most of the activities of the nation will be involved, it is not surprising that numerous equivalent international organizations will have to be called upon. Thus, the UNESCO Mission to Brazil, after the Mission to India, formulated the following recommendations which was in practice readopted by the South American Mission:

A development project of this scope and magnitude can only succeed with the active cooperation of all the Brazilian authorities concerned. Since such a multi-purpose project corresponds to the objectives of a number of the UN Specialized Agencies and other international bodies, the mission feels that, if requested, the support of the international organizations should be based on the same coordinated, integrated approach. The project,

a large-scale use of television via satellite in the service of education and national development in Brazil, therefore concerns and warrants the involvement of the UN, UNDP, CEPAL, UNESCO (various departments in cooperation), ITU, FAO, WHO, WMO, ILO, UNICEF, UNIDO, IMCO and ICAO. Further, in the realization of the project, the international organizations could support and assist the Brazilian Government through a joint approach in association with such institutions as the World Bank, the Organization of American States, the Inter-American Development Bank, etc..<sup>5</sup>

The UNESCO South American mission stressed:

...that each interested country on the national level set up a co-ordinating body on a sufficiently high level and establish the appropriate organizational structure needed for decisions concerning a national policy with regard to the role and function of television in the light of a possible satellite project, for participation in the proposed feasibility study as well as for co-operation and negotiations with other interested countries of the area and with the concerned international organizations.<sup>6</sup>

#### INVENTORY OF AVAILABLE RESOURCES

##### Hardware Production

If the country which is a future utilizer of the satellite wants to manufacture part of the materials of production and reception, the manufacturing networks will have to be established in advance. In particular, if a country wants to equip itself locally with TV receivers, it will be advisable to expand its existing electronic industry or even to establish one if necessary. The Mission to India has formulated some recommendations in this regard:

Though the production capacity is limited at the moment to 30,000 TV sets per annum it is understood that in the course of the next five years it would grow to 50,000 or more. However, it should be realized that a great demand

for sets would probably be generated in the wake of the deployment of a satellite system. The manufacture of television sets in large numbers would be important for a number of industries and would substantially enhance the employment potential. The competent authorities should also consider the possibility of accelerating their plans for development of indigenous television transmitters and associated studio equipment.

At the present time satellite life is expected to be around five years. Therefore necessary steps should be taken to ensure the continuation of the system through the use of successive satellites. A project such as that envisaged might imply the country itself taking over certain tasks in the field of research and development. It would be desirable that ground station technology should before long become wholly indigenous.<sup>7</sup>

### Software Production

Programming of various types will be needed for educational satellite systems. Even if these programs are all educational, it will not be possible to utilize only existing production structures. When they do exist, which will not always be the case, they will more than likely be insufficient. A start can be made by regrouping a certain number of production elements in appropriate centers of production.

It is difficult to specify now the type of center needed. However, the Socrates Report, relying on several African experiments in regard to TVS, and basing its views on calculations dealing with the extrapolation of the management of a satellite from a network on the ground, declares that it must include three services:

1. The service of a pedagogical production which has for mission to contribute the substance of the broadcasts. It includes a research service, different pedagogical sections, a service of supporting documents and a service of transmission and programming.

2. The service of visualization which has for mission to work out the broadcasts from the material furnished by the pedagogues of the preceding service.

3. The technical service which has for mission the management of the center.

For a national center, during a period of stabilized production costs, it is necessary to plan for about 125 people for its working operation.<sup>8</sup>

It is certain that a complex organization is required, which will approach the type dealt with in the Socrates Project. But the number of personnel will vary according to the quantity of production. As an example, Project Socrates, at the beginning, will utilize four broadcasts of a quarter of an hour each, for each one of the six primary courses in the basic cycle of the first degree, and three broadcasts for after-school. In addition, "...the total production for a course is worked out the first year. The second year, 40% of the initial production is renewed; the third year, 30%; the fourth year, 25%; the fifth and sixth years, 20%; the following years, 15%."<sup>9</sup>

A production center, designed to introduce several additional hours of broadcast time a day for adults, will have to be much more important. It must, therefore, make provision for a schedule of rebroadcasting, the one worked out by Project Socrates offers a good example.

The volume of production will also depend on the types of broadcasts. If it is necessary to resort to programs made on the outside, the amount to be produced in-house will diminish. Likewise, the calculations made for Project Socrates relate to small broadcasts composed, on the average, of 50% turn-table time, 40% document reading, and 10% TV-film. For example, raising the TV-film to 50% reduces the production work of the center almost by half; except when the TV-film utilizes footage mainly filmed and produced by the center.

In the case of a satellite educational system covering several states, a supra-national center of production might need to be established. Project Socrates defends this principle in the following passage:

Under hypothesis A for national educational television networks, each state being master of its own television channel, it is logical to plan a production center for each state. Under hypothesis B, on the other hand, for the use of one satellite where a single broadcasting station suffices for the retransmission of the message to all the countries covered by the satellite broadcasts, it is logical to plan for a single supra-national production center associated with the broadcasting station.

To this technical motive may be added others.

1. Economic motives: A supra-national production center, while it obviously will cost more than one national production center, will as evidently cost less than five, ten or seventeen national production centers.

The annual per student costs will be that much lower, as the expenditures for investments and management are spread over a wider population.

2. Pedagogical motives: Quality specialists are rare if not non-existent for definition or presentation of pedagogical audio-visual subject matter.

Only an international center will be able to assemble a homogeneous personnel at the quality level that the size of ambitions demands. Moreover, the pedagogical effectiveness of the system will be essentially conditioned by the degree of integration that it will attain. (By integration is meant analysis, assumption of responsibility for and organization of the interactions of all the factors which are involved in the process of educational communication: content, form, distribution of the message, characteristics of the communication channel, characteristics of the reception environments, characteristics of the pedagogical aids, and characteristics of the return networks.)

The concentration of specialists from these different sectors constitutes a decisive factor for good integration.

3. Political motives: Only a third of the states interested in the project possess the technical means to intervene directly, from the beginning of a televised educational activity.

It would not be right that this third be favored for this reason, in the joint action. On the other hand, the programs will have to be conceived in such a manner that, while proposing a complete message sufficient and necessary in itself for all the users, the possibility remains for any one user who would have the means to specify his own 'terminal'.

Even if at the beginning of such a common undertaking certain states do not have an autonomous production center, it will quickly be necessary for them to create one, in order to add national broadcasts to the international ones. Moreover, these will be favored by the supra-national center which, at certain hours, would send programming to the national centers.

The parallel distribution of supporting documents, printed, mimeographed or audio-visual, is also a difficult task.

However, these are indispensable if the system is to be effective. Their quantity also will vary from one project to another; but even restricted, their production will represent an expense that has been estimated as at least equal to that of television production, taking into account known experiences with educational radio-television. Project Socrates discusses the problem in the following terms:

It is an illusion to think that the televised message, ephemeral by nature, can alone suffice for the transmission of ideas and the modification of pupil behavior. A written support is necessary for the purpose of fixing and deepening the knowledge acquired by the picture.

Reading and recitation cards (100 pages) and partly-programmed cards (two each day) will be elaborated by the pedagogical production service and distributed to each pupil.

Provision must also be made for supporting documents for the teachers, to guide their management of the broadcasts. In the case of educational television in Niger, for example, seven 'cards for the teacher' of two to three mimeographed pages were produced per schoolday and per class.<sup>11</sup>

In this case it is only a matter of printed or mimeographed documents, but more and more, conditional on the schools having the necessary apparatus, provision will have to be made for audio-visual documents such as magnetic tapes, slides and other media.

In any case, the problem will be less in production than in transmission. In many of the developing countries, postal communications are unreliable, and therefore many schools are in danger of receiving the televised messages in excellent condition, but the supporting documents in an

irregular manner. Plans can be made for the use of electronic procedures which would permit the transmission of these documents by facsimile with reception on television sets with adapters.

### Reception Equipment

While simple in the developed countries where the sale of receiving sets and their maintenance is assured on the local level, reception presents serious problems in most of the developing countries. In many villages there is no electricity. Energy will thus have to be furnished by batteries, storage batteries or electric generators. The supplying of fuel or storage batteries, again presents transportation problems, as does the recharging of batteries.

Project Socrates has considered these problems:

To introduce television in a school in the African countries, is often synonymous with complete modernization of the external aspects of the educational apparatus. It is not planned, for example, to install a (TV) receiver in a traditional school building.

It is necessary to insist on the fact that this indicates a psychological attitude without practical basis.

Suitable conditions of reception can be arranged in very primitive premises. It has been done in Niger and Gabon. Simple appliances permit the creation of entirely adequate conditions of optical comfort in straw-hut classes or 'banco' classes. The acoustical characteristics of these buildings are often superior to those that are found in many 'modern' premises.

The only new requirement presented by the introduction of a TV receiving set into a class is protection of the apparatus and its supply devices. Nothing compels expecting the building to assure this protection.<sup>12</sup>



And further on:

If the question of school buildings must be raised in an educational system where TV will have the preponderant place, the Nigerian experience would urge its presentation rather from the point of view of a modified educational praxis than from that of the physical conditions for comfortable reception, which becomes with use almost secondary.<sup>13</sup>

But the problem of receiver maintenance is much more intricate. This problem particularly held the attention of the originators of Project Socrates:

The installation and maintenance of a reception network for educational television presents a number of problems. As television is the key support of the instruction, it is important that it function without breakdown. In most cases, the receiving equipment is entrusted to the teaching personnel having no technical competence and whose role, outside their pedagogical assignments, will consist in starting and stopping the equipment. In addition, a large number of the schools will be located in isolated places with no possibility of communicating with any sort of emergency repair service (telephones are rare in Africa).

It is therefore necessary to make provision from the beginning for a mechanism which will permit the mitigating of the above-mentioned inconveniences; and consequently, it is necessary to incorporate into the reception network a considerable network of technical maintenance which can be structured in the following way (for each state):

- a central unit (echelon)
- decentralized units (one for each 'HF region')
- mobile teams attached to each decentralized unit

The role of the central unit, in addition to its administrative and coordinating mission, will be to order the reception equipment for the schools, to try out this equipment before sending it out to the decentralized units and to repair defective sub-assemblies received back from those decentralized units.

It can also assure the training of the technicians in charge of installation and upkeep for the entire group of receiving sets.<sup>14</sup>

Calculations follow which seek to establish the amount of equipment and personnel at each of these units on the basis of 100 schools for each mobile team, and making provision for one emergency repair technician for 500 working television sets, and one technician for 1500 television sets at the central unit.

### Personnel

It would be impossible to approach here in all their diversity the extremely varied educational techniques that will be inspired by the satellite in developed countries, and therefore a definition of the general outlines of the systems that can be envisaged in the developing countries will be offered. The project for French-speaking Africa offers an interesting example:

The system of TV-instruction can be analyzed into three elements of equal importance:

- 1 - A broadcast designed to bring a pedagogical content rationally programmed and always presented on the screen by a qualified teacher.
- 2 - The instructor who, aided by his daily cards, exploits the broadcast, individualizes the educational work, directs the exercises, and controls the results.
- 3 - Active methods which present the advantage of setting up a permanent counterweight to the collective character of televised instruction and offering to the pupil the maximum of opportunities to acquire a taste for study.<sup>15</sup>

The balancing of the elements in this trilogy is most often assured at the level of reception by young teachers not very well qualified, called monitors. The new systems of education are in fact set up principally to give an education where, using traditional systems, none would be possible for a long time, particularly due to a lack of teachers. The effort will thus be made to train, in an accelerated way, young people without the degrees required to be school teachers. They will have to be trained both to respect the instructions that a television-guided education will quite naturally give them, and to take the necessary initiatives for implementing active methods, made all the more necessary by the relative importance of television. These monitors will have to be periodically retrained on a schedule of from once a trimester to once a year. Special broadcasts, mimeographed materials, and cards will be especially directed to them.

But the most important part of the "pedagogical maintenance" will devolve upon travelling pedagogical advisers. Extrapolating from the educational television of Niger, Project Socrates defines their place and numbers thus:

The proportion of one adviser for 20 beginning monitors has proved to be very satisfactory. This proportion permits, by reason of a half-day per class, each monitor to be visited in a thorough manner twice a month.

From the statistical perspective of a regular growth in monitor reliability, the formula  $N = \frac{E \cdot c \cdot m}{20}$  has been adopted in Niger as the basis

of computations for a national network of pedagogical maintenance:

$N$  = the number of pedagogical advisers  
 $E$  = the number of schools  
 $c$  = the number of classes by schools  
 $m$  = a variable coefficient according to the seniority of the monitors  
 $m_1$  = 1 (monitors of first and second year)  
 $m_2$  = 0.4 (monitors of the third and fourth year)  
 $m_3$  = 0.1 (monitors of the fifth and sixth year and later).

This is equivalent to saying that a beginning monitor is visited every 15 days during the course of his first two years of work, then every two months, and finally, after four years of practice, about every six months.

The advisers obviously will have to be provided with enough vehicles to enable them to supply the school with supporting documents and incidental pedagogical materials.

Moreover, at the center of each of these 'HF regions' (zones covered by transmitters), provision is made for the installation of a responsible pedagogue, the official coordinator for a group of travelling pedagogical advisers. Finally, central coordination of the network of pedagogical maintenance can be assured through the intercommunications radio network.<sup>16</sup>

### Feedback

The pedagogical advisers will be one of the essential cogs, but the return information which they furnish to the production center will be delayed because of a shortage of transportation and communication means.

In traditional education the feedback is permanent and immediate. In systems of TV-education, the production teams can only modify or adapt their messages with a delay which has been estimated at from one month to six weeks under the best conditions. It is thus important to watch over

the installation of feedback systems calling upon all the support possible, from the telephone to answer cards, including periodic regrouping of users. In addition, a few pilot classes placed near the transmitting stations would aid considerably in procuring an initial feedback, if the broadcasts are tested there in closed-circuit television before being sent out by the satellite. The experience of Niger was fruitful in this regard. But

in any case, on the satellite scale, only macroscopic probing methods are capable of furnishing a rapid feedback. In this case, the supra-national production center will have to include an evaluation cell working according to statistical methods and probably having at its disposal automatic treatment means for the data.<sup>17</sup>

Some credit sums will have to be assigned to the feedback system according to a fixed percentage of the total production expenses. Otherwise, experience proves that the necessary credits for feedback are limited sharply by production imperatives. This is not desirable since feedback is vital, and without it, any undertaking for education via television will not succeed.

#### STAFF TRAINING

Provision must be made for a very sizeable increase in the number of technical staffs and for an improvement in their qualifications; for they must ensure the installation, functioning and maintenance of the producing, transmitting and receiving stations, and of the sub-structure installations on the ground utilized for the new system. For most of the

developing countries, this means that for certain categories of technicians, it will be necessary to organize study programs and training abroad at least three years in advance, and/or the coming of foreign experts to train other technicians on the spot. International Telecommunication Union assistance programs can be utilized here.

As the satellite is a heavy consumer of programs, provision must be made for the training of an increased number of production personnel. The report of the Mission to India gives details on the professional categories concerned and some idea of the size of the training program to plan for, in comparison to the "normal" needs of the country.

The following table shows the numbers of trained television personnel now in New Delhi and the All India Radio estimate of the numbers probably required over the next five years. Engineering and technical personnel are excluded.

Categories of training	Probable number of trained staff as of 1968	Number of trained staff required by 1971
Station directors	1	5
Assistant station directors	3	8
Programme supervisors	5	44
Transmission executives	8	24
Producers	18	60
Scriptwriters	2	10
Floor Managers	11	30
Designers	1	10
Production assistants	13	60
Newsreaders/Announcers/Commentators	5	55
Cine-cameramen	7	32
Lighting supervisors	4	5
Television cameramen	14	50
TV instructors (teachers)	8	25
News staff	3	20
Liaison officers (ETV)	1	5
Audience research officers	1	5
Evaluation assistants	1	5
Graphics	7	25
Vision mixer	4	20
Film Editors	4	20
Film sound recordists	4	20

It is expected that these categories of creative skills will be increased as the next phase of India's television expansion programme (4 Metropolitan stations) comes to fruition, but the present estimate of 478 additional trained television people by 1971 indicates the order of the task. In addition, any comprehensive training programme must provide for refresher courses for staff, for retraining and upgrading opportunities.

A communications satellite system would place some added burdens on the staff training programme but for categories of skills not significantly different from those required in normal station programming. The skills associated with multi-language broadcasting, over and above those now employed, would have to be provided for.<sup>18</sup>

Two very different categories of teaching staff will have to be trained: producing and receiving teachers. The producing teachers are the studio instructors already mentioned in the above table. They must be chosen among quality instructors and subjected to a training period which should be at least two years, and which would include both theory and practice. They must be closely integrated with production teams in such a way that the educational messages are well adapted to their purpose, without losing contact with the teaching environment.

The receiving teachers are those who will utilize the reinforcement broadcasts, but more important they are the monitors who will guide the various groups to be taught. Their training will be done in short stages of at least a period of six weeks, during which sample broadcasts will be presented at the same time that an analysis of the different types of reactions is made.

## RECEPTION FACILITIES

The installation of reception centers, "schools" of a new type, provide the opportunity to rethink the concept of a school building in terms of new standards, different from those for traditional educational buildings. This is all the more true as these structures are no longer exclusively reserved for school use but are also open at certain hours to adults.

The physical components of the traditional classroom have lost their immutability. The ground and the walls have become writing surfaces, the furniture has split up into constituent modular units, available for multiple uses. It is easy to imagine, from this perspective, that the most elementary materials, the least specialized, and therefore the most economical, are the best; sand is to be preferred to concrete.<sup>19</sup>

Cost of production calculations, calculations of comparative cost-effectiveness according to the various technical and educational systems employed, and other cost predictions must be made. The basis for such research, or at least its premises, is found in most of the UNESCO reports which all stress its necessity. It is difficult to arrive at any precise conclusions as many factors have to be considered simultaneously. Often the initial cost of the satellite is only a relatively limited part of the total cost.

For any large country, the cost of ground installations will probably be much higher than the cost of the spatial equipment. And the annual cost of operating the installations on the ground will be much greater than that for the spatial equipment. This is particularly true



as the programming expenses, upkeep, and the multiple arrangements aimed at assuring the cooperation and liaison between the schools and the broadcast centers will enter in; as will the costs of production of all the supporting texts for the broadcast instruction.

Like television, which must be utilized on a vast scale so that the basic prices will be acceptable, the communications satellite must serve a very extensive area for its basic costs not to be prohibitive. To utilize a satellite "a little" for education and economic development, would consequently not be a reasonable policy for a developing country; for any utilization, even limited, of a satellite, involves huge investments in capital, labor and technical resources.

This does not mean that such investments would not be justified. But they probably only would be for some countries, under some conditions, and at a certain stage of development.

One of the key criteria is the size of the country. In order for the basic costs to be favorable in relation to costs of other transmission means, the country in question must be very large - have an area in the order of two million square kilometers; or the satellite must be used jointly by a group of countries. The utilization of a satellite for educational purposes still raises the problem of local needs and local systems of education.<sup>20</sup>

In addition, not only the expenses of investment must be considered, but also the expenses of operation and maintenance. These are even more difficult to calculate than the first. One estimate is that \$16 million per year would be needed for the operating expenses for a distribution satellite destined for Central America, Mexico, Columbia and Venezuela, as compared to an initial investment of \$74 million. For a direct-broadcast satellite, the respective figures would be \$89 and \$17 million dollars. Consequently, the ratio investment: operation would be 1 : 4 : 5.<sup>21</sup>

Economic studies must be conducted in a wide national and international context; and if it is already difficult to circumscribe the costs, it is still more difficult to evaluate the manifold benefits expected which must, however, be taken into consideration in a correct evaluation of the cost : effectiveness ratio.

While fully aware of the other claims on a nation's financial resources, not least in the field of education, one paper expressed the opinion that national space programmes in small developing countries are not a luxury but a necessity, and that it is both possible and practical for such nations to engage in these activities today. A national space programme in a developing country will stimulate, inter alia, accelerated development in the following areas: mass production of high quality products; mass communications; and an important role in government decision-making processes, played by scientific and technological arguments. In addition one should not underestimate the shorter-range economic benefits to be derived even by small countries in the field of applications.

That the opportunity exists to realize direct practical benefits from outer-space exploration and research is not in fact questioned. The relevant question is, how can the non-space powers, especially the developing countries, best avail themselves of these benefits?<sup>22</sup>

#### THE NEED FOR EDUCATIONAL RESEARCH

The development of any plan for a satellite system for national development, education and cultural exchange must consider the complementary research that must be undertaken in both the technological and the educational spheres. Following is a listing of various topics that suggest areas for further educationally-oriented research.

## I. Studies on Curricula Development

- A. Possibility of Harmonizing regional and national curricula.
- B. Definition of international curricula in the field of
  - 1. agriculture
  - 2. family planning
  - 3. literacy
  - 4. general education
  - 5. school education
  - 6. university education
- C. Needs for regional and local adaptations or complements.
- D. Analysis of the problems of interaction between different cultures.
- E. Psychological and sociological reactions to the use of mass media for education.
- F. Reactions of the educators of all kinds to be employed in the system to their new status and responsibilities.
- G. Problems of providing education through a foreign language.
- H. Inventory of the educational needs unsatisfied in developing countries.
- I. Coordination between long-range planning of the educational system and of the use of the satellite.

## II. Studies on the Content of the Educational Programs

- A. Study of programs already produced and used internationally.
- B. Specific contribution of educational television programs to the curriculum.
- C. Specific contribution of programs distributed by satellite.

- D. Specific fields of intervention of satellite distributed programs.
- E. Information and formation of the content of international television programs.
- F. Motivational content and nature of international television programs.
- G. Specific contribution of educational television programs to the training and retraining of teachers of large cultural zones.

III. Studies on the Production and the Distribution of Educational Programs

- A. Methods of international co-production of programs.
- B. Types of organization for international exchange of programs by satellite.
- C. Production of programs for international use.
- D. Production of programs including one visual and commentaries in several languages.
- E. Adaptation of already existing programs for international use.
- F. Copyrights of international educational television programs.
- G. Study of international visual symbols to be understood by large international groups.

IV. Studies on the Use of Educational Programs

- A. Compare qualifications of teachers and monitors.
- B. Retraining of teachers using the satellite programs.
- C. Training of qualified monitors.
- D. Forms of integration of the television message.
- E. Compare advantages of direct and differed use of programs.
- F. Multi-media complements to the television programs.
- G. Reactions of pupils to international television programs.

- H. Reactions of adults to international television programs.
- I. Systems of feedback analysis.
- J. Methods to measure results.
- K. Determination of the thresholds beyond which international programs have no impact.
- L. Determination of whether international programs lead to pedagogical homogeneization?

#### V. Pilot Experiments

- A. Exchange of programs inside a large cultural zone through the existing terrestrial network.
- B. CCTV use of programs with the same visual and different language commentaries.
- C. Experiments in broadcasting CCTV programs.
- D. Mock-up experiments where two or more educational systems would use educational television programs as if they were received by satellites.
- E. Similar mock-up experiments with adult groups.

#### THE NEED FOR INTERNATIONAL COOPERATION

All the reports of the UNESCO missions, even those that relate to individual countries like India, Pakistan or Brazil, insist upon the need for international cooperation. By its nature and dimensions, a satellite encourages cooperation among the peoples of the world.

The exploration of space and space applications in particular are, by their very nature, global in character and international in scope. Further, such activities are expensive propositions and involve considerable investment of resources. Because of these special factors they hold enormous promise as a means of bringing all

nations of the world together for participating in an activity which has many benefits - proved as well as potential - to offer to mankind.

Experience during the first decade of space research activities has clearly shown that even nations which have demonstrated their capabilities in space flights cannot optimize their programmes without external support, i.e. without the co-operation of other countries, because of their global nature. This synoptic nature of the space programmes, and of the applications satellite programmes in particular, encourages participation and enables the cooperation in the field of space activity, therefore, is vital both for the countries which are already engaged in space research activity and those wishing to engage in such activity.<sup>23</sup>

Thus, the satellite is an instrument of international cooperation; a complex instrument, for this cooperation takes place at various levels according to whether global, regional or local systems are involved. Take, for example, the South American project, where several countries are involved:

A project of this magnitude would concern a number of regional and international organizations with partly overlapping functions. The mission very strongly feels that co-ordination on the national and regional levels must be matched by a corresponding co-ordination on the international level.

On the Latin American level, the organization of American States, the Inter-American Development Bank, the Economic Commission for Latin-America, and such subsidiary bodies as CITELE, will all be directly involved.

On the international level, the objectives of the project will concern the United Nations, primarily the UNDP, and such specialized agencies as FAO, ILO, ITU, UNESCO, UNIDO, WHO, WMO, the World Bank.

The mission therefore recommends that this aspect also be taken up in a possible feasibility study.<sup>24</sup>

In addition it is necessary to act on a regional plane, appeal to a combination of existing regional institutions, and set up a regional plan of action.

The feasibility study and other preparatory studies would result in a regional plan taking into account the national plan of each country. Regional agreement would therefore have to be reached on a number of aspects among which the following seem of special importance:

- Organizational forms for the establishment and operation of a regional satellite system. The mission has not been in a position to study this question in detail, but in discussions with various authorities in the countries visited, such proposals as a consortium of the countries involved, and some arrangement under the overall direction of a United Nations co-ordinated effort have been mentioned;
- technical decisions on system configuration based on the user requirements;
- user requirements based on consideration of national priorities, taking into account opportunities of sharing of facilities, common programmes for some of all countries, etc.
- decision on whether system should be used for educational television only, or should be of multi-purpose use;
- financial support and aid request;
- agreements on legal and other related aspects.<sup>25</sup>

Thus the advantages of regional cooperation can be clearly seen.

#### THE CASE FOR INTERNATIONAL CO-PRODUCTION

Keeping a satellite regularly supplied with educational documents requires substantial production which generally will surpass the capacities of any one country. If the

satellite is used by several countries the programs will probably emanate from each of the countries. The problem becomes one of implementing cooperation in program production.

In the minds of many people, the problem revolves around completely worked out programs, or program series for radio or television. Of course, such programs will play a very important role and will possibly take up the major part of the broadcast time, but international cooperation must be aimed at other components as well. Co-production involves the development of pedagogical inserts or "pedagogical bricks" capable of being inserted in a variety of programs.

If one country, in cooperation with others, is responsible for the production of the visual elements of a series, the parallel production of commentaries in several languages can be made in other countries, as can dubbing when it proves necessary. Such organization of co-production will be indispensable in any continental project where several languages have to be employed in a single educational activity.

Finally, co-production cannot be limited to radio and television programs, nor to audio-visual documents. The production of all supporting documents should also be conceived and conducted on the international plane. This is plainly necessary when the printed documents must be published in several languages.

International co-production requires preliminary agreement on the objectives and content of the programming.



According to the situation, intellectual cooperation may be more or less extensive at the synopsis stage, the scenario stage, or the cutting stage. Once the projects are agreed upon, the next step is to implement them. According to international experiments conducted to date, there are several different formulas:

- A. A single producer can carry out an agreed-upon and jointly financed series on behalf of all the other countries involved.
- B. The various programs composing a series may be carried out by various countries.
- C. Within a single program, several countries may assume responsibility for certain sequences or parts.
- D. A country may rearrange existing documents which it then republishes and eventually completes with new documents.

In some cases it will not be enough to coordinate pre-existing national centers of production. The establishment of an international center of production for the region will perhaps prove necessary. There are precedents for this development. The Mexican center for Latin America is an example. It first produced film strips, then films, and then programs for television. Such centers could take on the production of both program series and supporting documents, as well as a certain proportion of the adaptations and dubbings necessary, provided they have on their staffs specialists from the countries or regions for which the adaptations and dubbings are being made.

Such a formula, combined with national centers, would permit some real economies to be made in the cost of administrative personnel, programs and equipment, as well as in technical expenses (such as electricity, tapes, film, photographic and cinematographic products). Obviously, such a center will be more expensive than a national center, but, compared with the investments and initial costs of operation of this international center, the greater the number of countries involved, the more economical this solution will become. In the Socrates Project:

In order to take into account the supplementary expenses which will necessarily exist when a single center of production serves several countries, it was agreed to multiply the unitary costs by the following coefficients:

- ..1.10 when one center serves two countries,
- ..1.20 when one center serves three countries,
- ..1.25 when one center serves four countries,
- ..1.30 when one center serves five countries.<sup>26</sup>

It is also possible to imagine a more flexible formula of center organization for several countries, even if some countries have their own center, and even if there exists, in addition, a multinational center for the whole system.

The Socrates Report thus examines two successive hypotheses:

For eight-center and four-center hypotheses, we have assessed the countries in the following manner:

- .. Eight-center hypothesis is: one center for four countries (twice) + one center for three countries + one center for one country (four times).
- .. Four-center hypothesis: one center for five countries (twice) + one center for four countries + one center for three countries.<sup>27</sup>

Such centers would not only have production, but also broadcasting functions.

#### PROGRAM EXCHANGE

A satellite system involved with various programming schedules may wish to increase its programming output through regional exchanges. Two methods can be utilized: sometimes exchanges take place on a commercial basis. The petitioner country regulates his orders according to an agreed upon scale or scales. Sometimes it is a matter of exchanges made in the setting of free exchange agreements involving a minimum transfer of funds or currency. This latter approach is most desirable when the programming is basically of an educational nature. These free exchange agreements have been mainly perfected and put into practice in the field of films and audio-visual media by non-governmental international organizations such as the International Council on Educational Media. It would be easy to transpose and adapt them for radio and television programs, all the more so as promising tests have already been made by regional radio broadcasting associations. It is through the good offices of these organizations that international programs for training personnel can ultimately be established, as well as regular relations with qualified international institutions like the International Association of TV Communications.

## AREAS OF COOPERATION

A certain harmony must exist over the content of the scholastic programs (curricula) of all the schools receiving instruction by satellite. If not, the insertion of broadcasts will be sporadic, sometimes out of phase and often judged to be superfluous. This harmonization must take place both at the international and at the national level, through qualified interlocutors like the Ministries of National Education. This difficult work must not be left to the diligence of individual departments. Further, this harmonization should not be limited to scholastic programs but should extend to other regional educational activities, including agricultural, sanitary, and community education.

Institutions or instructors can be associated in systematic activities for the introduction of innovations in education and in new educational methodology. The same instructions can thus be given and the same works, in one or several languages, could then be broadcast for this purpose. Exchanges of experience would follow, either informal or inserted into a body of appropriate pedagogical research conducted on the international plane. The pilot experiences would constitute a particularly favorable ground for any international educational cooperation. Although only aimed at a limited public, and only involving a limited number of teachers, the international circulation of documents and pedagogical ideas could be facilitated in this way.

Various international and regional pedagogical committees would certainly foster international intercourse between teachers. Beyond international exchanges between instructors, international correspondence between pupils (children, adolescents or adults) can also be instituted.

The success of a television instruction operation at a regional level, rests in large part on a satisfactory system of feedback. The teachers comprise an indispensable link. Not only by various oral means, but particularly by writing, they can make their reactions and their criticisms known to the broadcast centers. In addition, they are the intermediaries of the taught who must also participate in the feedback at all times.

For developing countries, the training of artistic and production technique personnel will have to take place in whole or in part abroad or by resort to foreign experts. The producing teachers and directors will also have to be the beneficiaries of training programs of international design. As all these staffs are called upon to cooperate within a specific region, it will perhaps be good to have the training also organized in this way so that these people become accustomed to sharing ideas and working together.

The training of basic teaching personnel can also benefit from international cooperation. Participants having experience can help in training their counterparts, or can directly train instructors or monitors in the developing

countries. In co-production, exchanges, technical and economic collaboration, the key word in regard to instruction by satellite is cooperation; international cooperation. The changes brought about in the size of the educational enterprise must be translated through a new dimension in international procedures of cooperation.

FOOTNOTES

1. Material on this section has been obtained from a translation of "The Use of Space Communications for Educational Purposes" by M. Robert Lefranc, April 1971.
2. Preparatory Study of the Use of Satellite Communication for Education and National Development in South America. UNESCO (distribution limited) 1969, at 2.
3. La Radiodiffusion par Satellites. UNESCO - Etudes et documents d'information. No. 60, 1971, at 21. [Translation: Radio Broadcasting by Satellites. UNESCO, Studies and Information Documents. No. 60, 1971].
4. Preparatory Study of the Use of Satellite Communication for Education and National Development in Brazil - UNESCO, at 33. (distribution limited)
5. Id. at 31.
6. UNESCO South American Mission, op. cit. note 2 at 99.
7. UNESCO Brazil Mission, op. cit. note 4 at 48.
8. Projet Socrate - Télévision éducative en Afrique Noire francophone. Etude économique comparative entre un système à satellite d'éducation et des chaînes de télévision nationales - Centre National d'études Spatiales (CNES) - Rapport provisoire - Paris, 1969, at 33. 140p. Plus annexes. [Translation: The Socrates Project - Educational Television in French-Speaking North Africa. A comparative economic study, between a satellite system of education and one based on national television channels - National Center of Space Studies (CNES) - Interim Report - Paris, 1969, 140p. plus supplements
9. Ibid.
10. Id. at 34-5.
11. Projet Socrate, op. cit. note 8 at 33-4.
12. Id. at 44.
13. Id. at 46.
14. Id. at 49-50.

15. Id. at 32.
16. Id. at 48-9.
17. Id. at 37.
18. Preparatory study of a pilot project in the use of satellite communication for national development purposes in India - UNESCO (distribution limited), 1967, at 38-40.
19. Projet Socrate, op. cit. at 46.
20. Schramm, Wilbur - Satellites de télécommunications pour l'éducation, la science et la culture. Etudes et documents d'information, No. 53 - UNESCO, 1968, at 20 [translation: TV-communication satellites for Education, Science and Culture. No. 53 - Studies and Information Documents, UNESCO, 1968, 28 p.
21. Platt, William, Education by TV Satellite in Developing Countries. UNESCO, International Institute for Educational Planning, 1970, at 14.
22. Practical Benefits of Space Exploration - United Nations, 1969, at 69.
23. Id. at 62.
24. UNESCO South American Mission op. cit. not 2 at 96.
25. Id. at 94.
26. Projet Socrate, op. cit. note 8 at 83.
27. Id. at 84.



## VIII

## THE DEVELOPMENT OF A COMPREHENSIVE COMMUNICATION SATELLITE SYSTEM: AN APPLICATION OF THE MODEL

Before one undertakes the development of a comprehensive communication satellite system, there are some pertinent questions which need to be answered, such as:

1. What are the educational and national development needs of the area?
2. How do these needs compare with the needs of other areas?
3. To what extent can satellite communications solve the needs, and is satellite communication a better solution than other forms of communication for the needs of this area?
4. Are there resources in the area which might assist such a project?
5. What method should be followed in applying this solution to these needs?
6. What is the appropriate methodology to be followed in undertaking a project of this kind in this area?
7. Who should carry out the project?

Satisfactory answers to these questions will determine the criteria for a comprehensive communication satellite system for national or regional use. There are a number of discrete steps that must be undertaken in this system development in order to ensure success.

1. Parties interested in establishing the system should be consulted independently and conflicting interests and notions observed.

2. These interested parties should be consulted together to make them aware of conflicting interests and notions.
3. Parties disinterested, but expert in the area, should be consulted, if available, as a check on bias of interested parties.
4. The recipients of the system should be consulted, as well as the administrators of it, to check on disagreement as to what is wanted and what is thought necessary.
5. The needs of the area must be regarded as more important than the requirements of the system, the second must fit the first.
6. An evaluation of the system must be built into each stage of its development.

A second step would be the arrangement of conferences with all of the people identified above while simultaneously carrying out independent research.

A third step would be conferences, probably in the following order:

1. Individual and separate conferences with chief experts in each country, institution, and center concerned, in the areas of administration, health, education, social and economic welfare, agriculture, and communications engineering.
2. A conference of the experts in each field (e.g., health) from all the countries and institutions consulted above.
3. A conference in each country with the experts from each field in that country.
4. A meeting with the local leaders in each field in selected villages.

In the carrying out of these conferences the questions asked need to be carefully prepared to elicit accurately the

feasibility or otherwise of setting up a system, as well as to find out what kind of system is needed. The conferences should ascertain not only if a satellite communications system is needed, but also what is its desired nature, and how, when, where, and why it is wanted. Even more important is the tone of such conferences. It is important that the parties concerned both provide and discover as many of the answers to the problems as possible for themselves. With these principles as a guide, the following questions might be a sample of those to which answers should be obtained:

1. What problems do they recognize and have an interest in doing something about?
2. What information do they already have about these problems?
3. What do they perceive as the cause and possible solutions?
4. What are the usual channels of communication in which the people have confidence?
5. What are the social, economic, cultural, and religious characteristics of the people - their value systems, customs beliefs and ways of working? What action do they take?
6. What resources exist in the community that can contribute to any educational program?

As well as such general information, more particular information regarding various media, would be obtained in a similar manner.

Following all of the above steps, a plan can be developed which by considering the primacy of software problems will make the most effective use of the satellite hardware.

It would be wrong to suppose that any definitive method of establishing a satellite network could be determined without the above studies, but, having said that, two things must be kept in mind. One, it is eminently desirable to have some possible method in mind for working purposes before the studies begin; second, whatever method is adopted, it is absolutely essential that its projected growth be organic, in an evolutionary sense. However urgent the progress required, it must occur organically. Dr. Jaffee has warned that:

We must be careful at this time to let the new communications technology mature. We should not expect, nor plan for, the infant systems to have the sophistication of an adult. There are pressures to do just that, but these must be tempered to permit an orderly evolution and incorporation into the already existing and rapidly expanding conventional communications systems of the present and future.<sup>1</sup>

As Teilhard de Chardin has said, "To an increasing extent every machine comes into being as a function of every other machine."<sup>2</sup> He emphasizes in his consideration of the formation of the noosphere, the collective thought of mankind (and what better symbol for it than the educational satellite), the necessity of the growth of the mind being as organic as the growth of the body:

Necessarily following the inflexive tendency of the zoological phyla, the mechanical phyla in their turn curve inward in the case of man, thus accelerating and multiplying their own growth and forming a single giant network girdling the earth.<sup>3</sup>

Keeping in mind this necessity for an organic progress, the best approach would probably be to concentrate first on

meeting the needs in communication of the region under consideration - first locally, and then globally. As an example of this approach let us consider the development of a comprehensive satellite system for the South Pacific region, and the concurrent need for a feasibility study.

### THE SOUTH PACIFIC: AN EXAMPLE

#### The Needs of the South Pacific Region

The needs of the South Pacific Area, as those of most such areas, are many and complex;<sup>4</sup> but the more important and urgent of them have probably been most thoroughly researched under the patronage of the South Pacific Commission.

The South Pacific Commission is a consultative and advisory body which was set up in 1947 by the six Governments then responsible for the administration of island territories in the South Pacific region. These were Australia, France, the Netherlands, New Zealand, the United Kingdom and the United States of America. Participation by the Netherlands Government ceased at the end of 1962. The Independent State of Western Samoa was admitted as a participating Government in October 1964 and the Republic of Nauru admitted in July 1969.

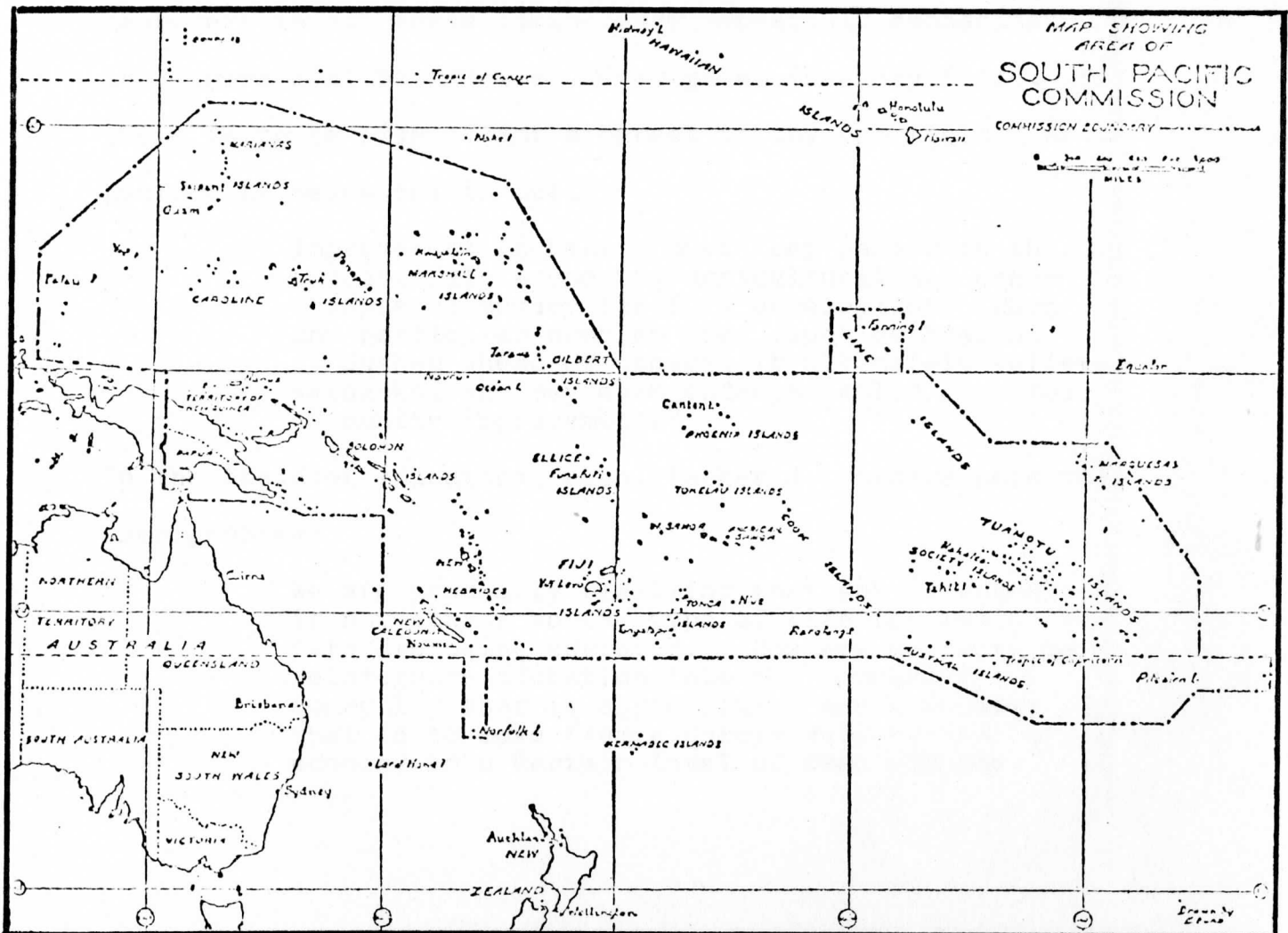
The Commission's purpose is to advise the participating Governments on ways of improving the well-being of the people of the Pacific island territories. The Commission is concerned with health, economic, and social matters. Its headquarters are at Noumea, New Caledonia.

The Commission consists of not more than fourteen Commissioners - two from each Government. It normally holds one session each year. There are two auxiliary bodies: the Research Council and the South Pacific Conference.

In the past the Research Council has normally met once a year. Members of the Research Council are appointed by the Commission. The chief function of the Research Council is to advise the commission on the work programme.

The South Pacific Conference consists of delegates, who may be accompanied by advisers, from the Governments and territories within the Commission area. Until 1967 the Conference met every three years. It now meets every year immediately prior to the annual Session of the Commission.

The principal officers of the Commission are the Secretary-General, and Chairman of the Programme Research and Evaluation Council, Afioga Afoafouvale Misimoa; and Programme Directors and members of the Council: Dr. Guy Loison, Mr. John E. de Young, and Mr. Alan Harris.<sup>5</sup> [See map below]



There are a number of other organizations, for example, The Research School of Pacific Studies at the Australian National University in Canberra, whose work would need to be considered in a feasibility study, but for the purposes of this preliminary proposal, the stress is research organized by the South Pacific Commission. The areas in which the Commission has seen fit to put most emphasis are: Health Education, General Education, Social and Economic Development and the Development of Natural Resources with special emphasis on Agriculture. Before examining each one of these spheres individually, it is very necessary to stress that key researchers in all these fields have repeatedly emphasized that there must be parallel development in every field, if there is to be significant progress in any one field. As Lynford L. Keyes points out,

Improvement in health must keep pace with the educational, economic, agricultural and other changes necessary for full development. When any particular problem area, such as health, is pushed ahead of others, it ultimately suffers setbacks, and may even endanger solid or total community improvement.<sup>6</sup>

In the field of education, also, Father J. Snyders sees the same problem:

We are gradually realizing that school education is not linked to the type of life for which profits are being educated... How are we going to reintegrate education into the community - a community that is agricultural and a society that is to move from a purely subsistence economy to a certain level of cash economy.<sup>7</sup>

Similarly R. C. White, after emphasizing the necessity of integrating social and economic education, says of agricultural education:

Agricultural development has been, and, for the foreseeable future, will continue to be the dominant feature in the development of most Pacific territories. It is essential, however, that care should be taken to foster the development, not only of other non-agricultural industries, but also of those aspects of the community which are affected by changes in social attitudes. Adequate provision must be made both for the maintenance of traditional cultural and social activities and for the satisfaction of demands for such additional social recreational, and cultural activities as may develop. In the early stages of development, many difficulties and uncertainties confront developing territories. Low educational levels, depressed standards of health...are considerable obstacles in the path of development.<sup>8</sup>

It seems essential, therefore, that any dynamic educational means introduced into the area must attempt a parallel development of all the principle aspects of the human situation; educational progress must be horizontal as well as vertical; in other words, it must be organic. As Father Snyders has pointed out,

All avenues of communications should cooperate to give our people a better understanding of the real aims of our schools - i.e. to prepare children for life in developing villages, and not to give them a way out of the village.<sup>9</sup>

#### Health Education Needs

The Commission has organized many individual research efforts into specific diseases, and surveys of health problems in specific areas. Typical of the recommendations of such surveys are those of A Health Survey in the New Hebrides:



1. Further local surveys are required, especially to determine the incidence of malaria, tuberculosis, and leprosy.
2. Based on such surveys, plans for dealing with the chief public health problems should be worked out on a territorial basis. Regular staff conferences should be held.
3. Responsibility for the collection of vital statistics needs to be laid down and enforced.<sup>10</sup>

It seems apparent that a communications system providing telephone and teleconferencing facilities would greatly assist the implementation of these recommendations. Such a system would assist the collection of vital statistics, the notification of communicable diseases, and the correlation of research surveys mentioned above. But perhaps the most valuable paper for our purposes is Health Education in the South Pacific. The introduction to this paper stresses the need for technical assistance in health education:

The interest shown in health education during the discussion of this subject at the Second Pacific Conference in Noumea, April, 1953, focussed attention on the need for an exchange of health education information among the territories and for some type of direct technical assistance in this field.<sup>11</sup>

Besides such direct expressions of communication needs, the principles laid down as worthy of consideration for the development of health education activities and programs also imply the need for a communication system more efficient, continuous, and effective than that at present in use. The first factor mentioned is that of planning: "Such planning should include an assessment of what has been done, what needs

to be done, what the people want done, financing, and the use of existing resources."<sup>12</sup> Telephoning and teleconferencing may greatly assist such planning, as it probably would the other factors and principles in need of implementation:

1. Finding out about the people
2. Planning with the people
3. Locating and using local leadership
4. Cooperation of private physicians
5. Cooperation with other agencies
6. Focusing on the local situation
7. Administration of Health Education
8. Team work
9. The Professional Health Educator
10. Financial Priorities...a high priority should be placed on the establishment of training courses [teleconferencing].
11. Evaluation<sup>13</sup>

The researchers then had to visit various territories personally, to gauge the needs of each area in the light of the above principles. This must be a continuing process and, it seems, would save much manpower and finance, and could be done more comprehensively, if more efficient means of communication were available. The conclusions of the researchers' visits to South Pacific Territories highlight, once again, the urgent need for an efficient communications system between the various territories. These "Conclusions" and a "Projected Plan of Health Education Assistance to the South Pacific

Territories" are included in Appendix A;<sup>14</sup> but one general conclusion should be stressed here. Having mentioned the "wide interest in health education" in the territories, the authors add:

much interesting and promising health education work is being carried on in a somewhat isolated manner in various territories. This is to say that while this work is in itself sound, it is not widely understood or participated in by other categories of workers or related agencies. Such a situation naturally produces gaps and overlapping of work.<sup>15</sup>

With existing resources, such overlap and waste seems inevitable, but with an efficient means of communication one could imagine it being completely eliminated, because of more easily organized administration and liaison.

#### General Education Needs

It is the consensus of interests and agencies working in developing countries that a prerequisite to economic, political or any specific development, is the development of human resources through education generally. Accordingly, the South Pacific Commission has held a number of seminars, all of which have expressed pressing needs in this area. The two most urgent problems which emerge seem to be the training and supervision of teachers, and the education of the adult population.

At an Education Seminar for the South Pacific, held in December 1960, one Director of Education said there was a great need for more such conferences "where educators in the

area can sit down together and discuss their common problems...for there is great value in the exchange of ideas."<sup>16</sup> Unfortunately the vast distances of the Pacific Ocean and lack of communications therein make such conferences extremely rare. But the lack of trained teachers makes some kind of inservice training absolutely essential, if any educational progress is to be achieved. The same seminar referred to the quite difficult problems in ensuring a supply of trained teachers:

The short term solution in most territories require acceptance of trainees who would not be regarded as satisfactory in a well-established system, and from this flow, certain consequential needs, especially in the form of help and supervision, as well as of provision for inservice training and refresher courses.<sup>17</sup>

The seminar examined,

possibilities of making the budget go further by getting a better return of money spent, through such things as the use of broadcasting... It is possible to effect improvements in education systems in Pacific territories more economically by the use of broadcasting than by other means.<sup>18</sup>

The seminar also considered that other ways of "the utmost importance" in which the Commission can assist educational work are,

- (a) by encouraging and assisting the interchange of professional experience within the region; and
- (b) by facilitating the introduction of relevant specialist experience into the region to assist in the solution of specific problems encountered by the territories.<sup>19</sup>

It seems that in both these instances, some kind of efficient communication system is absolutely essential.

In another regional educational seminar held in 1964, Richard Seddon pointed to the almost impossible task of maintaining even existing levels of education now that population is expanding in excess of production and revenue.<sup>20</sup> He sees the answer in regional and sub-regional organization. In 1966 the S.P.C. appointed an education officer who began to draw up a program of assistance to education. This program emphasizes the need for inter-territorial cooperation, awareness of regional community considerations in the design of educational systems, and the need for region-wide standards.<sup>21</sup> It is apparent that to organize a program of this nature over such a vast area as the South Pacific would require very effective communications. As J. W. Taylor indicates, if the disastrous mistakes of the past are to be effectively remedied urgent, widespread and well-organized communication must be invoked: "What education has done in many areas is to create a tremendous mental conflict."<sup>22</sup>

This is because:

a metropolitan syllabus...has been transplanted...on to a group of people whose needs, cognitive processed, language, social structure, culture, and climate are totally different.<sup>23</sup>

Such a process is a direct result of lack of available communication in assessing needs and training teachers:

There is need for more research, with the needs of the people in mind, for better systems of schooling that will do something to repair the damage while there is still time. Greater inter-territorial cooperation is needed to prevent much needed duplication of effort. Positive research

results should be disseminated as widely as possible, and these results should be incorporated in educational thinking and planning.<sup>24</sup>

Considering the urgency of the needs mentioned above, it is difficult to see how the solutions suggested could be implemented without a very comprehensive communications system. This is especially the case when one realizes the obvious need for, and emphasis placed on, adult education. If the existing educational system is inadequate in the schools, how can it also handle the more pressing need for adult education?

Special attention should be given to adult education, and public relations, when changes are envisaged, to ensure public acceptance rather than bewilderment and rejection.<sup>25</sup>

A conference on adult education held the year previously (1968) outlined problems in the field and suggested solutions.<sup>26</sup> The conference stressed two prescriptives:

- (a) The necessity of informing communities of the reasons for proposing certain projects and, in consequence, enlisting their will participation in the ensuring programmes.
- (b) The importance of coordinating the efforts of all agencies working for the well-being of particular communities.<sup>27</sup>

It was also stressed that it was important that people's attitudes, reactions and needs be passed back by field workers to the policy making levels, and that there should be consultation between all departments concerned. The needs were obviously all dependent for their solution on effective communications, and the conference resolved that the training programs should include three main things:

1. The problems of communication and of information
2. The techniques of extension work
3. The use of audio visual aids<sup>28</sup>

It is abundantly evident that a significant contribution to human progress and the economic development of the South Pacific area could be made through the implementation of a well-planned and integrated program of adult education. Perhaps the best means, possibly the only means, of achieving such a goal will be the use of a Satellite Communications System.

#### Agricultural Education Needs

Once again a description of the nature and urgency of needs is best left to the experts who have done research in the field and have a real understanding of the area; in this case, E.J. Britten in his article, "The Problem of Agricultural Education in the South Pacific."<sup>29</sup>

The problem is an urgent one. The economic situation in the islands is deteriorating, because of the depletion of the natural resources of the area - lagoons have become fished out, soil fertility is being depleted. In some instances, mining operations are damaging land and water which might be productive for agriculture and fisheries. On the other hand, the population of the region is increasing, as elsewhere in the world. Thus, the pressures will increase as the resources of land and water are depleted. It is quite obvious that the people of the South Pacific need assistance.

It would seem that the present situation offers an excellent opportunity for an experiment in education.<sup>30</sup>

A very comprehensive survey of needs in Agricultural Education was carried out by J.A. Sutherland and summarized

in his paper, Agricultural Education in the South Pacific.<sup>31</sup>

He continually stresses the importance of establishing a proper communications link between educational institutes, field workers and researchers, and the farmers themselves.<sup>32</sup>

Sutherland's treatment in Part IV of this paper of "Needs and Facilities" underlines, again, the importance of communication in solving these needs:

1. The Manpower Problem
2. Training of Graduates
3. Sub-professional Training
  - a. "Colleges" - Training of diplomats
  - b. "Farm Institutes" - Training of field assistants
4. School Agriculture
5. Young Farmer's Clubs
6. Other Needs
  - a. In-service training
  - b. Coordination within territories

It seems self-evident that the manpower problem could be greatly assisted if there were available between the various territories means of experts using satellite telecommunications for individual, group, or even mass instruction, as the need arose. Similarly in the liaison of graduates, field assistants, and farmers, a mechanical means of communication should, in many instances prove helpful. For coordination within the territories, and for inservice training, satellite communication could be invaluable. The use of prepared programs for agricultural schools, colleges, and institutes could be



centrally implemented with the use of an efficient telecommunications system, and save individual territories the cost of producing their own programs separately. Finally, Sutherland's "Summary of Recommendations" (Included in Appendix B) illustrates how helpful an educational satellite communications system could be in solving many of the agricultural education problems of the area. At least ten of the fourteen recommendations could be greatly assisted in their implementation by such a system.

#### Social and Economic Education Needs

Many of these kinds of needs will have been implicit in those mentioned above, but it is necessary that they be considered separately, and kept in mind as part of parallel plans for solving all needs:

It is extremely important for governments to realize that, in planning for development, economic action and change invariably have social consequences, and that consideration must also be given to the social aspects of change, implying a sound understanding of value systems institutions, customs and traditions, and of this relationship to individual and collective behavior, and of their place in planned development.<sup>33</sup>

An S.P.C. Conference, held in 1966, recommended, "long-term planning based on surveys of social and economic conditions" and "assistance from appropriate agencies in such surveys and planning."<sup>34</sup> Both in the planning and in the implementation of its findings, there is a possibility of a satellite communications system being very helpful. V.D. Stace emphasizes the importance national governments

give to citizenship instruction in economic planning, and points out that in Western Samoa, radio is used for this purpose.<sup>35</sup>

The South Pacific Commission has for some time organized Community Education Training Centers, particularly for educating women socially and economically. A study of the structure of this training illustrates both the keenness and urgent need of such people, as well as the extremely primitive means of communication used to implement this training: "These women travelled to the courses from considerable distances - they walked, rode, canoed, and even swam."<sup>36</sup> It is superfluous to suggest that a widespread satellite communications system would be invaluable in assisting such essential projects.

An S.P.C. technical meeting on economics and business training also highlighted the need for some means of disseminating knowledge in these fields:

In view of the growing tendency in the area of more widespread transition to commercial production, it is important that adequate attention be given to the needs of producers for knowledge and information which will assist them in their change to more improved methods in rapidly developing economics.<sup>37</sup>

In this area, also, it is realized that education is necessary just as much, if not more, for adults as for children,<sup>38</sup> and yet there are practically no effective means available for reaching the majority of those concerned.

Finally in considering the great number and great variety of educational needs in the South Pacific, one might

well refer to the words of Henry R. Cassirer, Chief of Educational Use of Mass Media for UNESCO, words which though applied to Asia, are equally applicable to the South Pacific region:

The serious massive problems faced by most Asian countries require an educational effort of immense dimensions which can be tackled only by a new technology in education and the employment of all available resources.<sup>39</sup>

Thus the need for a comprehensive communication satellite system is seen as being justified in terms of health, general, agricultural and social and economic educational needs. Satellite technology can obviously react most satisfactorily to the general needs outlined above, but it can also respond to the special needs of the South Pacific region.

#### Special Nature of South Pacific Needs

The uniqueness of the needs of this area arise, for the most part, from the geographical nature and position of the South Pacific Nations.

#### Individual Nations

Any one national group of islands would find it very difficult to establish the comprehensive communications system needed to solve its problems, not only because the usual finance required might not be available, but also because the terrain is difficult and the member islands are scattered, so that expenses would be much greater than usual. There is, in fact, a case history which serves as an

example of the difficulties involved, for an individual nation in this area, in such an undertaking. Vernon Bronson describes it in his outline of the establishment of an education television system in American Samoa.<sup>40</sup> He points out some of the difficulties caused by the mountainous peaks, for example,

It was decided that transmitter and tower design would have to be adopted to the characteristics of this peak... In order to provide the six channels, six transmitters had to be housed on top of the high peak, and six antennae had to be mounted on a single 400 ft. tower adjacent to the transmitter.<sup>41</sup>

The feasibility study carried out for this project demonstrated firstly, that there was a great need and desire for an educational communication system, "There was a reservoir of talent, a high rate of intelligence, an eagerness to learn and a potential motivation for self-advancement that would make a crash rehabilitation of the educational system possible and desirable."<sup>42</sup> Secondly, Bronson underlines, what the above study of various needs revealed, that such a system must be very comprehensive. "It is important that a communication system designed to establish modern educational methods be as complete and as fully integrated into the total instruction process as possible."<sup>43</sup>

Adequately trained outside teachers were brought in to share with native teachers the educational task, and television programs were made the core of instruction. In order to do this it is considered necessary to have six channels.<sup>44</sup> But the educational needs could be satisfied:

Not only by restructuring the school system, but by including the whole population in the new educational process. The family group is the most powerful single force in the education and development of these children and the adults in the villages would have to understand and participate in the new educational structure if it were to be built rapidly and be effective.<sup>45</sup>

Thirdly, the feasibility study showed that a comprehensive communications system can work in this area, as both an emergency measure and a long term benefit.

The importance of this model is that it describes a plan wherein it is possible to use the best of all that is available to improve the educational system of an underdeveloped and widely dispersed population. It is possible to maintain the important elements indigenous to their culture by arranging for native teachers to be used in every classroom. It is possible to use the most efficient distribution system by employing television to reach school buildings and community centers spread over an area nearly 100 miles in length. It is possible to provide for the application of appropriate audiovisual materials by installing power circuits in every school room. It is possible to make the best use of the available native school buildings by studying their light, sound, and ventilation characteristics. But perhaps most important is that it is possible to provide a continuing method for the improvement of this system by using trained, experienced school personnel who will work to develop and train the society's own native teachers and educational staff.<sup>46</sup>

#### Common Problems and Physical Separation

The research done by the South Pacific Commission, and others, shows conclusively that many of the problems in the South Pacific are common to all the nations in the area, and that the best means of solving such problems for any individual nation, it is even more essential between one nation and another in this area where all have so much in

common, especially their needs in education - medical, social, economic and agricultural. E.J. Britten emphasizes the frustration for the island people, eager to solve their problems, in this combination of similar problems and physical isolation:

Added to this is the impoverished cultural environment imposed by limited land masses isolated by mountainous terrain or vast stretches of ocean, and, in many cases, by social isolation also. No matter how well attuned such people may be to their own environment, or what their own traditions of history, this isolation - whether self-imposed by custom or imposed by the vicissitudes of geography - makes contact with other cultures and modern technology possible only by teaching.<sup>47</sup>

Other developing countries may have many of the same problems, but the people of the South Pacific have the additional, aggravating problems of isolation from neighbors, which prevents both cooperation and initiative much more than is the case in nations which are in a continental situation. Geography has also placed them in a position most isolated from the rest of the globe.

#### Global Isolation

Another of the great disabilities of the people of the islands is what has been referred to as "cultural deprivation." These people on small islands, or even on large ones with limited means of transport, do not have the background to grasp concepts which they might have had, had they been able to enjoy a wider cultural experience. For this reason it is difficult for them to probe problems with the same intellectual curiosity as they might have done in a different environment.<sup>48</sup>

In most other underdeveloped countries there is at least contact with the cultures and civilization of other different

countries, and though such people may have medical, social, economic and educational problems, they at least have also the motivation gained from the observation of such cultures. The South Pacific islands, on the other hand, are generally too remote from the rest of the world to benefit sufficiently from it in an educational manner. They have a great desire to progress, but are continually frustrated by lack of means:

But there is an optimum beyond which the stimulating results of stress give way to inhibitions and destructive results. In my opinion the society of Fiji is at a dangerous point at which if stress is increased there will be an overflow into destruction.<sup>49</sup>

Belshaw sees one solution as being better communication within the nation itself; he says a "solution could occur if the present political leadership makes an effort to link with village communities in a way which so far it has not done."<sup>50</sup> But he also sees their world isolation as a cause of their stress: "The Fijians are involved in a limited culture, and little attempt is being made to introduce them into the wider practical world of affairs."<sup>51</sup> This is true, in varying degrees, of all the nations in the South Pacific.

Such then are the unique problems of the South Pacific island nations. They seem to be the kinds of problems that lend themselves to a solution by means of satellite communications. In this situation are all the concerns of utilizing the communication system for national development, education and cultural exchange. The needs have been clearly identified and analyzed. The remaining question is whether satellite communication for the above purposes provides the optimum systems mix.

### The Desirability of a Communication Satellite System

A communication satellite system is probably the most satisfactory way of solving the problems of cooperation within the island nations, cooperation between one nation and the next, and cooperation with the outside world, especially as all these problems can thus be solved at the one time, with the one instrument, so providing an integration of all three solutions.

### The Financial Implications for Individual Nations of a Regional Satellite System

What Bernard W. Poirer said of Alaska is probably applicable, also to the South Pacific: "Generally speaking, terrestrial or traditional communications are not economically feasible for much of the state. Satellite communications theoretically can be the answer."<sup>52</sup> Although it has been stressed that comparison of satellite and terrestrial communications costs is elusive, this is in relation to a single state, and it is unlikely that one satellite system would cost more than ten independently organized terrestrial systems. If the ten or eleven nations of the South Pacific were to cooperate in establishing a satellite system, the cost would probably be much less than if each nation established a separate terrestrial system, which might later have to be disregarded, in any case, if it proved incompatible with a desired satellite system. As Senator Ted Stevens said of Alaska, South Pacific governments might well be inclined to say of themselves:



We cannot afford to let any potential user of satellite communications invest in or utilize any other form of communications if by so doing that user may delay the completion of full satellite communications.<sup>53</sup>

The researchers in the South Pacific region have continually stressed that any communications system in the area must be immediate and comprehensive if crises are to be solved, and this is what a satellite system would tend to give as opposed to a terrestrial system. Besides being most adequate as an emergency measure in the short term, satellite communication seems likely to be the long-term eventuality in any case. It would be unwise and uneconomical to attempt to solve a problem needing an immediate and long-term solution with a solution which is intermediate and likely to become obsolete.

Even if the arguments of financial saving, immediacy, and comprehensiveness do not matter, there still remains the need for communication between one nation and the next, which cannot be achieved with internal communications only.

#### Satellites and International Cooperation

By international cooperation here is meant, firstly, cooperation between Pacific Island neighbors. The research of the South Pacific Commission indicates that this is vital for the survival of these nations and, as has been indicated in the above section, it is difficult to see how it can be achieved without satellite communication. The educational problems are so similar that it is a tremendous waste for each nation to proceed independently. Realizing this, these

nations have cooperated in establishing the University of the South Pacific. But even this institution cannot operate successfully or independently without a comprehensive communications system.

Going outside a terrestrial system, besides enabling cooperation between immediate neighbors with similar problems, also opens up contact with more powerful nations often better equipped to assist in the educative process. For example, Tadashi Yoshida, Controller of Programs for N.H.K., has expressed a positive aim in this direction:

N.H.K. also hopes to share such programmes of high educational value or the segments of them with developing countries. In other words, if a satellite intended to facilitate consolidation of domestic TV networks should be launched and used, at the same time, for the purpose of providing programmes and materials for the developing countries, the situation would be highly desirable even when viewed from an economic standpoint. As a member of ABU (Asian Broadcasting Union), [The South Pacific Nations are also members] N.H.K. is seriously considering the possibility of such a satellite.<sup>54</sup>

Not only would a satellite education system allow the South Pacific nations to benefit from such programs from a variety of such developed countries, but these same nations could be more easily relied upon to assist in setting up the groundwork for a satellite system than for a conventional communications system. It is obvious that the developed countries are more likely to supply money for a system which they can make use of, than for one confined to the individual nation.

It should not be forgotten, of course, that education is a two-way process and, in this regard, the South Pacific Islands are ideally situated, geographically, between five of the world's seven continents. Not only can they take in information from all the countries concerned, but could also act as a convenient disseminating center for satellite education. Dr. Tatomir Andelic, Professor at the Faculty of Science, University of Beograd stresses the necessity for such centers in such places in his paper, "Applications of Artificial Satellites to the Education and Instruction of People in Developing Countries."<sup>55</sup>

Utilization of Existing Educational Institutions: The University of the South Pacific as a Model of Regional and International Cooperation

The University of the South Pacific is an ideal center for the dissemination of education to surrounding countries, not only because of its geographical position with relation to both developed and underdeveloped countries, but also because of the nature of its charter which is designedly regional in character.

Sir Norman Alexander, in drawing up a detailed plan for the development of the University, said that "emphasis should be placed on the regional character of the University."<sup>56</sup> The University is keyed to the needs of the surrounding region:

It is recognized that the University has an important contribution to make towards the general education of the communities in the region, and that there is a need for the "University Presence" throughout the region. The University will, therefore, provide a variety of extension services

and facilities for extra-mural study... In due course it hopes to establish extension centres throughout the region, with resident representatives, to stimulate local participation in these activities, and act as a centre for the dissemination of the University's work.<sup>57</sup>

To achieve this task over such a huge area is impossible under the present communications system. These necessary aims would most likely, and most successfully, be fulfilled with a satellite communications system. There seems no other feasible plan if one is to follow "the concept accepted for the University of the South Pacific - of a central core of degree studies, and a group of semi-autonomous institutes,"<sup>58</sup> the latter, of course, at great distances, in some cases, from the center.

Another factor which makes the University of the South Pacific an ideal center for educational diffusion is that its schools, and the research being done in the schools, correspond exactly with the needs of the area, as they were recognized years before the establishment of the University. The four departments of the University correspond to the four need areas established in the section above. The research efforts of each school, moreover, are being aimed directly at the major problems in its area. So the School of Natural Resources recognizes that, "the peoples of the area are mainly dependent upon the land" and "will therefore concentrate its main research efforts on problems arising from terrestrial resources."<sup>59</sup> The school of Social and Economic Development is concentrating its research on "economic development and other applied

questions of social and economic changes in the countries of the South Pacific."<sup>60</sup> The School of Education, "will be working in curriculum development within the University and over the whole of the South Pacific Region."<sup>61</sup> The Fiji School of Medicine is, of course, most intimately connected with the problems of the area. It is doubtful if the research of any other University is more closely tied to regional problems.

The University of the South Pacific is a microcosm for the development of international educational communication. There is the ideal situation of ten nations already organized (a major political obstacle already overcome) under one educational authority. Not only would it be possible to observe, in miniature, the problems associated with the growth of such a system, but also to ascertain the political, social, educational and financial resources and organizational arrangements required for a much enlarged system.

As the circle of communications widens, the University of the South Pacific could well become the center for an exchange of research materials and research enquires between universities in North America, Asia, Australia, New Zealand and South America. Research being done in any field can thus be kept much more up-to-date.

The Development of a Communication Satellite SystemVoice Communication via Satellite

The first logical step and the most pressing need seems to be the establishing of telephone links with remote areas, first for university, and then for national use. Such a series of communication outposts would allow, first, the administration of the University to communicate with both the various authorities of member nations and its own wide-spread facilities. It could use such a system to organize research for the various schools, and to arrange both for the expansion of the telephone system and the widening to include radio and television. A telephone network such as this would be a built-in evaluation facility of the progressing system. The administration communication needs may not seem directly educational but are the essential basis on which the educational fabric must rest, besides being the area in which, as John Platt points out,<sup>62</sup> crisis is likely to arise soonest.

Secondly, the various schools of the university need such a telephone system because of the regional nature of their research; it is needed to organize research in outlying areas, and for researchers in the field to contact the university center for receiving and giving of information. Once the findings of researchers have been programmed, the same process needs to be followed at the various stages of administering, advising, and earning a livelihood in the implementation

of such programs. At this stage a wider audience media could be fruitfully employed.

Providing evaluation of the telephone network shows the system to be working satisfactorily, and there is preparedness for reception by radio, the following radio programs could be effectively broadcast via satellite:

1. Teleconferencing
  - a. In-service conferences for teachers who can be given results of latest research and methods of implementing it. A feedback of evaluation of programs, from teachers to researchers.
  - b. Similar conferences for agricultural advisers and land users.
  - c. Similar conferences for government economists and social workers.
  - d. Conferences to arrange programs of public education, e.g., citizenship programs and intercultural communication.
2. Adult Education Programs
  - a. For whole area, on subjects found needful by all three schools, and subjects whose need was general to the whole South Pacific Area.
  - b. For individual countries, it might prove feasible to broadcast these, also, from the one central point, the U.S.P.; more coordination could be achieved this way - manpower, time, and space economized.
3. A University of the Air - Self selection programs which allow external students to work at their own pace, and in conjunction with written correspondence courses.
4. School Broadcasts - Such broadcasts would help the U.S.P. to achieve some unity in the nature, quality and quantity of knowledge of its entrants from various member countries. As with adult education some programs may be special to particular countries,

but many would be general. In any case it would be a saving of resources to have both program types emerge from one center.

5. Teleconferences with other countries outside the South Pacific area might be feasible at this stage.

#### Television via Satellite

The establishment of educational television can take place in the same areas as radio outlined above, though almost in the reverse order, (4), (3), (2), (1), (5). The final goal might well be the reception and transmission of worldwide television programs with multi-lingual sound tracks.

It might be well to keep in mind the psychological potential of the media mentioned above. Their very presence and availability will have just as much, if not more, effect than what they communicate. The presence of a telephone will bring a sense of confidence and support needed by any human endeavor in its infancy, the radio will bring a sense of knowledge so sought after in youth, and television a sense of empathy and unity, a necessity for maturity.



FOOTNOTES

1. Quoted by Bronson in "Implications of Communication Satellites for Educational Television," 22 NAEB Journal 58.
2. The Future of Man, Trans., Norman Denny. (London 1969) p172. (First published Paris, 1959).
3. Id. at 172
4. The material on the South Pacific Region was developed by the EDSAT Center of the University of Wisconsin, the research effort being under the direction of Mr. Ian Mills.
5. Inside cover of S.P.C. Technical Paper No. 164 (Noumea, June 1970).
6. "The Role of Education in the Improvement of Health in the South Pacific," 4 S.P.C. Quarterly Bulletin, No. 1, (Jan 1954), at 13.
7. "School and Community in the Solomons," 20 South Pacific Bulletin, No. 1 (Noumea, 1970), at 35.
8. "Balanced Social and Economic Development," 16 South Pacific Bulletin No. 1, (Noumea, Jan 1966), at 48.
9. "School and Community in the Solomons," op. cit., at 36.
10. W. Norman-Taylor and W.H. Rees, A Health Survey in the New Hebrides, S.P.C. Technical Paper No. 143 (Noumea, 1964), at 37.
11. Guy Loison and Lynford L. Keyes, Health Education in the South Pacific, S.P.C. Technical Paper, No. 96 (Noumea, 1956), at v.
12. Id. at 4.
13. Id. at 3-6. These principles are in keeping with the findings of: (i) The WHO Expert Committee on Health Education (WHO Technical Series, Report no. 89, Geneva, Jan 1953). (ii) First Australian Health Education Seminar (Canberra, Australia, Jan 1955). (iii) F.A.O. & WHO Health Education Seminar (Baguio, Philippines, Oct 1955).
14. This Appendix can be found immediately following this section.
15. Id. at 26.
16. Education Seminar for the South Pacific, S.P.C. Technical Paper, No. 133. (Noumea, Dec 1970), at 1.

17. Id. at 2.
18. Id. at 4.
19. Id. at 13.
20. "Secondary Education in the South Pacific," 14, South Pacific Bulletin, No. 4. (Noumea, Oct 1964).
21. "The Work Programme of the S.P.C. for 1967," supplement to South Pacific Bulletin, Vol. 17, No. 2 (Noumea, 1967).
22. "Education for What," 19, South Pacific Bulletin, No. 3, (Noumea, 1969), at 26.
23. Ibid.
24. Id. at 27.
25. Ibid.
26. K.J. Flynn, "Conference on Adult Education," 18, South Pacific Bulletin, No. 4 (Noumea, 1968).
27. Id. at 30.
28. Id. at 31.
29. 18 South Pacific Bulletin, No. 2 (Noumea, 1968).
30. Id. at 24.
31. South Pacific Commission Technical Paper No. 158 (Noumea, 1968).
32. Id. at 67-70.
33. A.C. White, "Balanced Social and Economic Development," op. cit., at 48.
34. Id. at 51.
35. "Western Samoa, An Economic Survey," 6 South Pacific Bulletin, No. 2 (Noumea, 1956), at 32.
36. "The South Pacific Commission Community Education Training Centre," 16 South Pacific Bulletin, No. 1 (Noumea, 1966), at 35.
37. "Technical Meeting on Economics and Business Training," 16 South Pacific Bulletin, No. 4 (Noumea, 1966), at 28.
38. Id. at 27.
39. "Radio and TV in Asia - A Meeting Report," The NAEB Journal (Sept-Oct, 1966), at 3.

40. "Applying a New Communications System to Modern Educational Methods: A Case History," NAEB Journal, Vol. 22, No. 2 (March-April, 1963). This article was presented at a United Nations Conference at Geneva in February 1963.
41. Id. at 8.
42. Id. at 5.
43. Id. at 3-4.
44. Id. at 7-8.
45. Id. at 5.
46. Id. at 11.
47. "Problems of Agricultural Education in the South Pacific," South Pacific Bulletin, Vol. 18, No. 2 (Noumea, 1968), p22.
48. Ibid.
49. Cyril S. Belshaw, Under the Ivi Tree, Society and Economic Growth in Rural Fiji (Los Angeles, 1964), at 275.
50. Ibid.
51. Id. at 273.
52. Speech at Satellite Communications Conference, Anchorage, Alaska, August 28, 1969.
53. Speech at Satellite Communications Conference, Anchorage, Alaska, August 28, 1969.
54. "Possibility of, and Profit to be Gained by, Using Satellites for Educational Purposes," Thematic Session 1, United Nations Conference on the Exploration and Peaceful Uses of Outer Space, May, 1968.
55. Paper delivered at the United Nations Conference on the Exploration and Peaceful Uses of Outer Space, May, 1968.
56. See University of the South Pacific Calendar, (1970), at 13; also Sir Norman Alexander's report in South Pacific Bulletin, No. 2 (Noumea, 1968), "The University of the South Pacific."
57. University of the South Pacific Calendar, 1970, at 74.
58. Sir Norman Alexander, op. cit. note 56 at 17.
59. University of the South Pacific Calendar, 1970, at 74.

60. Ibid.

61. Ibid.

62. "What Must We Do," 166 Science (Nov 1969), at 1118.

## APPENDIX A

I. Summary of Proposed Health Education Scheme

In some territories the major interest and achievements in health education rest with the health or medical department, while in others the schools have the leadership. As has been reported, much interesting and promising health education work is being carried on in a somewhat isolated manner in various territories. This is to say that while this work is in itself sound, it is not widely understood or participated in by other categories of workers or related agencies. Such a situation naturally produces gaps and overlapping of work. Added to this is the problem of divergent views regarding the basic concepts and functions of health education, together with many misconceptions about the most appropriate effective health education methods and techniques to be employed.

The following list is presented by the authors as the major health education needs in the territories visited:

- A. a wider understanding on the part of health, education, agriculture and related organizations and agencies, both official and private, of the basic concepts, functions and role of health education;
- B. the inclusion of basic principles, methods, and techniques of modern health education in the basic and in-service training of all categories of health workers, school teachers, missionaries and voluntary health agency workers;
- C. the provision of a wide variety of proper audio-visual materials to be developed as close to the specific needs and problems of each territory as possible. The more practicable materials such as filmstrips, flannelgraphs, flip charts and the like should be favoured over the more expensive and often less effective materials such as motion pictures, posters, slick cover booklets and so forth. In addition, based on worldwide experience, all materials produced outside a particular territory, especially those from highly developed countries, should be carefully screened and pre-tested before being used with the people in a territory;
- D. the provision of practical health text or reference books prepared in the vernacular of the territory and profusely illustrated for school children, teachers, nurses, sanitary inspectors and for the population at large. There is also a need for teaching guides in health education which could be used by teachers, nurse educators and other training personnel to assist them with teaching methods and techniques;
- E. the establishment of a clearinghouse of health education for the South Pacific territories. Although it has been approved by the South Pacific Commission at its Fourteenth Session, in November 1955, that the Commission act as a clearinghouse for health education materials prepared in the territories, it would be helpful for this function to be expanded to include the circulation to territorial authorities of such

health education material from other parts of the world as may be considered suitable for use in the Pacific region;

- F. research to determine effective ways of applying modern health education principles in specific South Pacific territories. Investigations need to be expanded into the particular beliefs and customs of the people regarding their health and medical practices;
- G. demonstrative work in health education in each territory should be jointly planned and implemented by all interested groups and agencies concerned rather than by a single department. Such projects should precede the formulation of any work programme in health education;
- H. the formulation of a long-range comprehensive health education programme for each territory. It would be hoped of course, that the health or medical department would provide the leadership in the formulation of such a plan;
- I. the provision for each territory of **at** least one qualified professionally trained health education specialist, preferably an islander.
- J. the establishment of a representative territorial coordinating committee for health education with representatives from all inter-government agencies, missions, and other interested individuals.
- K. the development of a health education syllabus for elementary and secondary schools with emphasis on practical and functional health activities for children rather than on technical hygiene information.
- L. the development in the teacher education colleges of the territories of a health education curriculum designed to prepare teachers to carry out practical and functional health education programmes.

## II. Projected Plan of Health Education Assistance to the South Pacific Territories

### A. Introduction

It is fully recognized that the planning and implementation of health education programmes in each territory can best be worked out through the cooperative efforts of the responsible and interested departments, agencies and groups. It is suggested, however, that the South Pacific Commission and the World Health Organization might jointly assist in meeting some of the major health education needs of the territories through a long-range programme. Such a programme is outlined below but is, of course, subject to review and approval by both the World Health Organization and the South Pacific Commission, while its implementation will depend upon the availability of funds from both organizations. This proposed programme takes into account the many encouraging health education developments which have taken place in the various territories. Attention should also be drawn to the contribution which the South Pacific Commission through its Health Section, Literature Bureau and Audio-visual Aids project has already made to health education in the territories by means of frequent professional articles in the South Pacific Commission Quarterly Bulletin on health education, the technical discussions on health education at the Second South Pacific Conference, and the production of filmstrips, posters and pamphlets on various health subjects.

### B. General Objective

The objective of the programme is to meet as many as possible of the major health education needs outlined by the writers in Chapter III.

### C. Part I - Training Course\*

The aim of this course will be to train selected personnel from the territories in the basic concepts, principles, methods and techniques of modern health education. It should be recognized that such a course would not prepare health education specialists, but rather give practical instruction which would enable its members more effectively to carry on health education activities within the scope of their own particular work.

It is planned that the course would be held between July and November, 1957. It will last approximately ten weeks and the number of trainees would be limited to forty. Each territory in the South Pacific area would be invited to send from one to four members with the sponsoring organizations meeting the cost of their subsistence and half of their travel costs. The course would be held at some central place in the South Pacific where adequate housing, instructional and service facilities are available. In

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\* At its Fourteenth Session held in October, 1955, the Commission approved in principle the holding of a short training course in conjunction with the World Health Organization and other interested international organizations.

order to develop the closest possible working and fellowship relations among the trainees and staff during the course, the working and living facilities of the course should be accommodated under one roof.

The trainees would be drawn mainly from experienced island people in the fields of health, education and related work, to include such personnel as nurses, sanitary inspectors, assistant medical practitioners, school teachers, teacher training instructors, home economic instructors and agricultural extension workers. It is important that plans be made both before and after the course for the trainees to be given an opportunity on their return to utilize the information and skills gained.

#### D. Staff

Arrangements will be made for a teaching staff of ten people representing: health education, social anthropology, psychology, audio-visual education, teacher education, public health administration and training, and general education. In so far as possible staff members should be recruited from the South Pacific area. It is expected that the Western Pacific Regional Office of the World Health Organization will make its Health Education Adviser available for the course and that this officer might be given the responsibility for the technical organization of the course.

#### E. Language

English will be the working language of the course, with French interpretation and translation provided where necessary.

#### F. Course Content

The following broad fields of knowledge would be covered by the course:

1. the principles and process of learning;
2. consideration of the sociological factors and their relation to the changing of attitudes, beliefs and habits;
3. consideration of the administrative structure and economic factors which condition the action of any given population group;
4. human relationships involved in working with people, i.e., members of communities, colleagues in other professions and the like;
5. study of the educational methods most suitable in various circumstances, i.e., individual instruction, group education, community participation, the use of mass media, etc.;
6. discussion of the health education concepts and experiences needed in basic and in-service education to meet the requirements of community workers;



7. principles of planning, organization and coordination of educational services in health, education and other relevant fields;
8. consideration of the main criteria in the planning, production, use and evaluation of suitable educational materials and aids;
9. consideration of the best methods and means for evaluating the effectiveness of educational progress in their broader aspects, as well as of gauging the usefulness of specific methods and media.

#### G. Conduct of the Course

No fixed programme for the course will be drawn up as the instruction will be built around the particular needs and problems of the trainees. There will of course be a body of information provided by the staff, but the course will stress the exchange of views and experiences among the trainees through small working groups composed of staff and trainees. In so far as possible the administrative responsibility and programme formulation of the course will be shared jointly between the staff and trainees. In this way the trainees will receive valuable experience in this type of educational method.

#### H. Part II - International Health Education Specialist

Although the trainees from the health education course will be prepared to carry out many practical health education activities upon their return to their respective territories, it is felt that a follow-up programme is necessary. Such a programme would consist of the assignment of a qualified international health education specialist by the World Health Organization to the South Pacific Commission for a two-year period. The primary functions of this specialist would be to give specific and continuous guidance to the course trainees on the spot. While visiting the territories the specialist could also give such consultative services in health education as might be necessary and desired. The period of service of this health education specialist would be divided between the direct services to the territories mentioned, by means of frequent field visits and work with the Secretariat of the South Pacific Commission, particularly the Health Section, the Literature Bureau and the Audio-visual Aids project. The assignment of the health education specialist should begin with the training course in order that he become acquainted with the trainees and take part in their initial training.

Listed below are some suggested ways in which the health education specialist might work:

#### I. Activities in the Territories

1. Follow-up of the health education course trainees.
2. Organization and conduct of short health education training courses for various types of health and education personnel.

3. Assistance in the development of long-range health education programmes for interested territories.
4. Assisting in the development of health education materials such as text books, visual aids, courses of study and the like.
5. Assistance in the development of health education programmes for schools.
6. Development of demonstrative projects in health education.
7. Assisting in the organization of territorial health education coordinating committees.

J. Activities with the Commission

1. Interpretation of health education principles to the Secretariat.
2. Development of research projects in health education.
3. Collaboration with the Literature Bureau, and the audio-visual aids project in the development and evaluation of health education materials.
4. Assisting with the establishment of a clearinghouse for health education materials for the benefit of the territories of the South Pacific.

## APPENDIX B

Summary of Recommendations to Solve Educational Needs in AgricultureRECOMMENDATION 1.

That territories be advised of the desirability of having a survey made of manpower resources and needs as soon as possible.

RECOMMENDATION 2.

That territories in the South Pacific region continue, for the time being, to make use of overseas facilities for university training in agriculture science and continue to recruit expatriate graduates so long as a shortage of local graduates exists.

RECOMMENDATION 3.

That, as far as possible, agriculture colleges accept for training suitably qualified students from other territories, and that some of the burden of this cost be borne by the students' own territorial government.

RECOMMENDATION 4.

That the South Pacific Commission sponsor meetings arranged for the purpose of discussing standards of theoretical and practical instruction at the agricultural colleges.

RECOMMENDATION 5.

That the agricultural colleges of the South Pacific give consideration to the possibility of specializing in the provision of post-diplomate courses.

RECOMMENDATION 6.

That, as soon as possible, officers responsible for training in extension methods be suitably trained in the methods of group dynamics.

RECOMMENDATION 7.

That, as soon as possible, centres for training in extension methods be established at each of the agricultural colleges.

RECOMMENDATION 8.

That staffs of farm institutes take the first opportunity to meet and discuss curriculum construction.

RECOMMENDATION 9.

That the South Pacific Commission consider the possibility of setting up an information service concerning agricultural publications suitable for use in colleges, institutes, and schools.

RECOMMENDATION 10.

That teachers' training colleges in each territory introduce into their curricula training in the teaching of agriculture, and that lecturers be selected and given an opportunity to prepare themselves for this work.

RECOMMENDATION 11.

That the South Pacific Commission establish the position of agricultural educationist to coordinate agricultural education in the South Pacific; that the Commission consider an immediate appointment to this position.

RECOMMENDATION 12.

That the South Pacific Commission offer to organize technical in-service training courses for members of staff of all colleges, institutes, and schools concerned with agricultural education in the region.

RECOMMENDATION 13.

That territories be urged to give support to attempts to establish some organic connection between an agricultural college in the South Pacific region and the new universities being established in Fiji and the Territory of Papua and New Guinea.

RECOMMENDATION 14.

That each territory be urged to set up an advisory committee on agricultural education to advise on the development and coordination of institutions and services, and to make the most economical use of resources.

## IX

INTERNATIONAL LAW AND THE USE OF COMMUNICATION SATELLITES FOR  
EDUCATIONAL, NATIONAL DEVELOPMENT AND CULTURAL EXCHANGE  
PURPOSES

By far, the major problems relative to satellite technology in legal scholarship at the present time are those relating to legal responsibility for satellite operation, the implications of possible damage caused by satellite broadcasting, and ownership of the broadcasting satellite itself. The damage could be actual--such as that caused by any part of the satellite causing personal or property damage, or it could be harm resulting from a satellite broadcast or the utilization of incorrect data recovered from a satellite. Coupled with these two issues would be the one of determining the actual ownership to the satellite.

One implication of the ever-increasing use of satellites for educational communication purposes is that traditional concepts of international law become somewhat inadequate. Satellites do not observe national boundary limitations; thus, questions arise concerning the broadcasting capabilities of the satellite and the degree of control that the launching State has over it once it is launched. The legal problems in this area are just beginning, and questions such as liability for damage caused by a communication.

satellite must continue to be dealt with by both domestic and international lawyers if the development of the law is to be responsible to and assist in the development of the technology.<sup>1</sup>

### The Question of Liability

One of the basic questions which has arisen concerns the extent to which a nation might be liable for damage caused by communication satellites that it launches or operates. Should it make any legal difference, for example, whether a satellite is to be used for national broadcasting purposes or whether it is to be used for an international broadcasting service? Should different rules apply if a satellite is operated by a private organization as opposed to being operated by a governmental or international organization?

The 1967 Outer Space Treaty<sup>2</sup> provides basic guidance as to the assumption of liability, and the proposed Draft Convention on International Liability for Damage Caused by Space Objects<sup>3</sup> provides an indication of future specific guidelines.

On a general level, the 1967 Outer Space Treaty provides:

States Parties to the Treaty shall bear international responsibility for national activities

in outer space . . . whether such activities are carried on by governmental agencies or by nongovernmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.<sup>4</sup>

More specifically, Article VII states:

Each State Party to the Treaty that launches or procures the launching of an object into outer space . . . and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space . . .<sup>5</sup>

Thus it appears that not only is the State that launches an object into space liable for damage, but also the State from whose territory or facility the object is launched incurs a similar liability. This would seem to create liability for a nation, even though its launching facilities were used by a third State for launching a particular satellite; and, since the liability would appear to be joint, some agreement as to percentages would have to be reached before launching. The situation is further complicated by Article VIII which states: "A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object. . . ." <sup>6</sup> If the satellite launched by a third State using another State's facilities were carried on the registry of the third State, it would appear illogical to give the third State jurisdiction and control over the satellite, while making the launching State jointly liable for damage caused by it, simply because its launch facilities were used.

In an early draft of the liability convention, the United States suggested that the responsibility of the launching State should be absolute.<sup>7</sup> Another suggested option was to limit liability to those activities that were considered to be "unlawful." However, there is precedent for the position that when an immensely hazardous activity is engaged in, absolute liability is imposed.<sup>8</sup> To the extent that all nations of the world might benefit from the use of a communication satellite launched by a particular nation, it could be argued that absolute liability should not be based on the hazardous nature of the activity, but rather that standards of fault and lawfulness should be relied upon. Nevertheless, in balancing interests between a launching State and an injured national of a third State, it could be argued that, for humanitarian reasons, liability should rest with the launching State.<sup>9</sup>

The proposed draft of the liability convention states that:

A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight.<sup>10</sup>

However, the definition of "launching State" indicates that both the State which launches or procures the launching of a space object and the State from whose territory or facility a space object is launched are considered the launching State. Thus it would appear that there could be several "launching States" and this might present difficulties for



a State suffering damage in presenting a claim. Article V (3) of the Draft Convention states that a State from whose territory or facility a satellite is launched is to be regarded as a participant in a joint launching and thus subject to joint and several liability with the launching State.

#### The Role of International Organizations

Further problems are posed by the possibility of limiting liability or of shifting it through an assumption of liability by an international organization, such as the United Nations or its specialized agency, the International Telecommunication Union, or perhaps even an international consortium such as INTELSAT which could contract for the launching of a communication satellite and its operation.

The 1967 Outer Space Treaty provides in Article VI that

When activities are carried on in outer space . . . by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States parties to the Treaty participating in such organization.<sup>11</sup>

This raises questions as to the way in which this "sharing" of liability is to be accomplished. Is the liability to be joint and several? Is the international organization to accept "half" and the Member States to divide the other "half," or is there to be an assignment based on financial contribution to the organization or active participation in the launching activity? Further, it would appear that whatever the distribution of liability between the inter-

national organization and Member States, under Article VII this liability would be further shared with the launching State, or the State from whose territory the satellite was launched. Would it make any difference if this latter State were also a member of the international organization? Would it thus be required to accept an even larger share of the responsibility?

While Article VI attempts to create joint responsibility for the launching of satellites between international organizations and States, Article XIII of the Treaty asserts that it is the States that are ultimately responsible for outer space activities:

The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space . . . whether such activities are carried on by a single State Party to the Treaty or jointly with other states, including cases where they are carried on within the framework of international inter-governmental organizations.<sup>12</sup>

Here the further limiting feature is that only inter-governmental organizations are considered, and this by implication, excludes international organizations with membership beyond States, such as the International Council of Scientific Unions (ICSU) which is a nongovernmental international organization. Article XIII attempts to make States the basic unit of responsibility even though the framework of an international organization is used. This Article continues by stating that:

Any practical questions arising in connection with activities carried on by international inter-governmental organizations in the exploration and use of outer space . . . shall be resolved by the States Parties to the Treaty either with the appropriate international organization or with one or more states members of that international organization, which are Parties to this Treaty.<sup>13</sup>

While what is meant by "any practical questions" is ambiguous, the implication in the Treaty is again clear that States are to be the final unit of responsibility, and that if any questions arise regarding international organizational activity, either the State Party to the Treaty will settle it with the organization or, if that is not possible, the States themselves will resolve the problem without consulting the organization as a separate entity.

The role to be played by international organizations is further clouded by reference in Article VIII of the Treaty only to the registry of a State when considering jurisdiction and control. No provision is made for a registry of the United Nations nor for any other international organization. Thus, there would appear to be no way that an international organization could launch and maintain control over a communication satellite. It is interesting to note that at one time there was a suggestion that a registry be located within the United Nations Committee on the Peaceful Uses of Outer Space. In support of this

position, the Draft Code of Rules on the Exploration and Use of Outer Space by the David Davies Institute provided:

Sec. 5.2

Every spacecraft to be launched by an international body shall be registered with the Committee on the Peaceful Uses of Outer Space, which shall issue a registration mark.

Sec. 5.3

For all purposes including that of any claim concerning the activities of a spacecraft:

- a) every spacecraft to which Sec. 5.1 (registration provision) applies shall be deemed to have the nationality of the State in which it has been registered . . . and
- b) throughout its life shall, with its component parts, so long as they are identifiable, be deemed, in the absence of special agreement, to be the property of the State concerned under Sec. 5.3a or of the international body registering it, as the case may be.<sup>14</sup>

While this Draft dealt with the ownership of a spacecraft by an international organization, it did not consider the question of nationality of the spacecraft.<sup>15</sup> It might be possible to separate ownership and registration in the event that an international organization were to be involved in launching a satellite.<sup>16</sup> Thus, while it would not seem possible for international organizations to launch and be liable for spacecraft, it may be possible to use the structure of a joint operating organization, or an international operating agency, and to apportion State liability for such an undertaking.

The existing analogies here are with the joint operating agencies established by States to pool their resources.<sup>17</sup> However, the problems of nationality and registration still arise in the existing Conventions dealing with such devices as aircraft. For example, Article 77 of the Chicago Convention provides:

Nothing in this convention shall prevent two or more contracting States from constituting joint air transport operating organizations or international operating agencies. But such organizations . . . shall be subject to all the provisions of this Convention . . . The Council shall determine in what manner the provisions of this Convention relating to nationality of aircraft shall apply to aircraft operated by international operating agencies.<sup>18</sup>

The implications of this provision have created some ambiguity when attempts have been made to determine its manner of application to various international operating organizations.<sup>19</sup>

As to the question of jurisdiction, the Tokyo Convention<sup>20</sup> provides in Article 18 that:

If contracting States establish joint air transport operating organizations . . . which operate aircraft not registered in any one State, those States shall, according to the circumstances of the case, designate the State among them which, for the Purposes of this Convention, shall be considered as the State of registration and shall give notice . . . to the ICAO which shall communicate the notice to all States Parties to this Convention.<sup>21</sup>

This idea of designating one State to be the State of registration could also be applied to a situation in which a group of States wished to launch a communication satellite, and one of them was willing to accept the designation as the

national State of registration. However, suggestions were made when the foregoing proviso was inserted into the Tokyo Convention to the effect that all of the Member States of such an operating organization should have the jurisdiction of the State of registration.<sup>22</sup> This would be in direct conflict with Article 17 of the Chicago Convention which limits registration to individual States and does not include international organizations. This is a direct parallel with the provision in Article VIII of the Outer Space Treaty which refers only to registration in a State.

The difficulties arising from having more than one State of registration would center around the differences in domestic laws regarding liability and compensation. These differences would be detrimental to any attempt to fix liability so that the expectations of the nations involved would be taken into consideration. It must be remembered that the designation to be made under Article 18 of the Tokyo Convention applies only to the matter of jurisdiction, and for purposes of the Chicago Convention it may not apply at all, or another set of regulations may be used. This would create further uncertainty concerning the State responsible. The possible conflict between Article 77 of the Chicago Convention and Article 18 of the Tokyo Convention points out the difficulties inherent in any attempt to establish either a joint operating agency or an

international operating agency, and suggests that Article VIII of the 1967 Outer Space Treaty has rightly limited registration to States.

An elaboration of Article VIII could be suggested along the lines of Articles 20 and 21 of the Chicago Convention, which provide that every aircraft engaged in international air navigation shall bear its appropriate nationality and registration marks (Article 20), and that each State will supply to any other contracting State or to the International Civil Aviation organization ". . . on demand, information concerning the registration and ownership of any particular aircraft registered in that State"<sup>23</sup> (Article 21). The codification of a formal duty of notification of satellite registration would be particularly beneficial, since observation of their registration marks when in orbit proves extremely difficult.

Additional legal complications would arise in the event that a State leased a communication satellite to another State or to an international organization.<sup>22</sup> The analogies to air law are sparse and inconclusive since the subject was omitted from the Tokyo Convention altogether. Problems of lease, charter, and the limitation of liability generally, would arise if the United States were to consider that the acceptance of strict liability

for the satellites that it launches would be unconscionable, and that since all nations would benefit from the use of the satellite, liability should be limited or shared. This could lead to a situation where an agreement would be reached as to the liability to be accepted among the nations participating in the programs, and possibly some sort of joint operating agency would need to be established.

The Draft Convention attempts to resolve the problems surrounding the participation in satellite launching by international organizations by providing in Article XXII that

1. In this Convention, with the exception of articles XXIV to XXVII references to States shall be deemed to apply to any international intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies.
2. States members of any such organization which are States Parties to this Convention shall take all appropriate steps to ensure that the organization makes a declaration in accordance with the preceding paragraph.
3. If an international intergovernmental organization is liable for damage by virtue of the provisions of this Convention, that organization and those of its members which are States Parties to this Convention shall be jointly and severally liable; provided, however, that:
  - (a) Any claim for compensation in respect of such damage shall be first presented to the organization;



- (b) Only where the organization has not paid, within a period of six months, any sum agreed or determined to be due as compensation for such damage, may the claimant State invoke the liability of the members which are States Parties to this Convention for the payment of that sum.
- (4) Any claim, pursuant to the provisions of this Convention, for compensation in respect of damage caused to an organization which has made a declaration in accordance with paragraph 1 of this article shall be presented by a State member of the organization which is a State Party to this Convention.<sup>25</sup>

This provision deals solely with intergovernmental organizations and as such does not apply to non-governmental international organizations. Further, the effectiveness of this provision depends on the organization making the declaration referred to in section 1. The six month waiting period is a desirable procedural step, but it is questionable whether, if the organization declines to pay for damage caused, the individual States will have a different opinion since the initial decision not to pay would have been the result of their collective judgment.

The Draft Convention on International Liability for  
Damage caused by Space Objects: General Comments

The Legal Sub-committee of the Committee on the Peaceful Uses of Outer Space of the United Nations has, at its meeting on 29 June 1971, adopted the text of the Draft Convention, which will eventually be considered by the United Nations General Assembly. At present this document can serve as an aid to understanding the trend of thought

on questions of liability in the United Nations as reflected by the emphasis placed on certain provisions in the document. For that reason it is reproduced in Appendix I to this Chapter.

Absolute liability is incurred by a launching State under draft Article III if damage is caused on the earth or to an aircraft, and this is contrasted with the fault concept that is introduced when the damage is caused elsewhere such as to another space object.<sup>26</sup> The concept of absolute liability is further clouded by Article VI which provides for exoneration from absolute liability if the launching State can establish that the damage has resulted ". . . either wholly or partially from gross negligence or from an act or omission done with intent to cause damage on the part of a claimant State or of natural or juridical persons it represents."<sup>27</sup> The requirement, however, is that exoneration will only be allowed if the activity which resulted in the damage was in accordance with international law with specific reference to the Charter of the United Nations and the 1967 Outer Space Treaty. Thus the terms of the Outer Space Treaty, specifically, becomes important in the construction to be placed on specific claims for reparation arising out of the Draft Convention. This reference back to general international law and the Outer Space Treaty may provide some difficulties in resolving damage claims given the wide range of materials that may be cited in support of particular positions.

Of further interest is the provision providing that while the initial claim for damages is to be presented through diplomatic channels (Article IX), that if no settlement is reached in this matter within one year from the submission of the claim, the parties shall establish a Claims Commission to resolve the problem.<sup>28</sup> It will remain for future documents to spell out the procedures to be followed in the operation of the Claims Commission subject to the applicable provisions of the Draft Convention.

The draft provision dealing with the amount of compensation to be paid is of concern if the Convention is to be effective. Draft Article XII provides:

The compensation which the launching State shall be liable to pay for damage under this Convention shall be determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred.<sup>29</sup>

While punitive damages are excluded in this context there can be a wide divergence of legal opinion as to what constitutes adequate compensatory damages, and these problems will need to be dealt with when the Convention comes into force. There are a significant number of international claims adjustments which outline standards for compensatory damages and these can be used as guidelines in this area.

New international legal arrangements and treaties will eventually be needed to deal with satellite technology.

There are a number of alternatives ranging from an all-encompassing international treaty, similar to the Outer Space Treaty, to a series of interlocking bilateral or regional agreements. Perhaps agreements similar to the INTELSAT definitive arrangements will prove most practical. In any event there is a need to consider the alternatives and to attempt to formulate rules and regulations that will not stifle the growth of satellite technology, but which will rather channel it into productive directions, taking advantage of various organizational forms.

While the Outer Space Treaty is a major source of legal doctrine relative to communication satellite liability, it must be remembered that it does not contain any articles dealing with violations of treaty provisions or with sanctioning provisions. Nevertheless, it is valuable as a formal indication of the intentions of the major nations, and as such can serve as the basis for the liability convention and additional conventions in specific problem areas. Even in the case of the draft Convention on liability there is some question as to the effectiveness of the award granted by the Claims Commission. For example, the decision of the Commission is final and binding only if the parties have so agreed and otherwise the decision is final and recommendatory which the parties are asked to consider in good faith. Thus it would be possible for the party asked to pay a claim to consider that it is unable to do so and that

would appear to close the procedure established by the Convention.<sup>30</sup>

If some form of international organization, such as INTELSAT, were involved in the launching and control of future communication satellites and claims were brought under Article XXII of the Liability Convention and the six month waiting period elapsed, there might still be a question as to whether all Member States in the Organization should be jointly liable or whether some proportionality standard should be adopted. While the draft liability convention is clear that the liability is joint, there may be reasons for reconsideration on this point. In any event, if liability were apportioned in whatever manner amongst the Member States this might create a hardship for developing nations and might in fact diminish the propensity of some of these nations to participate in particular international organizations.

THE WORLD ADMINISTRATIVE RADIO CONFERENCE FOR SPACE  
TELECOMMUNICATION

The International Radio Consultative Committee (CCIR) of the ITU conducted studies during 1967 on the technical and operational aspects of space communications and particularly the relative merits of the three theoretically feasible ways in which satellites could be used

to transmit program material for international broadcasting services. These three approaches were described as follows:

- a) by means of a satellite for point to point relay purposes, which implies the existence of at least one advanced ground station in the territory to be covered and also the existence in that territory of a well-developed terrestrial network consisting of cables or microwave relay systems, or a mixture of both; this approach is already being applied in a number of countries;
- b) a distribution satellite system, whereby a somewhat more powerful satellite would transmit to a number of relatively simple ground stations, which would relay programmes so received, with the necessary frequency changes, to domestic or collective receivers within their area of coverage;
- c) a direct broadcasting satellite, whereby a signal transmitted by the satellite would be sufficiently strong to be received directly by domestic or collective receivers which, however, would have to be equipped with special antennae and, depending on the frequency used by the satellite, with the necessary frequency-changing equipment." 31

At an interim meeting in 1968 a Joint Working Group of CCIR Study Groups X (Broadcasting) and XI (Television) considered the problems of frequency sharing between satellite and terrestrial broadcasting services, and concluded that the use of existing broadcasting bands for the broadcasting service from satellites, and particularly the use of band 10, raised technical problems which required further study by the CCIR. There was also discussion concerning the exchange of television programs and the technical standards to be maintained, and the adoption of a question entitled "Specifications for low-cost television receivers" which would enlarge the concept of direct broad-

casting by providing for adequate and low cost television receivers to be made available to developing countries.

The expectation of numerous satellite capabilities has led the CCIR to a consideration of the problem of potential overcrowding of the geostationary orbit, since it is desirable to use synchronous satellites at an altitude of 22,237 miles above the earth in the plane of the equator. While the entire orbit is very large, because of population densities certain sections of the orbit will be preferred, and it is likely that there will be a tendency to place a number of satellites relatively close to one another. If this is done, and if they operate on the same frequency, discrimination between them will depend on the resolving power of the satellite antenna systems and the earth station systems. To determine the seriousness of this problem, and to establish technical rules, experiments are being conducted to determine the minimum angle of separation possible. As with other problems of this type, the technical solution to the problem of overcrowding of orbital positions will only prove effective to the extent that a political accord has been reached.

At a meeting of the World Plan Committee held in Mexico during 1967, consideration was given to the question of communication by artificial satellites, and the Plan then drawn up considered the possibilities of this mode of telecommunication.<sup>32</sup> While the ITU is responsible for the

development of a number of Plans for telecommunication development, since these are compiled at five year intervals they have general validity but they are not particularly reliable as short-range guides. In this respect the Atlantic, Pacific and Indian Ocean Regional Planning Conferences of INTELSAT are far more explicit and germane to planning for satellite services.

#### Relevant ITU Administrative Bodies

In order to provide a background for the 1971 World Administrative Radio Conference, some comment on administrative conferences, the ITU and the International Frequency Registration Board is in order.

Administrative Conferences are of three kinds, differing primarily in subject matter. The Ordinary Administrative Radio Conference (ARC) is responsible for the revision of the Radio Regulations and the election of the International Frequency Registration Board members - including the issuance of instructions and active review of the Board's activities. Membership and voting requirements correspond to the Plenipotentiary Conference, and while it has an undefined schedule, meetings are usually held at five year intervals. The Extraordinary Administrative Radio Conference (EARC), as its name suggests, is similar to the ARC except that it considers specific telecommunication problems and special revisions of the Radio Regulations. An



agenda determines the scope of authority at each meeting and it must be approved by a majority vote of the membership. There are also service conferences and regional conferences which deal with limited sections of the Radio Regulations such as that part concerned with "pirate" radio stations or the frequency allocation plans for transmission stations in a particular locality.

It would appear that the world administrative conferences are more important than the regional meetings, but it is probable that as a general rule more practical results emanate from the regional meetings. For example, a regional conference may recommend specific changes to the International Frequency Registration Board that would take effect, providing no other region was adversely affected and the changes were generally in accord with the Administrative Regulations. It has been suggested that even though there is a formal division between the Plenipotentiary and Administrative Conferences, that there is an informal relationship that extends beyond the formal, legal separation. This is probably true, given the similarity in subject matter discussed and the various types of exchanges that take place between these two bodies.

The International Radio Consultative Committee  
(CCIR)

The International Consultative Committees of the ITU study and formulate recommendations relating to the technical and operational areas of telecommunication, and are particularly concerned with the development and improvement of telecommunication in developing areas. The International Radio Consultative Committee with an elected director, permanent staff, and a membership consisting of the administrations of all Union Members and Associate Members as well as any recognized private operating agencies, works through the medium of the Plenary Assembly (which normally meets every three years) and study groups. Questions may be put to the Committee by the Plenipotentiary Conference, by an Administrative Conference, by the Administrative Council, by other Consultative Committees, or by the International Frequency Registration Board, but not by the General Secretariat. At the meetings of the Plenary Assembly, the work of the sub-committees and study groups is presented and administrative conference proposals are made.

One significant area of endeavor deals with the development of a general plan for an international telecommunication network which would involve the interconnection of various means of transmission in an inclusive system. To this end the International Telecommunication Convention provides for a

World Plan Committee and four regional Plan Committees (Africa, Latin America, Asia and Oceania, and Europe and the Mediterranean) to implement planning proposals. The World Plan Committee coordinates the regional activities and draws up routing plans between the regions. Towards this end the World Plan Committee has prepared a "General Plan for the Development of the Interregional Telecommunication Network, 1967-1970-1975," which replaced the Rome Plan publication which covered 1963-1968. Included are statistical tables indicating telecommunication services throughout the world and giving a clear view of the media available to route telecommunication traffic.<sup>33</sup>

The function of the International Radio Consultative Committee has been described as follows: "the CCIR serves as a filter which eliminates proposed regulations and operating procedures technically incompatible with the existing regulatory structure, and in some cases formulates technical criteria for telecommunication operations promising most effective international utilization of the radio frequency spectrum."<sup>34</sup> It must be remembered that the recommendations and study reports of the CCIR have no legal base and, hence, no binding effect on Members of the ITU or others. However, many of the recommendations have been accepted by national governments and have become a part of local law, and thus the CCIR is extremely valuable as a policy-making body.

The International Frequency Registration Board.  
(IFRB)

The efforts of the International Frequency Registration Board (IFRB), determine whether the Convention and the Radio Regulations are observed in the operation of stations which have been assigned frequencies by their respective countries. It also furnishes advice to Members regarding the maximum use of frequencies in those portions of the spectrum where harmful interference might occur, performs other duties prescribed by the appropriate Union bodies, and maintains the records essential to its duties.<sup>35</sup> The Board consists of five independent members, with technical skills and a familiarity with a particular region of the world, who are chosen from candidates sponsored by Member countries.<sup>36</sup> Special provision is made in the International Telecommunication Convention to the effect that no Board member shall receive instructions from any government or private body relating to his duties, and all Members of the Union are forbidden to attempt to influence them.<sup>37</sup> The number of members on the Board has been reduced from eleven to five in an attempt to create a more viable and responsible organization.

The difficulties facing the Board stem primarily from the fact that a number of countries do not obey the Board's findings when it is not in their own best interests to do so. One reason for this non-adherence is that frequencies

are still assigned on a time priority basis rather than on equitable principles. In the early days of regulation this caused nations to hoard frequency assignments that they would never use, and today it creates difficulties in the determination of which frequency use should predominate.

"The IFRB does not have dictatorial powers in frequency matters, but its action is nevertheless very far-reaching since it intervenes in the use made of radio frequencies by the various radio services throughout the world." <sup>38</sup> Even if the IFRB cannot completely control the use of broadcast frequencies, it does provide a technical monitoring publication service to indicate whether stations are actually occupying their assigned frequency or whether other frequencies are being used that will cause disturbance to other users. The monitoring is carried out by the Administrations of Member countries, the results being correlated by the Board, summarized, and published as international monitoring reports.

The Board cooperates very closely with the United Nations and with several of the U.N.'s specialized agencies, such as the International Civil Aviation Organization, the World Meteorological Organization, and UNESCO (regarding the Intergovernmental Oceanographic Commission). Through relationships with these, as well as with other <sup>39</sup> organizations, the Board is attempting to change its role from

one exclusively concerned with frequency assignment to one involving frequency management. However, a number of member administrations, including the United States, have questioned these attempts. It is likely that these matters will be raised at the 1973 Plenipotentiary Conference. An attempt is being made to concentrate more on long-term policies and on the implications of various programs on the international usage of the frequency spectrum. This has historically been more a CCIR function than an IFRB activity.

The Special Case for the International Educational Community at the WARC

The need for frequency allocations for educational purposes has been growing at an increasing rate over the past few years and will continue to do so in the years to come. The U.S. Office of Education has documented a wide range of current educational uses of telecommunications, including over-the-air TV broadcast, ITFS, and closed circuit television, facsimile and data transmission information, retrieval and computer-assisted-instruction. In many of these instances the availability of low cost satellite communication would result in improved service and lower costs for developing countries.

The Department of Health, Education and Welfare stated the importance of obtaining satellite distribution for educational use in its reply to the FCC prior to and in preparation for the WARC meeting.

Education is currently accused of irrelevancy; properly applied, technology can help solve this problem. By providing timely, high quality programming through a system of interconnection that links colleges and universities, primary and secondary schools, pre-school and adult education centers with distribution centers that provide only the best in programming, the nation can vastly improve its educational system. National production and distribution centers are vital to this plan. Only in this manner can the necessary excellence of programming be achieved, and the costs be spread over the widest possible audience, and thus reduced. Satellite communication is the most cost-effective method of providing this service. It is used exclusively by commercial networks as the only economically feasible means of distributing large amounts of information. 40

Following is an excerpt from the U.S. Proposals for WARC dealing with the interests of the educational community which indicates governmental concern with the educational community.

The health, education, and other public service interests have put forward a requirement for a low cost video band-width satellite system to meet the needs of hospitals, schools and universities. The 2500-2690 MHz band is particularly suited to meet these public service requirements since present technology and existing services permit a low cost multi-point satellite system to be developed in this band. The services envisioned fall into principal categories, (a) the distribution of TV program material direct to educational broadcast stations for retransmission to individual receivers, and (b) the distribution of TV and other video bandwidth materials to schools, universities and hospital receiving installations. The type of satellite

contemplated for this service would be capable of producing EIRP in the range of 45-50 dBW. The technical constraints on sharing between this satellite service, and terrestrial Instructional Television Fixed Service systems in current use in North America have been explored in a document to be submitted by the U.S. to the Special Joint Meeting of CCIR Study Groups (Geneva, February 1971) which shows that even under worst case conditions no interference would be caused by the above described satellite to any terrestrial Instructional Television Fixed Service. Because the earth station reception equipment will be simple and very low cost, an allocation to the communications satellite service in this band could also provide important communication services of a demand assigned multiple access nature in many regions of the world where present communications are not highly developed. Directional antennas on the satellites will make it possible for different countries, and/or regions to share the same orbit and spectrum space, conceivable even from the same satellite. If this band of frequencies were used worldwide for educational and public service space systems, the benefits of present space technology in this band could accrue directly to many developing and progressive nations.<sup>41</sup>

Of particular interest here is the fact that a number of national delegations to the WARC were concerned with the development of satellite systems for developing countries and particularly for educational purposes.

#### Some Results of the WARC

At the Conference which was held in Geneva during June and July of 1971 over 700 delegates from 101 countries concerned themselves with the development of a new framework for the use of satellites in space telecommunications. Seven major committees were formed including those in the areas of technical matters, allocation, regulation, and editorial



matters. Working Groups and smaller sub-groups were established to facilitate the work of the conference. The input to the conference came from proposals submitted by member administrations and reports by the permanent bodies of the ITU. Of particular importance here was the CCIR report based on its Joint Special Meeting of January and February, 1971. There were over 400 documents in the main series at the conference in addition to numerous working documents and other papers. The output of the conference originated with the sub-groups and then proceeded to the working groups and the committees. Following this the materials were considered by the editorial committee and finally discussed by the conference in plenary session.

The final acts of the WARC were signed by the participating delegations and are now subject to approval by the members of the ITU. The final acts themselves vary greatly and relate to both technical regulations which will result in partial revision of the Radio Regulations as of 1 January 1973 which will be binding on members, and also resolutions and recommendations which do not have a binding nature.

#### Frequency Allocations

Concerning frequency allocations, the WARC provided for a number of allocations to various space radio-communication services. However, particular limitations and constraints concerning technical characteristics, notification, regis-

tration and coordination procedures circumscribed the allocation process. Further, footnotes were employed as a procedural device to modify certain frequency allocations. Since in any international conference there is bound to be some necessity for compromise, the results of the WARC cannot be judged solely from a technical point of view but must also be evaluated in terms of the conflicting interests that were present and the resultant negotiations.

The allocations of the WARC for television and radio to the fixed satellite service included both the point-to-point communication satellite service and the distribution satellite service. Further new allocations were made to the broadcasting satellite service. Subject to many of the constraints commented upon above the following frequency bands were allocated to the broadcasting satellite service:

MHz 470-890	Region 2	on a shared basis with
MHz 582-606	Region 1	other space services (fixed,
MHz 606-790	Region 1	mobile, radio-navigation).
MHz 710-942	Region 3	

In the range 2500-2690 MHz, the allocation was made for Regions 1 through 3 on a shared basis with the additional provision that the use of this band by the broadcasting satellite service is limited to domestic and regional systems for community reception, and that such use is subject to agreement among the administrations concerned. The same provisions were also adopted for the fixed satellite service in this band.

Additional allocations of interest are as follows:

GHz 11.7-12.5 Regions 1-3 on a shared basis (fixed, mobile, terrestrial broadcasting)

The above allocation was made with the provision that existing and future fixed, mobile and broadcasting services would not cause harmful interference to broadcasting satellite stations operating in accordance with the decisions of the appropriate broadcasting frequency assignment planning conference.

GHz 22.5-23 Region 3 on a shared basis

GHz 41-43 Regions 1-3 on an exclusive basis

GHz 84-86 Regions 1-3 on an exclusive basis

A detailed list of the allocations can be found by consulting the final acts of the WARC conference. One of the significant implications growing out of these frequency allocations is the increased interest shown by the representatives of the developing nations. As the technology develops, more and more national administrations are beginning to realize the potential of the broadcast satellite for educational and informational purposes, and therefore it becomes important to see that

as many nations as wish to can participate in satellite communication in an optimum fashion.

In addition to frequency allocation, technical regulatory provisions were considered at the WARC which concerned procedures for the determination of the coordination area around an earth station, and similar matters which can be found in the final acts of the WARC. These provisions are extremely complicated and require an extensive technical background on the part of the reader.

#### General Resolutions

On a more general level, the WARC was concerned with equality among nations in the use of frequency bands for space radio-communication services. A resolution was passed which should be of special interest to developing nations which are considering developing their own or regional systems, but have not yet begun. The problems of pre-emption of the frequency spectrum and the geostationary orbit had been raised a number of times at the WARC, and the following resolution was an attempt to allay the fears that had been expressed. The conference:

"Considering that all countries have equal rights in the use of both the radio frequencies allocated to various space radiocommunication services and the geostationary satellite orbit for these services;

Taking into account that the radio frequency spectrum and the geostationary orbit are limited natural resources and should be most effectively and economically used;

Resolves that the registration with the ITU of frequency assignments for space radiocommunication services and their use should not provide any permanent priorities for any individual country or groups of countries and should not create an obstacle to the establishment of space systems by other countries...."42

It is not as yet clear what impact this resolution will have on the launching and deployment of satellites for communication purposes, but it does indicate an awareness of the situation and an opinion that the allocation of frequencies and the utilization of orbital slots may not be a purely technical matter, but may have significant political and developmental facets.

The WARC also adopted a resolution dealing with the establishment of agreements and associated plans for the broadcasting-satellite service. In the operative paragraphs of this resolution it was stated:

"That stations in the broadcasting satellite service shall be established and operated in accordance with agreements and associated plans adopted by world or regional administrative conferences, as the case may be, in which all the administrations concerned and the administrations whose services are liable to be affected may participate;

That the Administrative Council be requested to examine as soon as possible the question of a world administrative conference, and/or regional administrative conferences as required, with a view to fixing suitable dates, places and agenda;

That during the period before the entry into force of such agreements and associated plans the administrations and the IFRB shall apply the procedure contained in Resolution No. Spa G." 43

The interim arrangements referred to in the preceding paragraph have been adopted and this means that satellite broadcasting systems can be established before any specific plans have been established. Since there was some controversy over the desirability of such plans, this is probably the best alternative.

One additional problem which was considered in detail by developing nations at the WARC was that concerning the possibility of the reception of unwanted satellite broadcasts. This is often referred to as the spillover problem. While it was beyond the competence of the ITU to be concerned with questions of problems content control and the political aspects of propaganda broadcasting, the WARC did produce a new regulation for inclusion in Article 7 of the Radio Regulations which states:

"In devising the characteristics of a broadcasting space station, all technical means available shall be used to reduce, to the maximum extent practicable, the radiation over the territory of other countries unless an agreement has been previously reached with such countries." 44

It is apparent that such a regulation will be effective only to the extent that there is no open hostility between the nations involved. Technological developments in the area of beam-shaping may also help to negate this problem.

There were also a number of definitions developed at the WARC which can be found in the final documents of the conference. There was general disagreement as to the adequacy of these definitions, and there were found to be inconsistencies with definitions that have been used by UNESCO and other international organizations. This area will require further study and negotiation at future conferences.

It is still much too early to assess the full value of the WARC, but it is apparent that there is international concern over the utilization by all nations of the space broadcasting potential and that this concern will be growing in the future. At the 1973 Plenipotentiary Conference of the ITU, many of the issues mentioned above will be discussed again in different forms and it would be desirable for all nations to devote some considerable time to preparing for this meeting.

## FOOTNOTES

<sup>1</sup>D. D. Smith, International Telecommunication Control (1969).

<sup>2</sup>"Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies," signed at Washington, London and Moscow January 27, 1967: T.I.A.S. No. 6347, Reprinted in 61 American Journal of International Law 644 (1967). Hereinafter referred to as "Outer Space Treaty."

<sup>3</sup>"Draft Convention on International Liability for Damage Caused by Space Objects," found in "Report of the Legal Subcommittee on the Work of its Tenth Session (7 June - 2 July 1971): Committee on the Peaceful Uses of Outer Space: Doc. No. A/AC. 105/95, 8 July 1971. Hereinafter referred to as the "Draft Convention."

<sup>4</sup>"Outer Space Treaty," supra note 2 at Art. VI.

<sup>5</sup>Id. at Art. VII.

<sup>6</sup>Id. at Art. VIII.

<sup>7</sup>"Draft Resolution on Liability for Damages Caused by Objects Launched into Outer Space, A/A.C./105/-C.L./L.8 at Art. III.

<sup>8</sup>Rylands v. Fletcher (1865), 3 H&C 774 159 Eng. Rep. 727; and 1968 L. R. 3 H. L. 330. The Soviet Union allows only the defenses of a force majeure or gross negligence of the victim to a charge of absolute liability. See P. Jessup and H. Taubenfeld, Controls for Outer Space 241 (1959). Conventions have imposed liability upon industries such as the airlines industry, without regard to fault. See Latchford, "Bearing of International Air Navigation Conventions on the Use of Outer Space," 53 American Journal of International Law 405 (1959), and Association of the Bar of the City of New York, Report on the Committee on Aeronautics on the Warsaw Convention as Amended by the Hague Protocol, 1959.

<sup>9</sup>M. McDougal et al., Studies in World Public Order 761 (1960).

<sup>10</sup>"Draft Convention," supra note 3 at Art. II.

<sup>11</sup>"Outer Space Treaty," supra note 2 at Art. VI.



<sup>12</sup>Id. at Art. XIII.

<sup>13</sup>Ibid.

<sup>14</sup>"Draft Code of Rules on the Exploration and Uses of Outer Space," David Davies Institute (1963). See also 29 Journal of Air Law and Commerce 141 (1963), and M. Cohen, Law and Politics in Space 163-4 (1964).

<sup>15</sup>See S. Shubber, "Jurisdiction over Crimes on Board Aircraft," Dissertation submitted for the Ph.D. degree at the University of Cambridge, at 252-53 (1968): D. P. O'Connell, International Law 112 (1965): Jennings, "International Law of the Air," 75 Recueil des Cours de l'Academie de Droit International 560 (1949).

<sup>16</sup>This suggestion has been made with reference to aircraft operated by the United Nations. I. Brownlie, Principles of Public International Law 352 (1966): See also Mankiewicz, "Aircraft Operated by International Operating Agencies," 31 Journal of Air Law and Commerce 319 (1965): Jannings, "International Civil Aviation and the Law," 22 British Year Book of International Law (1945): Latchford, "Bearing of International Air Navigation Conventions on the Use of Outer Space," 53 American Journal of International Law 405 (1959).

<sup>17</sup>See B. Cheng, The Law of International Air Transport 252-59 (1962).

<sup>18</sup>"Convention on International Civil Aviation (Chicago Convention, 1944) Cmd. 6614 (1945): UNTS 15, 295.

<sup>19</sup>"Report on Art. 77 of the Chicago Convention" (Doc. LC/SC, Art. 77/Rpt., June 24, 1965) ICAO Legal Committee; Subcommittee: "Report of the Panel of Experts on Art. 77 of the Chicago Convention," 27 Journal of American Law and Commerce 292 (1960): International Law Association, Helsinki Conf., Air Law Committee 246-286 (1966).

<sup>20</sup>"Convention on Offenses and Certain Other Acts Committed on Board Aircraft," signed at Tokyo, 14 September 1963, ICAO Doc. 8864.

<sup>21</sup>Id. at Art. 18. The basic grant of competency to exercise jurisdiction is found in Art. 3, para. 1 of the Convention and it refers only to the State of registration.

<sup>22</sup>"International Conference on Air Law," Tokyo, Aug. - Sept., 1963, I. Minutes, ICAO Doc. 8565-LC/152-1 at 68, para. 23. As to the possibility that an aircraft which is not registered in a State would be a "pirate" aircraft with no international rights, see Mankiewicz, supra note 14 at 304.

<sup>23</sup>Chicago Conv. supra note 16 at Art. 21.

<sup>24</sup>For a discussion of the various types of charter arrangements, see Shawcross and Beaumont, I Air Law 600-01 (3rd ed. 1966). See also Kean, "Interchange," 67 Journal of the Royal Aeronautical Society 514 (1963); J. W. F. Sundberg, Air Charter (1961); Goldklang, "Trans-Atlantic Charter Policy--A Study in Airlines Regulations," 28 Journal of Air Law and Commerce 99 (1961-62).

<sup>25</sup>"Draft Convention," supra note 3 at Art. XXII.

<sup>26</sup>Id. at Art. III. See also Art. IV if a third State is affected.

<sup>27</sup>Id. at Art. VI.

<sup>28</sup>Id. at Art. XIV. Articles XV through XX deal with the establishment and operations of the commission.

<sup>29</sup>Id. at Art. XII.

<sup>30</sup>"Draft Convention," supra note 3 at Art. XIX.

<sup>31</sup>Seventh Report by the International Telecommunication Union on Telecommunication and the Peaceful Uses of Outer Space (Geneva, 1968). These studies were pursued on the basis of texts adopted by the XI Plenary Assembly of the CCIR (Oslo, 1966).

<sup>32</sup>See Malek-Asghar, "The Mexico City Plan and the Future Interregional Telecommunication Network," 35 Telecommunication Journal 109 (1968); 35 Telecommunication Journal 3 (1968); The plan itself is contained in the ITU publication "General Plan for the Development of the Interregional Telecommunication Network, 1967-1970-1975," which replaces the Rome Plan publication, 1963 to 1968.

<sup>33</sup>The authorization for the World Plan Committee is found in Article 14, para. 199 of the ITC. Provision is also made in that article for referral to the Consultative Committees of questions pertaining to developing countries. See 35 Telecommunication Journal 3 (1968). The most recent meeting of the World Committee was held in Mexico in November 1967. 35 Telecommunication Journal 259 (1968). There is a World Plan meeting scheduled for September 1971 in Venice.

<sup>34</sup>Huszagh, "The International Law-Making Process: A Case Study of the International Regulation of Space Telecommunication," unpublished dissertation, University of Chicago, 84 (1964).

<sup>35</sup>ITC, Art. 13, paras. 165, 166, 167 and 168.

<sup>36</sup>Id. at Art. 13, paras. 169, 170, 171 and 172. The election procedure is to be established by the conference itself, but in such a way as to ensure equitable representation of the various parts of the world. Id. at Art. 13, para. 173.

<sup>37</sup>Id. at Art. 13, para. 185.

<sup>38</sup>Cota, "The International Telecommunication Union as a Regulatory Body," 28 Telecommunication Journal 340 (1961).

<sup>39</sup>For example, the International Broadcasting and Television Organization, the European Broadcasting Organization, Inter-Union Committee for the Allocation of Frequencies, and specialized organs such as Interpol and the International Radio-Maritime Committee.

<sup>40</sup>U. S. Department of Health, Education and Welfare. "In the Matter of an Inquiry Relating to Preparation for a World Radio Conference of the International Telecommunication Union on Matters Pertaining to the Radio Astronomy and Space Service Before the Commission." Federal Communications Commission, Docket No. 18294. Washington, D. C. 23 September 1970, 10.

<sup>41</sup>U. S. Department of State. "Proposals of the United States of America for the World Administrative Radio Conference for Space Telecommunications (Geneva, 1971)." Washington, D. C. December 1970, 8-9.

<sup>42</sup>Resolution Spa D, "Relating to the Use by All Countries, with Equal Rights, of Frequency Bands for Space Radiocommunication Services," WARC, June-July, 1971, Geneva.

<sup>43</sup>Resolution Spa F, "Relating to the Establishment of Agreements and Associated Plans for the Broadcasting-Satellite Service," WARC.

<sup>44</sup>Reg. 428A for inclusion in Article 7 of the ITU Radio Regulations. For a consideration of this problem, see also the reports of the U.N. Working Group on Direct Broadcast Satellites.

## X

## THE INTERCULTURAL IMPLICATIONS OF SATELLITE COMMUNICATION

It is apparent that satellite communication by eliminating distance as a factor in communication costs will affect peoples of various cultural backgrounds. It is possible that mutual knowledge and understanding will be enhanced through the use of satellite communication. However, it is also possible that "cultural pollution" may result from the indiscriminate exchange of programming and a large influx of foreign programming. All forms of broadcasting have problems related to foreign programming, and thus it would seem most desirable to dwell on the positive impact to be made from intercultural satellite broadcasting.<sup>1</sup>

Regional broadcasting unions such as the Asian Broadcasting Union, the European Broadcasting Union, the International Radio and Television Organization and Intervision are concerned with program interchange as are the United States broadcasting systems and the Canadian Broadcasting Corporation among national systems. The work of these organizations is extensive and their activities have recently been the subject of a survey on program exchanges carried out by the UNESCO Secretariat between February and June 1971.<sup>2</sup> It is hoped that an analysis of the statistics on cultural exchanges will be available in the near future.

What is of particular interest here are the implications for satellite broadcasting. That there are implications is

made clear by United Nations General Assembly Resolution 2733 (XXV) adopted on 22 January 1971 which recommended that:

Member States, regional and international organizations, including broadcasting associations, should promote and encourage international cooperation on regional and other levels in order, inter alia, to allow all participating parties to share in the establishment and operation of regional satellite broadcasting services and/or in programme planning and production.<sup>3</sup>

UNESCO, also was invited to

continue to promote the use of satellite broadcasting for the advancement of education and training, science and culture and, in consultation with appropriate intergovernmental and non-governmental organizations and broadcasting associations, to direct its efforts toward the solution of problems falling within its mandate.<sup>4</sup>

The intercultural implications of satellite broadcasting are clearly within the UNESCO mandate. To this end work is presently being undertaken on a Draft Declaration on the Guiding Principles for the Use of Space Communication for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange. This is not to be a binding legal document but rather a statement of principle for the international community. In the area of cultural exchange, the following draft provisions are of interest.

#### Article X (Draft)

The objectives of the use and development of space communication for cultural exchange are to provide for the intensification of exchanges covering intellectual and creative activities and all aspects of cultural life. Such exchanges should take full account of the opportunities offered by space communication to permit audiences to enjoy simul-

taneously, on an unprecedented scale, theatrical, musical and other artistic performances as well as festivals, contests and similar events.<sup>5</sup>

Article XI (Draft)

Cultural programmes shall, while promoting the enrichment of all cultures through their beneficent action, respect the distinctive character, the value and the dignity of each culture. Programmes must recognize the right of all countries to preserve their culture as part of the common heritage of mankind.<sup>6</sup>

While the general statement of draft Article X will readily be accepted as a statement of objectives, more emphasis should be placed on draft Article XI which speaks to the intercultural problem. It is imperative that while one is furthering international program exchange, one is also conscious of the integrity of individual cultures. This double use of the word "culture" is important if the full potential of satellite broadcasting is to be realized. For the satellite will not only be used as a transmission means for nationally produced programs, it will also be used for regionally produced programs developed under co-production techniques. There will be shared programming in the fullest sense of the word.

When this occurs it will be important for cultural differences to be treated as real and not as superficial differences which are not significant.<sup>7</sup> The realization of these differences can prove to be one of the strengths of satellite broadcasting, since it will encourage research into the macrosociology of human inter-relationships.

Another drawback is that our present sociology has the tendency to exhaust its potentialities in micro research and theory, while present day anthropology has not yet really been able to switch from the study and theory of small and usually primitive communities and cultures to the social and cultural problems of modern man the world over. Thus the large overall social and cultural problems of the modern world are left untouched, or are given up to politicians and political scientists, whose first concern is power relationships.<sup>8</sup>

The basic similarity of the elements of human culture must be examined and seen as different configurations of the same basic elements and capacities of the human mind within the context of the necessary differences. There is a need to realize that various disciplines must be brought into play if a comprehensive satellite broadcasting system is to be created.

We cannot enter into education via satellite on the naive assumption that it can be more of the same but with broader dissemination and consumption - that is, merely an extension of what we do now via mass media. We have to create a new technology of intercultural teaching and learning to make the technology of satellite communications work in education. To do this we need the active help and participation of a great many people inside and outside of education and the scholarly disciplines. We need, furthermore, the participation of humanists who will help to frame objectives and purposes compatible with man's needs and wants.<sup>9</sup>

The interdisciplinary approach to satellite broadcasting development is necessary if we are to take into consideration cultural differences and requirements. The communication between teacher and learner can take place at a distance through an effective satellite communication system. However, teaching and learning are discrete acts and both must be

successful if the experience is to be complete, and therefore it becomes necessary to consider the intercultural learning experience.

Many studies will need to be done on the learning experience which is accomplished via satellite transmissions. The results of these studies will then aid in the development of the future technology and also in the improvement of our means of intercultural communication.

#### Intercultural Satellite Experimentation

There are two preliminary studies<sup>10</sup> which have been undertaken that have to do with the effects of satellite voice communication between people of different ethnic and cultural backgrounds. One of the issues raised is whether these people can create a viable learning context which would enable an effective interchange of cognitive and affective messages. The satellite used was ATS-1 and the transmitters and receivers were located on the Honolulu campus on the island of Oahu and the Hilo campus which is three hundred miles away. The twenty-four students on the Hilo campus were primarily Orientals and a few Caucasians, and the thirty students on the Honolulu campus were from Cambodia, Malaysia, Vietnam, Alaska, Hawaii, the Philippines and the United States. There were twelve interchanges, each preceded by a briefing session by the instructor. Six types of inter-personal communication were included: basic intelligibility, giving directions, communicating affects, problem solving, information gain, and prediction of attitudes toward controversial problems.



An attempt was made to explore the extent to which non-verbal information could be communicated by voice alone.

Affective information was defined operationally in several ways: by the intended message of the source and the received message of the respondent in reference to three categories - regard, sincerity, and status. Dichotomous choices were available for each category. For the category of regard, the intended message or received message could be evaluated as "he likes me, he does not like me;" for sincerity, "he is serious, he is not serious," and for status, "he is my superordinate, he is my subordinate."<sup>11</sup>

The performance under this limited experiment indicated that the performance of the groups using the satellite did not differ significantly from the performance of the face-to-face groups.<sup>12</sup> There were mixed results when formal instruction by satellite was attempted with one satellite group doing better and one face-to-face doing better in separate experiments. Since different course material was used in each case these results remain inconclusive. One of the conclusions drawn by the investigator was that considerable pre-planning was necessary in order to make a satellite interchange worthwhile.

The students in Hilo and Honolulu came to know one another and were able to work together. They were able to give and receive formal instruction, communicate feelings, and predict attitudes. It seems that voice and facsimile transmission enable the creation of learning contexts among people of different ethnic and cultural backgrounds even though they may be widely separated by space.<sup>13</sup>

A second study involved native speakers of English in communication with non-native speakers of English via satellite and defined this arrangement as an intercultural

dyad. The compatibility between speakers was measured by reference to the degree of agreement or disagreement between the communicator's perception of five criterion: co-communicator's communication effectiveness, success of outcome, comfortableness of communication environment, co-communicator's speech rate and leadership development. The purpose of the study was outlined as follows:

- 1) to measure performance of intercultural dyads in face-to-face and two-way voice communication by satellite by the number of correctly matched marks in a task which involves drawing abstract figures.
- 2) to measure performance in internally and externally task structure by the number of correctly matched marks in a task which involves drawing abstract figures.
- 3) to measure compatibility by the degree of similarity between communicator's responses and co-communicator's responses on a simple post questionnaire form.<sup>14</sup>

There were thirty-two communicators, sixteen from each of the two locations. Of the sixteen, eight spoke English and eight were non-native speakers of English. Each participated in an intercultural face-to-face session and also in an intercultural satellite session. The scores from these two sessions were compared utilizing the t test and rho. Preliminary results indicated that the tasks were accomplished better in the face-to-face situation; that for the satellite segment there was no differentiation between an externally and internally structured session, and that visual feedback in these situations was important. The utilization of a satellite link with a video capability will no doubt alter these preliminary findings.

There were also differences in the findings between the two studies indicating that all of the variables had possibly not been isolated and that more work needed to be done. It must be remembered that these studies were done with an audio link only and that television will greatly alter these findings. The significance of this work lies in the fact that intercultural research is being undertaken which will help in easing cultural differences.

### Intercultural Understanding

In essence the satellite will allow for a broader understanding of various cultures which brings with it an educational component.

The rapid progress achieved recently in space technology and electronics is putting means of satisfying the most urgent demands within reach. The satellite has an extraordinary capacity for uninterrupted distribution of all kinds of information, and cost, in contrast to other means of distribution, becomes less as the territory it covers increases. To solve problems on sub-regional, regional, or international levels it is called upon to play an important role in the future. Thus we have arrived at potentially the most productive of the space systems - a social system with a satellite as one of its characteristic elements.<sup>15</sup>

To the extent that effective satellite communication leads to a proclivity to adopt innovations, national development, education and cultural exchange are benefited.

The example of South America is an interesting one in terms of cultural imperatives. While it is stated by Tabanera of Argentina that implementation of a satellite system will require unprecedented cooperation in Latin America, he also realizes that customs and ideas must be protected. It is his

opinion that other customs and ideas can be learned and appreciated without constituting an obstacle to cooperation, and that different cultures should enrich rather than threaten each other. Nevertheless he notes that it is essential that any satellite system be run by Latin America.

Generally in Latin America there is a realization that social engineering is a significant part of satellite technological development. The use of the mass media in making creative use of leisure time coupled with a massive educational program could greatly benefit Latin America. There is an understanding that "adapting to the demands of the new technology is not the same thing as adapting the technology and its products to the needs of society or of particular individuals."<sup>17</sup> It is further recognized that:

Achieving physical well-being with ever better mechanical and scientific slaves at our service in exchange for regimentation and uniformity of men does not seem a good trade. Neither does freeing ourselves from the forces and pressures of nature in exchange for submission to the artificial surroundings we have created appear very attractive.<sup>18</sup>

It is through the use of socio-technology that we will be able to reduce the gap between the developed and the developing nations. This application of technology will produce numerous rewards, and will provide for progress which genuinely improves mankind.

Progress should benefit the whole man and not just the technician; it should be at the service of the human person and society. While the sociologist and politician meditate on their solutions, the educator should adopt revolutionary criteria for

the preparation of the human material of the future. Above all he should take the best products of the techno-scientific evolution and learn to use them rapidly and efficiently.<sup>19</sup>

Identifying the role of the educator becomes a crucial task in the development of satellite systems given the existence of cultural differences and cultural sensitivities. Even within national boundaries there will be a need to train the users of satellite programs.

Strategies for overcoming these information problems, then, will be all-important. Without them we will almost be forced to say, echoing Gorgias, that educational satellites do not exist, if they did exist we would not know how to use them, and if we learned a way of using them we would not be able to communicate the knowledge.<sup>20</sup>

The use of satellites for education and national development purposes must be viewed within a humanistic definition of the word "development." In one sense development can mean the need for conglomeration to permit industrialization. It can also mean an evolution toward a more human condition for man. Tabanera is of the opinion that satellite television will make an indispensable contribution toward decentralization which will avoid the "great city" of the future, and will allow for the rural man to be integrated into megalopolis without undue detriments.<sup>21</sup> If one accepts the proposition that the distances that exist between men and between populations are above all a function of a peoples' store of knowledge and preparation for life and that everything else is secondary and dependent on this basic informational function, then satellite development takes on critical importance.

Commercial television has been able, in a relatively short period of time, to radically alter existing social, cultural and moral structures. Satellite television for educational, cultural and national development purposes could also have this effect if it is developed properly. Numerous social goals can be furthered by recourse to satellite broadcasting.

It can be:

- A. A means to offer the benefits of education to the entire populace of a country equally, without regard to wealth, social class, race or other factors. This will aid in the development of the economically or geographically less advantaged.
- B. A means to develop campaigns to further regional and/or national goals.
- C. A means of rapid mobilization in times of crisis or disaster.
- D. A means to provide services for specialized groups such as doctors, engineers, teachers, etc.

In order for these goals to be reached, however, it is essential that all countries that may eventually be involved should take part in the planning discussions. As long as distribution satellites are used it will be possible for individual countries to veto what programming is made available in their countries. Prior agreement between the countries involved in satellite broadcasting can solve many of the cultural imperialism arguments that might arise. Direct broadcasting satellites will present different problems in this area and it is incumbent on the international educational community to study these implications.

The method used to produce the software for a satellite system can play a large part in alleviating cultural problems between nations. The strategies for innovation that are decided upon here are an important part of a satellite system development program. Dieuzeide has identified three strategies:

The first is to change everything at the same time, but so far there has been no instance of this having been done anywhere. The second one involves modifying the existing state of affairs by introducing innovation at the lowest level in the system and carrying on from there, the new system pushing the old one in front of it; such is the case with the gradual introduction of television, year by year, involving, in the case of the Ivory Coast, the transformation of primary education and, in the case of El Salvador, of secondary education. The third strategy involves setting up and developing a new system parallel to the old one and capable of replacing it one day; such is the case, for example, of educational television for elementary schools in Niger, or at another level, of the Open University in the United Kingdom.<sup>22</sup>

The second and third strategy are the most likely ones for educational satellite development, with the possibility that the third one will become the most popular. The means one selects to produce the necessary software will to some extent determine which strategy is decided upon. Seven tactical approaches have been identified for the production of software which bear on this situation:

- (a) It may be possible to agree an international curriculum and so to produce teaching materials that will fit it. The development of the international baccalaureate may offer an appropriate framework within which to experiment.
- (b) Even without a common curriculum it is possible to identify common elements in differing syllabuses even from different educational systems.

It may be useful both in itself, and as a way of working toward international co-operation more generally to make materials designed to fit into a number of different national curricula.

- (c) For these and for many other teaching materials it will obviously make sense to go for a modular form of construction, so that each learning 'package' is made up of separate elements which can be used separately, or in various different combinations. In this way the user can pick and choose which parts of an educational series to use and can reorganise them in his own way as he wishes.
- (d) Whether materials are in a modular form or not, it is essential that they should offer scope for local change and adaptation.
- (e) So far we have assumed that teaching materials will be prepared internationally - either by an international team or by a national team with an eye on international needs. But increasingly teaching materials recorded on film, television and tape are becoming available in many countries. The advent of videocassettes will make them more readily and widely available. Alongside a programme of international co-production we also need a series of experiments to see how far locally produced materials designed originally for local needs can also be used internationally.
- (f) There is a case for beginning experiments in higher education. For while the needs of higher education are perhaps not as dramatic as other educational needs, they are important enough. In higher education there is already, in some sense, a single world community of scholarship; scholars already feel that they belong to an international community with common subject interests to which national frontiers are not a barrier. It may be possible to benefit from this feeling of kinship in designing the early international experiments in co-production and in the use of each others' teaching materials.
- (g) Finally, it has been suggested that it will make sense to begin co-operation in those subject areas which cause least controversy. In theory it should be easier to begin with mathematics and the physical sciences than with the social sciences



or history. But there will be important exceptions to this rule. In higher education, for example, there is a case for beginning with comparative studies where the differences in approach are the key to the success of the exchange. Nor will it be all that easy to define non-controversial subject areas: anyone who has listened to arguments about curriculum development, even in a subject like mathematics, may need a lot of convincing that this is a field on which agreement among educators is necessarily easy.<sup>23</sup>

No matter which tactical approach is used it will be necessary to conduct a series of experiments, demonstrations and simulations. While a number of these have already been conducted, there remains the task of preparing future experimental research designs. Within these research designs there are a number of factors that need to be considered from an intercultural point of view.

One primary assumption is that there is a need for people to have more knowledge of cultures other than their own coupled with a fuller awareness of their own culture. Thus satellite system development should attempt to motivate people to increase their awareness by providing mechanisms whereby a motivated person can gain knowledge of other cultures. It will also be necessary to promote innovations in education and the mass media essential to the implanting of knowledge of other cultures. Since it will not be possible for one group to provide all of the central direction that is necessary, a pluralistic approach must be adopted UNESCO, perhaps, as the coordinator. In this area it will be necessary to maintain

information pools on each major culture, provide advisory services to organizations with similar goals, provide the services of scholars to government, corporations and foundations for the review of proposals for intercultural educational programs, and cooperate with schools, colleges, and universities in establishing and maintaining programs of intercultural studies. UNESCO is serving in this capacity by preparing their directory of satellite research and experimentation and making this available to interested parties.<sup>24</sup> National satellite organizations are also assisting in this task by publishing bibliographies which assist scholars the world over in developing their own expertise in satellite-related areas.<sup>25</sup>

Cooperation in this area will only be furthered if efforts are made to communicate the amassed knowledge that exists about different cultures. The operation of experimental and demonstration programs in multi-cultural education together with experimentation in the transmission of information between individuals about cultures would be desirable. Information could be prepared for teachers that would be used at every level of education and advisory services could be suggested to solve intercultural problems. In essence it is necessary to motivate people to seek the solution to intercultural problems and to gain an understanding of cultural differences.<sup>26</sup> The satellite can provide a mass communication device for accomplishing this goal. The success of its use will depend on the skill of the people involved with the initial planning and development.

## FOOTNOTES

1. For further information on this point the reader is referred to a UNESCO study which has been commissioned on the social and cultural impact of satellite based television and the problems that might be foreseen during the phase of satellite broadcasting direct to individual home receivers.
2. See Tor Gjesdal, "International Professional Cooperation Between Broadcasting Organizations," Paper prepared for the UNESCO Meeting of Experts on International Professional Cooperation Between Broadcasting Organizations," Paris, 5-8 October 1971.
3. U.N.G.A. Res. 2733 (XXV) 22 January 1971.
4. Ibid.
5. First Draft of Declaration on the Guiding Principles for the Use of Space Communication for the Free Flow of Information, the Spread of Education and Greater Cultural Exchange. COM-71/CONF. 5/4 Add. 1, Paris, 8 September, 1971, at 5.
6. Ibid.
7. Edward T. Hall, "Listening Behavior: Some Cultural Differences," Occasional Paper No. 2 The Bridge, March 1970.
8. S. Takdir Alisjahbana, "The Promotion of Understanding Among People," Occasional Paper No. 1. The Bridge, November 1969, at 8.
9. C.A. Wedemeyer, "The Next Frontier: Potentials and Problems of International-Intercultural Education Via Satellite," Paper presented January 9, 1969 at the University of Wisconsin.
10. These experiments were carried on by the University of Hawaii in conjunction with the Pan Pacific Education and Communication Satellite Program. See Sec. III of this work.
11. Elizabeth Kunimoto, "Speech-Communication Instruction by Satellite," Paper presented to the National Convention of the Speech Communication Association, December 28, 1971, San Francisco, California, at 4.
12. Ibid.

13. Id. at 7.
14. Sherry Nadai, "Performance of Native and Non-Native Speakers of English by Face-to-Face and Two-way Voice Communication by Satellite," Paper presented to the National Convention of the Speech Communication Association, December 28, 1971, San Francisco, California, at 3.
15. Teofilo M. Tabanera, Satellites and Education (1971) at Ch. II, sec. 7, p3 [translated from Spanish].
16. Id. at Chap. XV.
17. Id. at 4.
18. Ibid.
19. Id. at 7.
20. H.D. Perraton, "Education and Satellites, Third World Possibilities," at 13 (1971), a Report prepared for the Commission Française pour l'UNESCO and based on the International Meeting of Experts called by them in Nice, France, 4-8 May 1971.
21. Tabanera, op. cit. not 15 at 14.
22. UNESCO, Communication in the Space Age (Paris 1968) at 71.
23. Perraton, op. cit. note 20 at 15-16.
24. For further information on this project contact E. Lloyd Sommerlad, Office of Free Flow of Information and International Exchanges, UNESCO, Paris.
25. The EDSAT Center of the University of Wisconsin has published the following bibliographies: The Educational and Social Use of Communications Satellites, A Bibliography (May 1970); Teleconferencing, A Bibliography (February 1971); Legal and Political Aspects of Satellite Telecommunications, An Annotated Bibliography (June 1971).
26. One group, The Bridge: A Center for the Advancement of Intercultural Studies, has for its purpose the development of programs and projects which will enhance and increase intercultural understanding.

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