AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY
Education

B. SECONDARY
Technology

2. TITLE AND SUBTITLE
Broadcast satellites for educational development: the experiments in Brazil, India, and the U.S.

3. AUTHOR(S)
Cowlan,Bert; Jamison,D.T.; Polcyn,K.A.; Singh,J.P.; Smith,Delbert; Wolff,Laurence

4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1973	309p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
Academy for Educational Development
1414 22nd St. N.W.
Washington, D.C. 20037

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
Report No. 5

9. ABSTRACT
Pre-experiment case studies which document the experiment planning activities, intentions, purposes and objectives and decision points for three satellite communication situations: Federation of Rocky Mountain States (U.S.A.) ATS-F; Indian Satellite Instructional Television Experiment; and Brazilian Project SATI experiment. These were chosen because in each case existing communications systems are limited and the areas are remote. Emphasis is upon methodology and problems of planning. Some key questions are posed about multiple management as compared with control by a single entity, the effect of frequent changes of goals, priorities, and kinds and levels of technology; the mixture of personnel on many levels--political technological, managerial and educational. "Clearly, the stormier aspects (of planning) indicate the need for all those concerned to define and agree upon the goals, objectives, and scale of such an experiment at the outset".

10. CONTROL NUMBER
PN-AAB-291

11. PRICE OF DOCUMENT

12. DESCRIPTORS

13. PROJECT NUMBER

14. CONTRACT NUMBER
CSD-2825 GTS

15. TYPE OF DOCUMENT

AID 590-1 (6-72)

AED

ACADEMY FOR EDUCATIONAL DEVELOPMENT

Broadcast Satellites for Educational Development: The Experiments in Brazil, India, and the United States

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Report Number Five
1973

This report has been prepared by the Academy for Educational Development under Contract No. AID/csd-2829 for the Office of Education and Human Resources, Bureau for Technical Assistance, Agency for International Development.

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Each of the Case Studies contains an individual Table of Contents.

BROADCAST SATELLITES FOR DEVELOPMENT: THE EXPERIMENTS IN INDIA, THE ROCKY MOUNTAIN STATES AND BRAZIL

Progress implies improvement....development, on the other hand, is a neutral concept, not teleologic; it means growth, expansion, wealth, but one might debate whether that is progress, that is, if any development implies a true improvement in man and his condition. In practice, it is true, no distinction is really made; one takes for granted that to develop means to improve, to progress; but the fact that the more realistic, cautious term of "development" is becoming more popu lar than the more confident and optimistic 'progress' may be a semantic indication of man's state of mind today.[1]

We are accustomed to speaking of 'developing countries' in just such a tone which suggests the caution, the planning, and the objectivity embodied in "development." As our base of experience widens we come to understand the limits of enthusiasm, of perspective and change so often cloaking a conceptual "progress." The developing country indeed is in an excellent position to observe firsthand the dichotomy of progress and development, as it is itself often a testbed for those ideas, practices, and programs which are to lead toward an ephemeral progress. The new technology which is the subject of this report, communications satellites may be yet another test for developing nations: it holds exciting possibilities as can exist today yet its capacities for abuse and ineffectual use are great. On the one hand satellites offer many countries an opportunity to quickly implement a media system to reach huge quantities of people with virtually any kind of information while on the other hand, the design and establishment of such a system can hold many windfalls. The development of a satellite system may or may not

invoke progress. It is for this reason that the following report was written. Intending to inform, to provoke ideas and considerations, this work will not project impossible dreams. Rather it will suggest what is being done with satellites now and what the future holds for them, particularly with respect to developing countries. No matter what brand of progress the satellites may contribute, their development is certain. It is left to the leaders, educators, innovators of today to inform that development of affirmative progress.

Over the past twenty years a new 'ascendency' index has been identified: it concerns the use and development of communications. Communications may well constitute what some later day historian will call the third great technological revolution, after the development of agriculture and then the industrialization process which began in the nineteenth century. "How the third technological revolution will shape our ends is still far from clear, but its nature and substance are already becoming familiar. The industrial revolution was concerned with the production and distribution of goods; its technology was that of the steam engine, the spinning jenny and the

blast furnace. The post industrial revolution is concerned with the production and distribution of information; its technology is that of computers and communications."[2] Where the previous technological advance replaced much human labor time and more efficiently worked natural resources into manufactured goods, the recent computer/communications innovations advance our knowledge and access to information. And like the two previous major 'revolutions' the coming technetronic age will produce (and is producing already) its own set of parameters for our relationships -- economic, social, political, cultural -- with an 'expanded global reality'.[3] However, as the pace of scientific innovation quickens so also the problems associated with it multiply. Specifically, in a world of bits and pieces struggling for economic success, development, education, a certain way of life -- in a word, a certain ascendency -- the impact and application of a new technology becomes difficult to gauge.

To a large extent the vision of a technologically advanced present and future is now limited to the already 'developed' countries -- the United States, Canada, the United Kingdom, much of Europe, the USSR and Japan and a few others. Most African, Asian and Latin American

nations fall victim to quite another vision: the accomplishments of the major powers loom large as ideals or goals while at the same time the historical forces goading the requisite technology have not touched every country equally. The desire for advanced country standing on the part of the developing nations presents a situation wherein the major powers occupying the fulcrum from which advanced technology and information can be disseminated to the recipient less developed countries are integral factors influencing international development. This has been the case so far with respect to industrialization. Emerging over the last two decades as a technology which could be important to the developing countries, industrialization has been elevated to paramount importance. The same is now being recognized for the communications field. In particular, a possibly very useful, possibly very hazardous instrument is now unfolding: communication satellites. They may help to unlock a very different world for all peoples, a world in which instantaneous contact among individuals is only the most superficial, least subtle aspect. In facilitating broadcasting they can offer the services of an improved information flow, not only for the classroom but for the purposes of natural disaster warning, health and hygiene information,

weather forecasts, agricultural advice, newscasting, and other data delivery. It is this innovation which may, through transfer of advanced country expertise, fulfill some of the development hopes of less developed countries. This possibility is the basic subject of the following document.

The use in particular of communication satellites by less developed countries presents several interesting considerations. Basic to any discussion is a recognition first of the difficulties characterizing interactions of technology transfer with respect to cultural relationships. Naturally the existing gaps between the already developed and developing countries can camouflage one's understanding of the other. For example the establishment of economic growth in portions of Latin America has been more or less patterned on the process of industrialization which was so successful in the United States. However, in some nations a rapid industrialization move evidenced devasting repercussions: population movement from rural poverty areas into cities where a would-be lucrative labor market could not absorb increased manpower; decreased crop production and a weakened subsistence food base; massive unemployment. One writer notes, "To a very large extent, the serious unemployment and underemployment that characterizes the

less-developed nations of South America today is due to an indiscriminate application of production techniques which have been developed in and for the economic, social and cultural context of highly industrialized nations, where skill levels are high and labor tends to be scarce."[4] This object lesson substantiates the need for very careful planning for any sort of technology transfer from advanced to less developed nations. The very gap which separates the two implies a gap in planning frameworks. Hence the application of new communications afforded by satellites may also be filled with relatively unpredictable variables or effects. "As our technological capacity grows, the existing potentialities of telecommunications 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 telecommunications 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."[5]

Therefore it may be that models of existing or planned satellite technology experiments and uses may help to bring the beneficial knowledge to both developing and

already developed countries. Specifically those satellite experiments which are to address geographic areas representing the problems somewhat characteristic of developing countries can be helpful. By keeping a record of such experiments' progress we may begin to better comprehend the convolutions of planning and implementing a communications satellite system. Out of such considerations the National Aeronautics and Space Administration has designed over the past few years some of its communications satellite experiments with future operational constraints and possibilities in mind. In particular the Applications Technology Satellite (ATS) series including the imminent ATS-F, and the joint United States/Canada Communications Technology Satellite (CTS) programs propose to bring more "users" into contact with satellites. It is hoped that the experience gained from these experimental programs will lead to carefully planned, socially useful and economically viable satellite programs during the coming post-experiment years. One of the most logical methods to glean valuable and applicable knowledge is of course to study the NASA/user experiments from the planning stages through to the final evaluation.

Hence the decision was made to chronicle three user-oriented experiment plans for the ATS-F project. The following case

studies on the Federation of Rocky Mountain States (FRMS) ATS-F experiment and the Indian Satellite Instructional Television Experiment (SITE) and the Brazilian Project SACI experiment are intended not as primers in the technology but rather as guidepost references; as pre-experiment documents they are useful in documenting the experiment planning activities, the intentions, the purposes and objectives, and the decision points. The choice of these particular satellite experiments is not accidental. The problems communication technology can address in India or in the Rocky Mountain or Brazil areas are general, developmental problems: education, population control, economic productivity. In both cases the existing communications system is limited and the deprived area rather remote. Many developing countries present similar pictures. Hence some of the planning considerations for both ATS-F projects may be illustrative to other nations. Finally, since the studies have been performed at an early stage of the experiments their usefulness may be augmented by future updated studies whereby a more total picture of both projects may be sketched via comparison. If this report can create for developing countries some sense of the methodology and the problems entering into the project plans it will be successful.

NOTES

1. Juan Villaverde, "Green Revolution," Americas, March 1972, p. 11.

2. Instant World: A Report on Telecommunications in Canada Ottawa, Queen's Printer, 1971, p. 25.

3. Zbigniew Bzezinski, Between Two Ages, Viking Press, New York, 1970.

4. David A. Morse, "Unemployment: Bitter Burden of Millions in South America," Focus, February, 1973, p. 4.

5. Delbert D. Smith, Satellite Applications for Education, Culture and Development, UNESCO, 1973, p. 25.

THE BRAZILIAN EDUCATIONAL SATELLITE

Academy for Educational Development

November 12, 1973

(This study was prepared by Laurence Wolff on the basis of reports by Colin J. Warren; Kenneth A. Polcyn, Douglass P. Starr, and Charles H. Adair; and Mary Anne Cusack.)

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I. INTRODUCTION

This case study describes the activities and plans of the Brazilian government related to the use of an educational satellite expected to be launched in 1976. The study emphasizes an experiment in the use of educational technology now taking place in the state of Rio Grande do Norte, which is designed to prepare for nationwide usage of the satellite.

Since the purpose of the satellite is to improve Brazilian education, Section II gives a short overview of the Brazilian educational system. Section III describes Brazil's overall plans for an educational satellite, while Section IV describes in detail the experiment in Rio Grande do Norte.

The following reports formed the basis for this case study, and the work of their authors is gratefully acknowledged here:

"Education and Telecommunications in Brazil: Some Cost and Policy Considerations," by Colin J. Warren, in "Technical-Economic Considerations in Public Service Broadcast Communications for Developing Countries," by Robert C. Butman, George W. Rathjens, and Colin J. Warren, Academy for Educational Development, Washington, D. C., 1973.

"Planning National Information Distribution Systems for Education: Some Predeployment Considerations," (draft) by Kenneth A. Polcyn, Douglas P. Starr, and Charles H. Adair, Academy for Educational Development, Washington, D. C., 1972.

"The Systems Approach to Satellite Education in Brazil," by Mary Anne Cusack, in "Final Report, Innotech Regional Seminar on Approaches to Effective and Economical Delivery of Mass Primary Education, Singapore, 19-23 February 1973," Seameo Regional Innotech Center, Singapore, 1973.

II. EDUCATION IN BRAZIL

Brazil is the largest nation of Latin American in population, with an estimated 100,000,000 inhabitants in 1972, and in size, with an area almost as great as that of the United States. Brazil's land varies from the tropical and heavily forested Amazon region to arid, near desert to the fertile, semi-tropical south. Except for some 200,000 Indians nearly all Brazilians speak Portuguese.

While Brazil is among the poorer nations of the world, its economy has been advancing rapidly in the last few years. This growth has been unequal. The southern states, especially São Paulo, are rapidly industrializing, while the northeast is still one of the poorest parts of the continent and the Amazon region is still one of virgin forest and very low population.

Brazilian education also varies greatly in its quantity and quality. Overall, 68.2% of the school-aged population 7-14 years old was enrolled in school in 1970. The enrollment deficit for this age group for grades 1-8 was approximately 6.1 million. 26.4% of school-age population was enrolled in the secondary school and 5.1% at the university level.[1] Illiteracy in 1969 was estimated at 29.2% of the population above the age of 14.[2]

Attesting to the inefficiency of the educational system are the high failure rates, the large number of pupils who leave school immediately after enrolling in a grade and others who drop-out during the school year. The first grade presents a major obstacle to the primary school child. In 1968 only 37.4% of first graders went on to second grade the following year. 32.3% dropped out and 30.3% repeated the first grade.[3]

The magnitude of educational problems is greatest in the northeast; almost 30% of the population reside there and the educational system is least developed there. The northeast has the highest rates of illiteracy: 47.9% in 1969.[4]

The sparsely settled north and central west also have very weak educational systems. These areas comprise 64% of the national land area but only 9% of the population.[5] The Brazilian government's policy is to develop these areas through improvement of transportation and infrastructure and through migration from more populated areas of the country.

The urban/rural dichotomy in education should also be noted. Primary school enrollment per unit population is much lower in rural than in urban areas, and drop-out and repetition rates are higher. Most rural schools consist of one room which accommodates all four grades, if, indeed, the school has four grades. In 1970 only 63% of Brazil's primary school teachers had completed a teacher-training course equivalent to a high school level education.[6] The large numbers of poorly qualified and unqualified teachers, some of whom have incomplete primary level education, are concentrated mainly in the rural areas. Nearly all secondary schools are located in urban areas.

The low productivity of the educational system is due to two sets of causes:

Those intrinsic to the school system: lack of sufficiently trained teachers; short school hours; inadequate curricula (divorced from local needs, especially in the rural areas); poor installations (one room schools with mixed-grade classes); lack of teaching materials; lack of teaching standards; overambitious schedules; irrelevant and highly selective promotion criteria.

Those extrinsic to the school system: individual characteristics of the pupils (levels of mental and physical health); economic standing of the family (forcing the young to work, particularly in rural areas); lack of resources to buy food, clothing, school books, etc.; surroundings unfavorable to study; difficulty of access to the schools.

This low productivity means that Brazilian schools continue to produce adults who cannot read and who have little or no knowledge of modern health, agricultural and industrial practices. In turn, these adults are unable to provide their children with the home background necessary for school success.

In 1971 the Brazilian government reformed the structure of elementary and secondary education. The structure of the pre-reform educational system is still mostly intact and is expected to change only gradually. In the pre-reform system four years of primary school education are provided in every state. To pass from primary school to the medium-level stage of education the pupil has to pass an entrance examination; those pupils who can afford supplementary, private lessons have a better chance of continuing their education, as there is little coordination between the primary and secondary school curricula. Also, since most medium-level schools are located in urban centers, the educational opportunities for the rural child are limited. After four years of general medium-level education the student can elect either to follow the three year secondary course (itself divided into the "classic" and "scientific" courses) or a course leading to a professional diploma. Those following the secondary courses have the option of attempting to enter university.

The reform of primary and medium-level education, established by federal law on the 11th August 1971 (law 5.692), is destined to be applied progressively from the beginning of the 1972 school year. It attempts to make education available to a large segment of the

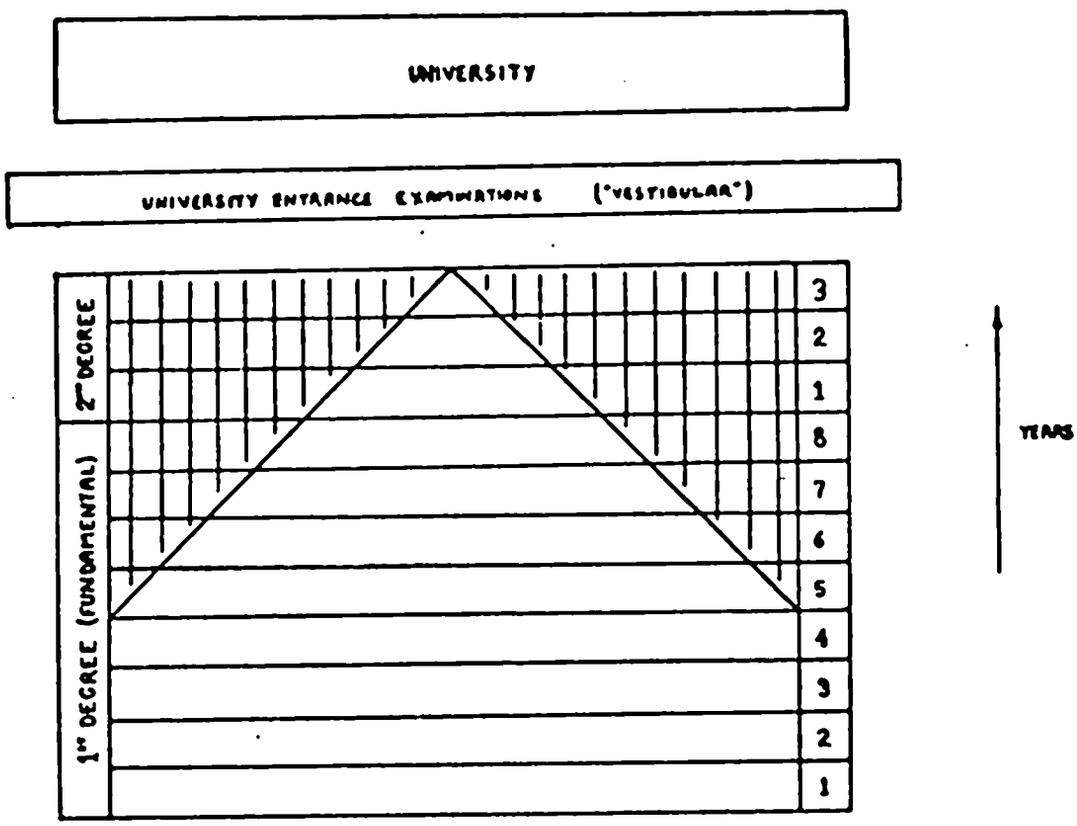
population, while tailoring curricula to meet the demands of the labor market. Using limited resources and covering a wide geographical area, the reform will take some years to penetrate every region.

The structure of the school system advocated by the reform is shown in Figure 1. The former primary education and first cycle of medium-level education ("ginasio") have been combined into an eight year "first degree" education, eliminating the entrance examinations. Beginning in grade 5, schools are now required to provide gradually increasing amounts of technical, professional and work-oriented education.

The transformation of elementary and secondary education means the implementation of universal primary education. According to Brazilian authorities, the only way to achieve this goal is through the massive use of modern technology, as provided particularly by television. The former Minister of Planning put it this way in 1969:

> The Government is convinced that . . . in order to revolutionize education, it will not suffice to solve the problem of resources and reform the existing structures. It will be necessary to take a giant step forward and adopt a new technology . . . which, utilizing advanced communication media--Image, Sound, and Motion--can take education, still within the 1970 decade, to all of the potential school population of the country, besides ensuring a permanent adult education service.[7]

Figure 1. Structure of the Educational System Based on the 1971 Reform



general education

aptitude testing and initiation to work (1st degree) and professional training (2nd degree). The duration of 2nd degree education varies from 3 to 4 years.

III. THE BRAZILIAN EDUCATIONAL SATELLITE

The interest in instructional technology has grown significantly over the past 10 years. As a result of a Governmental decree (Portaria No. 408 of July 1970) all radio and TV stations were required to provide five hours a week of free time to be used for educational and cultural purposes. A number of states already have educational television stations or are planning to develop them.[8]

This interest has been concurrent with national interest in a Brazilian satellite to serve educational and other purposes. A 1966 Stanford University study explored the possible value of satellite technology to developing countries. The potential described in the Stanford report prompted the Institute of Space Research (INPE, formerly CNAE) to conduct its own satellite feasibility study during 1967-68 resulting in the conclusion that a satellite information distribution system would make a major contribution to national development. As a result, INPE developed the program now in progress entitled Advanced Interdisciplinary Communications Satellite, better known as "Project SACI."[9]

SACI has three general phases:

Phase 1 involves the reception of selected voice, slow scan, and teledocumentation broadcasts from Stanford University, and the transmission of Brazilian cultural programs to Stanford via the Applications Technology Satellite, number three (ATS-3). This experiment began in

January 1972, and all Brazilian transmissions and receptions are confined to the Institute of Space Research at São Jose dos Campos in the State of São Paulo.

Phase 2 includes experimentation in one area of the country in the use of terrestrial and celestial information distribution systems to demonstrate the use of new technologies in education. Phase 2 is also viewed as providing the opportunity for developing on a small scale the equipment, personnel, organizations, and programming that might lead to a feasible educational satellite system.

Phase 2 began December 1972 in the state of Rio Grande do Norte and is discussed in detail in the following section. In its early phases it is utilizing a ground system of signal distribution, but later will transmit some of the programs through an ATS-F satellite.

To execute the satellite portion of Phase 2, INPE submitted a proposal to the National Aeronautics and Space Administration (NASA) requesting use of the ATS-F satellite while it is positioned for educational and other experimentation in the United States.[10] In February 1972, INPE provided another document that discussed satellite time allocations and the use of frequencies in the range of 2.5 to 2.7 GHz.[11] In the summer of 1973, NASA and the INPE established an agreement for use of approximately 50 hours of ATS-F time on a time-available basis, since most of the time has been allocated to the U.S. experiments.[12]

Phase 3 would see Brazil with its own satellite to provide educational opportunities as well as other communication services for the entire nation. The system planned is a hybrid one, with direct reception in isolated areas and community reception for rebroadcast in more densely populated areas.

For some time there was uncertainity in the Brazilian government over whether to depend on a terrestrial system of microwave links or whether to rely on the as yet untested system of a communications satellite. The SACI feasibility study estimated that a satellite system would cost about the same as a terrestrial system, but the satellite system would cover 100% of the population, compared with 86% for the terrestrial system. The figures are shown in Table 1.

TABLE 1 Estimates of Costs of a Satellite and a Terrestrial Transmission System

Satellite Transmission System Costs: these include all costs pertaining to the master earth station, the satellite and its replacements, the rebroadcast TV stations and the hardware necessary to enable ordinary TV sets to receive signals direct from the satellite. The system broadcasts 3 TV and 9 radio channels; 50% (87,500) of the schools receive 2 TV and 6 radio channels, the other 50% receive 1 TV and 3 radio channels; 100% population coverage.

Initial investment in hardware and its installation	$161.3 million
Equivalent annual cost (includes amortization of the initial investment at 8% over 14 years and all operating and maintenance costs)	$ 33.07 million
Present costs for a 14 year project (at 8%)	$397 million
(Initial investment in a single TV channel system	$ 61 million).

Terrestrial Transmission System Costs: these include all costs relating to the microwave network and the television and radio transmitters. Channel capacity is roughly equal to that of the satellite system; population coverage is 86%.

Initial investment in hardware and its installation	$ 85.95 million
Equivalent annual cost (as above)	$ 33.17 million
Present costs for a 14 year project (at 8%)	$399 million
(Present costs for a system with 91% coverage, 14 years, 8%)	$455 million).

TABLE 1 - Continued

Educational Sub-system Costs: (same for satellite or terrestrial system) these include the costs of the TV and radio studios, program production, school television and radio receivers, extra school buildings necessary to increase enrollment, the field staff to evaluate the educational results, the questionnaires and tests used in evaluation, and teacher manuals. Excluded are the cost of providing power to schools that need it, and the cost of producing and distributing student tests to accompany the broadcasts. A total of 264 days of lessons per year is provided.

Equivalent annual expenditure on hardware and school construction over 14 years (8%)	$ 43 million
Annual expenditure on operation, maintenance, salaries, teaching materials and transport	$ 136 million
Present total costs for 14 years (at 8%)	$1476 million

Source: Robert C. Butman, George W. Rathjens, Colin J. Warren, "Technical Economic Considerations in Public Service Broadcast Communications for Developing Countries", Academy for Educational Development, Washington, D.C., 1973. Based on information from Project SACI, "Viability Study of a Satellite for the Brazilian Educational System", LAFE-165, São Jose dos Campos, Brazil, 1971.

According to the Brazilian authorities, the satellite can be put into orbit in less time than microwave links can be set up all over Brazil. The satellite can also allow communication with the sparsely settled North (Amazon) and Central West regions which the Brazilian government wants to develop. It can help to improve the present communications system by providing an instantaneous network for national television, a backup system to provide for failure in the terrestrial system, and a rapid response to unexpected communications needs. Finally, it could enhance national security by providing immediate communication with frontier villages.

A first satellite should be launched in a geostationary orbit about 1976. It will probably encompass one TV channel, for education purposes, in 2.5 GHz band allocated to the Broadcasting Satellite Service in WARC, and a large number of telephony transponders, for telecommunication purposes, in the 6-4 GHz band. Its probable location is from about 72 to about 83 degrees west longtitude. The launch vehicle will be a NASA Thor Delta 2914 and the payload will be 700 kilograms.

The following graphics illustrate Brazil's plans for a domestic satellite.[13]

FIGURE 2: Services of the Brazilian Satellite System

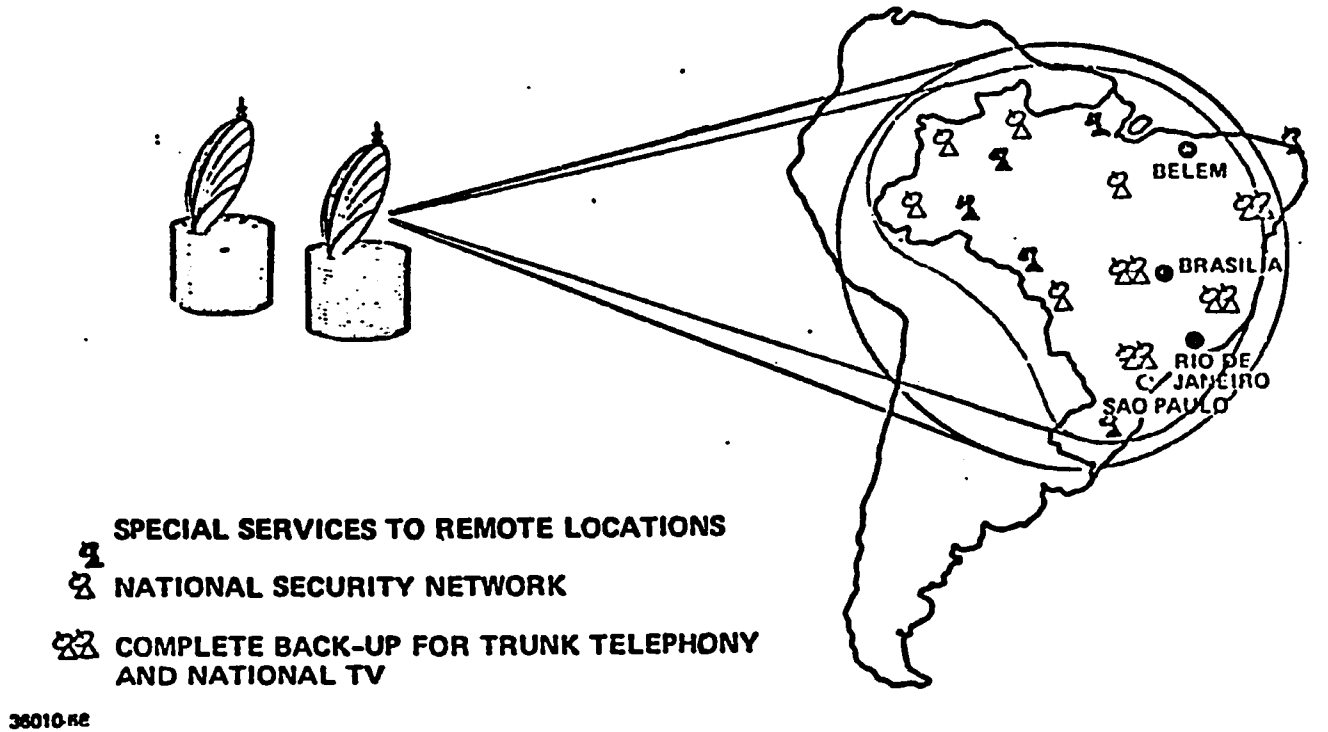
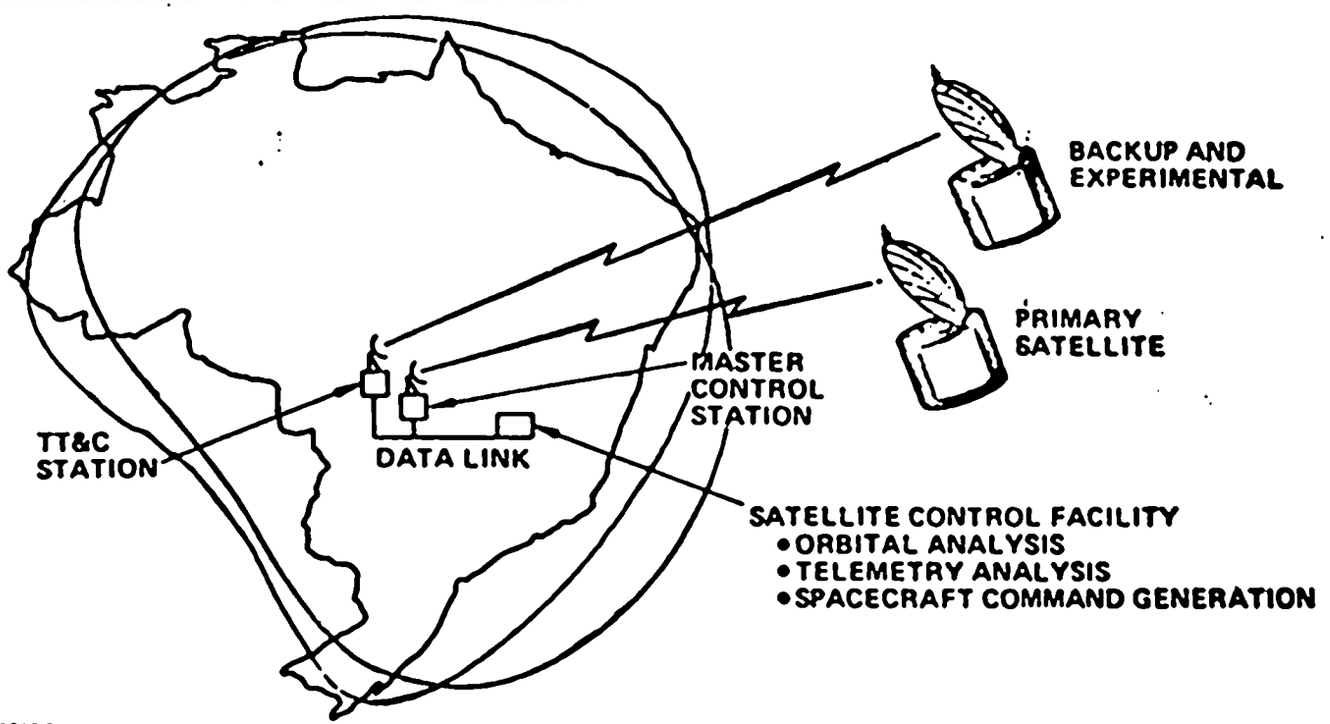


FIGURE 2

FIGURE 3:

IN-ORBIT OPERATIONS



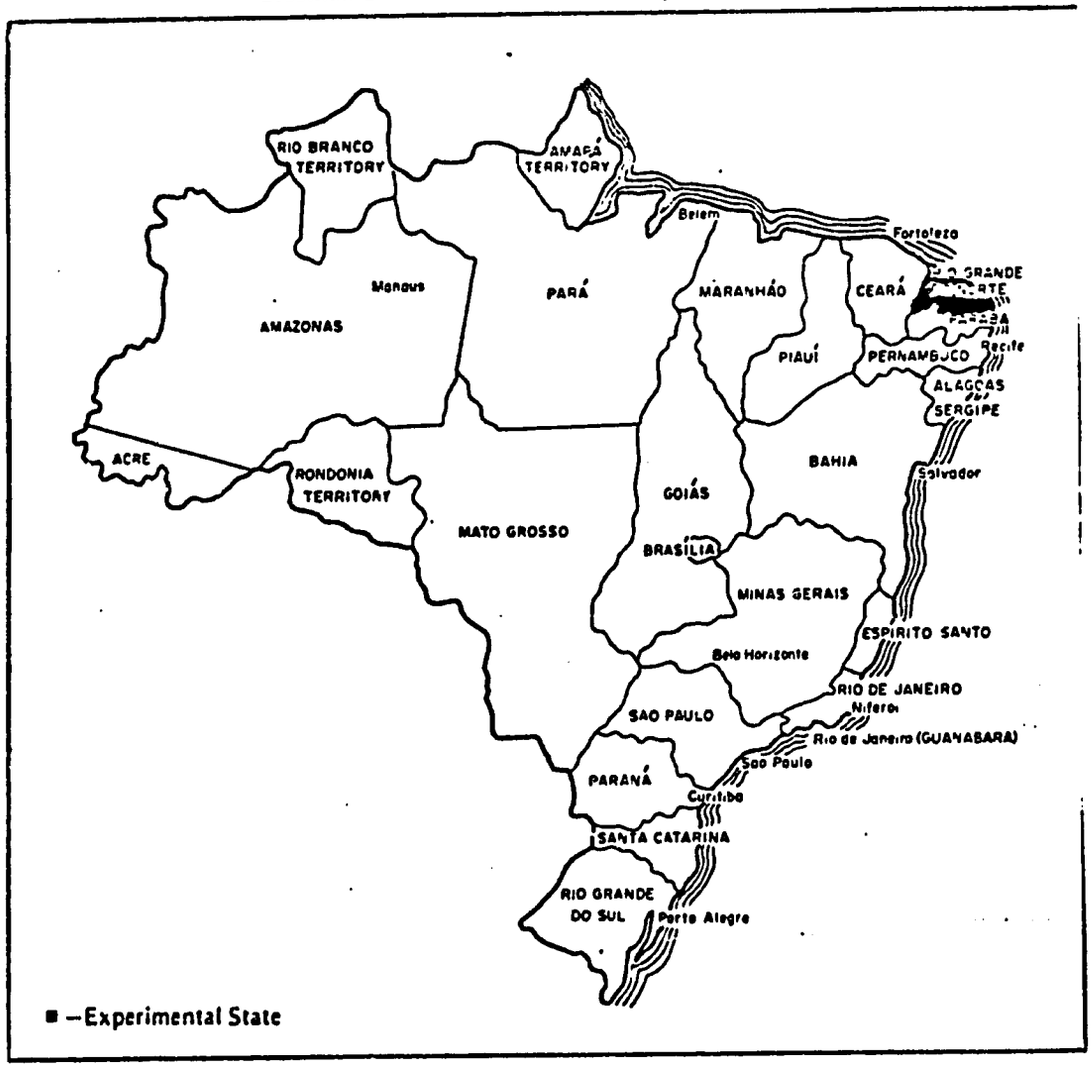
30010-81 FIGURE 5

IV. PHASE 2: THE EDUCATIONAL EXPERIMENT IN RIO GRANDE DO NORTE

The Nature of the Experiment

The State of Rio Grande do Norte, shown in Figure 4, was selected as the experimental site for Phase 2 because its environment, population, and problems are representative of many regions of Brazil.[14]

Figure 4
Brazilian States and Territories – Experimental Site



INPE believed that if the educational problems could be overcome there, they could be overcome anywhere in Brazil.

The experiment emphasizes the use of satellites for broadcasting of educational TV and radio programs directly to students in classrooms and to teachers to upgrade their subject matter knowledge and their teaching methods.[15]

In outline form, the following are the essential components in the program:

Main targets:

- Students in primary school--grades 1-4
- Primary school teachers

Bottlenecks in the current primary school system:

- High percentage of drop-outs
- High percentage of repeaters

Working Hypotheses:

- A system using educational technology will provide better results in terms of student achievement than the traditional system.
- A system using educational technology will reach a greater number of primary school age children with greater efficiency than the traditional system.
- The qualification of untrained teachers is more cost/effective through technology than the traditional system.

Educational Objectives:

1. Test the efficiency of the educational program for the first 4 years of primary school using TV, radio and slow-scan.
2. Develop techniques for the production of TV programs for different subject areas, grade levels, and evaluation techniques.
3. Train teachers in the utilization of audio visual media equipment and provide them with up-grading.

4. Offer better education opportunities to a considerable portion of school population.

5. Through formative evaluation, develop and improve school curriculum.

6. Analyze the results in terms of cost/benefits and cost/effectiveness, comparing them with data from the conventional system.

The experiment began in fall of 1972 and is to last for approximately four years. The first year or so is dedicated to work with a terrestrial information distribution system, with additional use of a celestial system in 1974-75.

Initially, the transmissions are being made to schools via VHF and medium-wave methods using three radio stations (in Natal, Mossoro, and Caico) and two TV stations (in Natal and Santana do Matos). When properly equipped, some of the experimental schools are scheduled to receive programs relayed by satellite. However, prior to the actual use of the satellite, its use will be simulated through a terrestrial transmission of its signal.

The experiment has been divided into missions according to years, based on the target population, the medium, and the distribution mode to be used.

As shown in Table 2, the major activities of the first year are training supervisors, upgrading teachers, and showing both how to work with media to improve learning. Up to two hours of television and one or more hours of radio programs will be provided per day in subjects such as the Portuguese language, social studies, health and natural sciences,

mathematics, civics and moral education, and principles of teaching. Though in-service teacher training will continue, a shift to student learning is scheduled for the remaining three years. All radio and TV programs will be complemented by instruction booklets at the schools.

TABLE 2

SACI Experiment Profile

Mission	SACI Emperiment Courses and Training	Distribution Modes
1972	1. Supervisor and Teacher Training 2. Course for Preparation of Primary Level Lay Teachers, 1st State--Elementary Level	1. Operational Demonstration 2. TV and Radio--Surface
1973	1. Supervisor and Teacher Training 2. Course for Preparation of Primary Level Lay Teachers, 2nd-Stage--Secondary Level 3. 1st Grade Teaching (for Students)--1st and 2nd Years	1. Operational Demonstration 2. TV and Radio via Surface 3. TV and Radio via Surface (Possible Satellite)
1974	1. Supervisor and Teacher Training 2. Course for Preparation of Primary Level Lay Teachers, 3rd Stage--Third Level 3. 1st Grade Teaching (for Students)--1st, 2nd, 3rd and 4th Years	1. Operational Demonstration 2. TV and Radio via Surface 3. TV and Radio via Surface (Possible Satellite)
1975	1. Supervisor and Teacher Training 2. Course to Bring Elementary Teachers up to Date 3. 1st Grade Teaching (for Students)--1st, 2nd, 3rd and 4th Years	1. Operational Demonstration 2. TV and Radio via Surface 3. TV, Radio, Slow-Scan and Facsimile via Satellite

Excerpt from: "SACI Project Review Meeting for Progress Examination." Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, Brazil, November 1971.

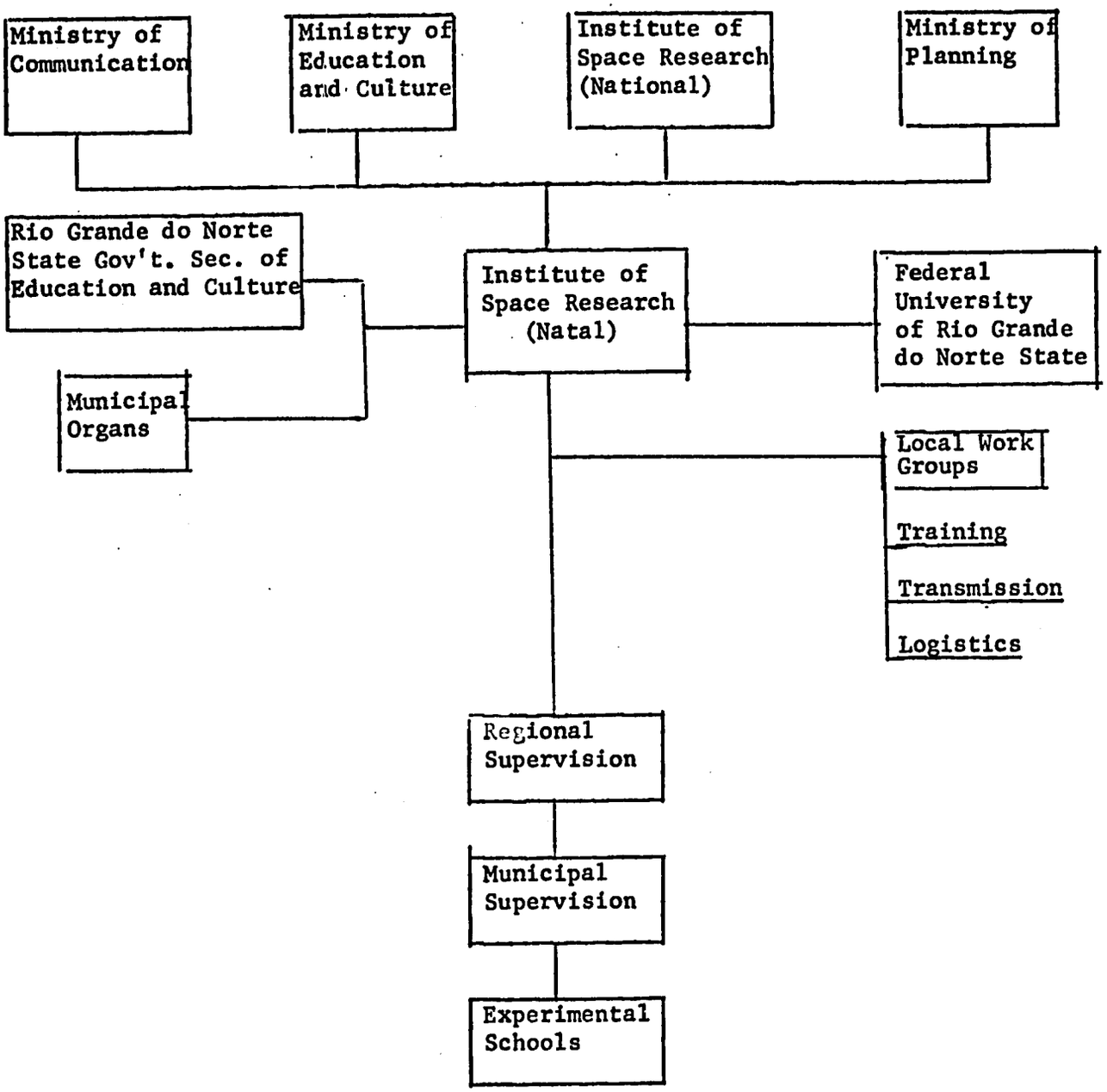
Organization

The importance of national, state, and local involvement in the experiment was apparent from the beginning of the SACI Project. The existing organizations in the area were used as fully as possible and integrated into the structure described in Figure 5.

Although INPE is in charge of coordination of the project, ministerial, state and municipal agencies are providing material and technical assistance according to their specializations. Local working groups include the training team to prepare supervisors and teachers to carry out their functions, the transmission team, and the logistics team for transportation, communication and maintenance.

One system of supervision includes state and municipal supervisors selected by the Secretariat of Education and Culture of Rio Grande do Norte. Their principal function is to supervise and assess the teachers participating in the up-grading course. Another system of supervision includes approximately 10% of the total of the schools in the Experiment and includes personnel from INPE and SEEC/RN. The objective of this system is to obtain more systematic data on the program.

FIGURE 5 : SACI Project Operational Structure for Rio Grande do Norte



Adopted from: "SACI Project Review Meeting for Progress Examination," Instituto Nacional de Pesquisas Espaciais, São Jose dos Campos, Brazil, November 1971.

Software Development

To provide an understanding of the environment and individuals scheduled to participate in the experiment, and to develop educational materials and programs accordingly, INPE conducted research which embraced surveys on:

- Teacher characteristics--to obtain detailed information on their needs, values, areas of interest, educational background, professional experience and personal aspirations.
- Student characteristics--to obtain information on their needs, values, learning difficulties and personal aspirations.
- School characteristics--to obtain information concerning location, administrative dependence, category, construction type, installations, quantity and quality of permanent school material.
- Community leadership--to identify the communities' leadership in order to get their support for the experiment.

The characteristics of teachers and students were determined by means of a representative sampling method. The survey of the characteristics of the schools covered the universe of schools involved. The community leaders were identified by a crisscrossing study of the opinions collected in a questionnaire applied to each municipality.

The actual production of material and the development of programs for the experiment is taking place at the Institute of Space Research, São Jose dos Campos, approximately 1,700 miles from the experimental site. The Institute has a small studio, a staff of novice actors, producers and directors and a limited number of subject matter specialists. Nevertheless, it has been able to produce good situational educational radio and TV programs. For example, in creating the "Wonderful World of

Mathematics," everyday situational problems are dramatized. A comic teacher livens up the situation and one of the characters teaches her younger brother the things she learned by imitating her teacher. In the programs on teaching methodology, situations in the classroom are dramatized and a narrator isolates, emphasizes and explains the situation to the student teacher. In the field of social studies, films and slide scenes are used along with narration in a journalistic framework.

The following alternative types of media will be utilized:

Conventional Radio: This will be used for transmission of 10 minute classes in the basic disciplines of the curriculum via ground system in 1973 and via satellite in 1975 and 1976. Accompanying material will provide visual aspects during the radio class and during the period after the reception. Radio will be tested in isolation and in combination with television.

Programmed Radio: This is an experimental project in programmed radio whose application in the Rio Grande do Norte project will depend on the results of the tests now taking place in SACI laboratories.

Television: Television classes will also be 10-15 minutes in duration in the basic disciplines of the official curriculum, via ground system in 1973 and 1974 and via satellite in 1975 and 1976. Television will be utilized in isolation, with conventional radio, and with programmed radio via satellite.

Slow-Scan: The potential of slow-scan to education programming has been recognized for some time. Its advantage is the narrow band width of the signal necessary for communication, and the possibility of utilizing telephone channels for the transmission of images. The slow scan used presently with the ATS-3 satellite is characterized by the transmission of static images. In the SACI experiment it will be utilized only in 1975, via satellite, for the transmission of 10 minute classes in the basic disciplines and will probably be restricted to 10 schools.

After testing the various systems of transmission and reception in isolation and in combination, the methods to be used in the experiment will be distributed among various schools. In 1973 and 1974, there will be two sub-groups of radio and two of TV. In 1975, with the utilization of more technological resources via satellite, the sub-groups will be in almost identical proportions.

The class schedules are appropriate for all of the types of programming, and based on a classroom schedule with two shifts; from 7 a.m. to 11 a.m. and from 1 p.m. to 5 p.m. The school day will be as follows:

Activities: a period of 10 minutes for the student to enter class, for attendance, and delivery of the material for the classes.

Preparation for the class: period of five minutes before the reception of each program.

Reception of the program: period of 10 minutes for each program.

1st Exploration: periods of 25 minutes for Portuguese language and mathematics and 20 minutes for the other disciplines, immediately after the reception of each program.

Interval: physical education.

2nd Exploration: a period of one hour and forty minutes for additional review and exercises concerning the subject under study.

Selection of Areas and Schools and Evaluation

The geographical area to be involved encompasses 150 of Rio Grande do Norte municipalities. Criteria for selection of these municipalities were inclusion of both rural and urban populations in the coastal area, the "agreste" and the "sertão"; inclusion of the greatest number of SEEC centers; inclusion of the economic centers of the State to coincide with

other government activities; inclusion of the greatest possible number of schools in order to select the best for experimentation and control; and consideration of technical restrictions on the coverage of TV and radio signals.

All schools in the experiment are public--either state administered or municipal. They were selected randomly among the three categories of public schools: "Grupo Escolar", "Escola Reunida" and "Escola Isolada" from rural and urban zones.* The total sample was set at 29% of all schools or 600 schools.

Since a primary objective is to compare the technological system and the traditional, the schools involved were divided into three groups:

1. Experiment Group--composed of 500 schools chosen at random from among those already selected. All untrained teachers take part in the up-grading course. The students of both morning and afternoon shifts of these schools receive their classes through the technological system (TV and/or radio). The program started in December 1972.

2. Control Group I--composed of 50 schools chosen at random. The teachers take part in the training and in the up-grading course the same as those in the experimental group. Classes will be taught under the traditional system, however, and will not receive TV or radio.

3. Control Group II--composed of 50 schools also selected at random. Teachers and students continue with the traditional system.

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* Grupo Escola--A school with a separate classroom for each class, a teacher for each class, a principal, a secretary, etc.

Escola Reunida--A school with several classrooms and teachers but without any administrative staff.

Escola Isolada--A school with one room and one teacher.

The evaluation of the experiment constitutes an essential part of Project SACI, and therefore is being carried out with all the scientific rigor possible. Two types of evaluation will be used: (1) formative, consisting of a detailed analysis of the results obtained in each unit of the program cycle, and (2) summative, consisting of measurement before and after the experiment.

At the beginning and conclusion of the experiment, questionnaires will measure attitudes of authorities and leaders of communities in the area of the experiment to determine the degree of receptiveness of the innovations introduced into the school system. At the beginning and conclusion of each school year questionnaires will measure teachers' and students' receptiveness to the educational TV and radio system and objective tests will measure learning retention of both teachers and students.

Weekly during the first two months, biweekly in the next two, and monthly from the fifth month on, questionnaires will measure teachers' opinions about daily class-programs. These will enable the production groups to revise the programs immediately. Daily data on student performance will be gathered using the answer sheets from the programmed instruction workbooks.

To maximize precision and minimize analysis time, the Mark-Sense technique will be used. The data forms will be read by an optical scanner and recorded on magnetic tape at the Natal computer center; then the tapes sent to São Jose dos Campos for processing and analysis.

Costs

According to a 1970 report, the software portion of the experiment will cost about $1.4 million and the hardware portion from $.9 million to $3.0 million, as noted in the following tables.

TABLE 3

SOFTWARE AND PROGRAMMING COST SUMMARY

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	
Teacher Training	147,600	
Administrative Instruction	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 (a) + (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.

Adapted from: "Brazilian Educational Radio and TV Experiment in ATS-F," Experimental Proposal--Submitted to NASA by CNAE, May 1970, revision, p. 78.

TABLE 4

HARDWARE AND ENGINEERING COST SUMMARY

Hardware and Engineering Costs	U.S. Dollars Low	U.S. Dollars High
Transmit Station		
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
TOTAL--Transmit Station	(178,400	212,002)
Receive Site Equipment	(742,500	2,815,500)
System Engineering, Design Integration and Installation	300,00	500,000(est)
HARDWARE--TOTAL	920,900	3,024,530

Adapted from: "Brazilian Educational Radio and TV Experiment on ATS-F," Experimental Proposal--Submitted to NASA by CNAE, May 1970 revision, p.79.

The hardware figure varies greatly because it was based on a number of alternate preliminary estimates. In addition about $3 million was estimated for the preparation of programmed instruction texts to be used with educational television. These figures have undoubtedly changed since 1970, but more recent data were not available to the author.

Brazilian television sets as well as radios and batteries will be available at low cost. One estimate of these costs is as follows:

TABLE 5

BRAZILIAN TELEVISION AND RADIO SET COSTS

Item	Manufacturer	U.S. Dollars Cost
23" TV Convential Power	ABC Brazil	@ 141 per unit
12" TV Battery Powered	Philco Brazil	@ 157 per unit
Radio Battery & Conventional Power	ABC Brazil	@ 15 per unit
Battery 12 volt	ABC Brazil	@ 17 per unit

SOURCE: Kenneth A. Polcyn, An Educator's Guide to Communications Satellite Technology, Academy for Educational Development, Washington, D. C., 1973, p. 76. Based on shipping invoices in Natal, Rio Grande do Norte, 1972.

Brazil has not yet developed a transmitter or receiver for satellite use. Estimates of the cost of producing one in Brazil range from $200 to $1200, but the higher estimate is probably more realistic.[16] In addition, Hewlitt-Packard has indicated they can supply frequency-modulation convertors, including the television, at a cost of $1000 each in lots of 500 units.[17]

Future Problems and Directions

INPE plans to extend the Rio Grande do Norte experiment to neighboring states in the Northeast, and would like to see the system available for the entire country when the satellite goes up in 1976. To prepare for that time, INPE is attempting to build up a cadre of professionals who can operate the system. It is now providing graduate programs in systems analysis and applications, space and atmospheric science, electronics and telecommunications, computer science, remote sensor applications, and educational technology.

As the project grows, its target audience can be expected to expand. While the earlier documentation emphasized adult education, the decision is to begin now with primary education. But a fully operational educational satellite system will have time available for diverse programs, including literacy, industrial, agricultural, and health training.

As the project grows, it will also face key problems not yet dealt with. One major problem will be the relationships of the project to the administrative structure of the educational system. A main assumption of the educational satellite system is that most programming is to be developed at one national program production center. The control local educational authorities would have over the programs would be minimal.

But the vast majority of primary schools are state or municipal run and there is a recent tendency in the more advanced states to shift more schools to the municipalities. In 1971 only .6% of all primary school enrollment was in federal schools, which were located only in Brasilia and two territories.[18]

At the secondary level, legislation in 1961 shifted most of the burden to the states, and 1.9% of all enrollment in 1971 was in federal schools.[19] Only in higher education does the federal government have significant direct control.

The 1971 educational reform represents a further step on the road towards decentralization. It authorizes rural schools to rearrange their calendars in accordance with the local agricultural calendar, while urban schools are urged to make more efficient use of their facilities by using them during vacation months for "recuperative" classes. It also proposes to speed

> the progressive passage of educational services and obligations into municipal hands, in particular those of the 1st degree, which by their nature may be carried out more satisfactorily by the local administrations.[20]

Technically, the idea of creating a "responsive" or flexible educational telecommunications system using a satellite is feasible, if costly. It involves a process of decreasing the area served by any one rebroadcast station and providing means for local or regional program origination. Future developments in satellite technology will, no doubt, enable a single TV channel to be beamed to ever decreasing areas and lead to increased channel capacity.* Until then, areas served by direct broadcasting will have limited control over program content.

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* The Intelsat IV spot beam covers 2.5 million sq. miles; the ATS-F will cover 1.1 million sq. miles. A proposal by Fairchild for a U.S. domestic satellite system involves the use of a 120 transponder satellite.[21]

With only three or four TV channels available over a large area of the country, it might be possible to form commissions consisting of representatives from the state councils of education from the North and Central West regions, the South and Southeast, and the Northeast respectively. Such a grouping of regions would correspond roughly to cultural and economic factors. Each commission could decide how to use available regional broadcast time and how to provide the national production center (which is linked to the master earth station) with its own programming.

The major question the SACI program will have to answer is that of cost effectiveness. Since lack of resources is the principal factor constraining growth in enrollment and in the quality of education, the use of radio or television in the classroom will spread only if it leads to lower per pupil costs. A decrease in per pupil costs may come about in a number of ways--through a reduction in staffing or construction costs, through increased enrollment, or through greater retention of students.

The quality of education may also improve, and thus provide a "better product". However, the economic and social causes of primary school failure will not disappear overnight, and educational television will probably have to be linked with economic improvement and the provision of more social services to the poor.

The large costs involved in educational television should not be underemphasized. As noted previously, SACI estimates hardware costs at $397 million and education costs at $1,476 billion over a 14-year period.

While this is considered within Brazil's capacity, other costs may also arise.

For instance, the power supply problem has yet to be solved in a reasonably economical manner in those areas not endowed with natural resources such as wind and water power, and even in the latter two cases the capital investment per generated watt is high. The assumption is that direct broadcasting permits access to locations poorly served by roads and other networks of an industrializing society, but problems of access and maintenance as well as cost will be great.

Cost calculations of the SACI study were based on the assumption that each school was to be provided with one television receiver. Since each broadcast would only last from ten to fifteen minutes there would be an almost continuous flow of pupils from one room to another, with subsequent loss of time and disruption of learning activities. A more realistic proposal would be to install one receiver in each classroom as is done in American Samoa and El Salvador. To do this at a national level would require 350,00 TV sets, approximately the number of classrooms in grades 1-8 in 1973. To provide facilities for those children presently outside the school system this number would have to be doubled, leading to almost four times as many as the 180,000 used for the project calculations.[22] The extra investment in receivers alone could more than double the cost of a national project.

In spite of these problems and questions, there is no doubt of the determination of the Brazilian government to utilize television for

educational purposes. The value of the experiment extends beyond Brazil, since it may provide knowledge about design of hardware and software and the process of systems development valid for other countries.

FOOTNOTES

1. "Brazil Education Sector Analysis," Human Resources Office, United States Agency for International Development, Rio de Janeiro, Brazil, November 1972, pp. 18, 22.

2. MINIPLAN/IPEA/CNRH, "Estudo Sobre Alfabetização de Adultos no Brasil," Rio de Janeiro, June 1970, Table 1.1.

3. Laurence Wolff, "Estimates of Efficiency and Extent in Primary Schools of Brazil: 1967-1968," Human Resources Office, United States Agency for International Development, Rio de Janeiro, Brazil, May 1971, p. 11.

4. "Estudo Sobre Alfabetização do Adultos no Brasil," op. cit., Table 1.1.

5. Robert C. Butman, George W. Rathjens, and Colin J. Warren, "Technical-Economic Considerations in Public Service Broadcast Communications for Developing Countries," Academy for Educational Development, p. III-17. Based on the Anuário Estatístico do Brasil, 1970, Ministério do Planejamento e Coordenação Geral, Fundação IBGE, Instituto Brasileiro de Estatitística, Rio de Janeiro, 1970

6. Annuário Estatístico do Brasil, 1970, op. cit., pp. 658-659.

7. Helio Beltrão, "Educational Revolution through Artificial Satellite," Commisso Nacional de Atividades Espaciais, Conselho Nacional de Pesquisas, São Jose dos Campos, Brazil, February 1970, pp. 11-12.

8. See "Brazil Education Sector Analysis," op. cit., pp. 87-91, for information on educational radio and television in Brazil.

9. Information describing the project comes from various INPE reports and SACI progress reports.

10. Commissão Nacional de Atividades Espaciais, "Brazilian Educational Radio and TV Experiment on ATS F," São Jose dos Campos, Brazil, May 1970.

11. Commissão Nacional de Atividades Espaciais, 'A Supplement to the Experiment Proposal (May 1970)," São Jose dos Campos, Brazil, December 1971.

12. Reported by Kenneth A. Polcyn, Educator's Guide to Communication Satellite Technology, Academy for Educational Development, Washington, D. C., 1973, p. 69.

13. This information is provided by Mary Ann Cusack, "The Systems Approach to Satellite Education in Brazil" in "Final Report, Innotech Regional Seminar on Approaches to Effective and Economical Delivery of Mass Primary Education, February 1973," SEAMEO Regional Innotech Center, Singapore, 1973.

14. Instituto de Pesquisas Espaciais, "SACI Project Review Meeting for Progress Examination," São Jose dos Campos, Brazil, November 1971, p. 27.

15. Information describing the project comes from various INPE reports and SACI progress reports.

16 According to Colin J. Warren in "Technical-Economic Considerations in Public Service Broadcasts for Developing Countries," op. cit., p. III-64.

17. Ibid.

18. "Brazil Education Sector Analysis," op. cit., p. 23.

19. Ibid.

20. Ministério da Educação e Cultura, 'Ensino de Primeiro e Segundo Graus (Atualização e Expansao)," Brasilia, 1970, p. 125.

21. "Technical-Economic Considerations in Public Service Broadcasts for Developing Countries," op. cit., p. III-107.

22. Ibid., pp. III-112, 113.

THE SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT IN INDIA: A CASE HISTORY

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PREFACE

Our purpose in this paper is to provide an overview of India's Satellite Instructional Television Experiment (SITE). While the bulk of the paper is a descriptive summary of the various strands that must come together to complete successfully an experiment as complex as SITE, we also attempt to place this experiment in the context of the present state of mass communications in India.

It is widely believed that television can play an important role in the economic and social development of India by assisting in a number of tasks, the most important of which are population control, improving agricultural productivity, improving formal education, and enhancing national unity. There is evidence to support belief in the efficacy of television for achieving these goals, and this evidence has helped lead decisionmakers in India to their commitment simultaneously to expand terrestrial television broadcasting and distribution and to experiment with satellite television broadcasting through SITE. Television is thus perceived as playing an important role in India's economic development.

The word "experiment" does not describe SITE well. SITE is more

of a demonstration of delivery of television via a high-power satellite to small terminals in remote areas than an experiment in television for developmental purposes. It is a pilot project designed to provide experience in development, testing, and management of a satellite-based educational television system, particularly in rural areas, and to help determine optimal system parameters for an operational satellite television system that might emerge in India. To those in India who are not yet convinced about the appropriateness of using satellites for massive and rapid expansion of television in India, SITE's significance lies in providing information on the basis of which the Indian planning authorities can study the alternatives for television expansion.

Indian planning authorities have yet to commit themselves to a precise scheme for expanding television service. Given the enormous costs of nationwide television service, many consider the present lack of commitment to one particular plan wise only in the absence of sharp and credible analyses of the alternatives to television expansion. Some remain skeptical about television, given its enormous costs. Benefits would indeed result, they argue, but are the benefits worth the costs? They argue: "Television is indeed an effective medium for mass communication

but there are others. Could radio (either terrestrially or satellite-distributed) achieve for some purposes as much as television for lower cost? What mixes of radio and television, local and national programming, and satellite and terrestrial distribution will best serve India's development needs? Until adequate analyses of these questions exist, it would be premature to undertake a massive commitment to a particular method of television expansion."

Thus, while our present purpose is to summarize the development of SITE, its scope and activities, we are mindful of the context in which SITE is being conducted. We shall discuss India and its problems (social, political, and instructional) that could be helped by a system of mass communication, the status of television to date in India, the near-term plans for the expansion of television service, and the long-term plans that have been proposed. In this context we shall discuss objectives, management, hardware, software, and evaluation plans for SITE.

I. INTRODUCTION

India is a country of more than 540 million people distributed over an area of 1.18 million square miles. India is a land of diversity; its internal variety compares with that of Europe in terms of languages, cultures, climates, and religions. It has 15 official languages (with 13 scripts) and about 800 dialects. Eighty percent of its population lives in about 560,000 villages, many of which lack approach roads, electricity, protected water supplies, hospitals, or schools. Even with massive efforts, only about 110,000 villages have so far been electrified.

The economy of India is predominantly agricultural, with agriculture accounting for about one-half of its income. The fact that 70 percent of the population can barely provide sufficient food for its 547 million people indicates how badly underdeveloped the economy is. Some 70 percent of the population is unable to read and write. Although the percentage of literacy has doubled to about 30 percent in the last 20 years (i.e., since the launching of the First Five-Year Plan in 1951) as a result of the rapid increase in population, the number of illiterates has in fact increased from less than 300 million in 1950-51

to about 380 million (Menon, 1972). This means that even with the massive effort and investment in education in the last few years, about 10,000 illiterates have been added every day. The rapid rate of increase suggests that by increasing conventional facilities alone, it will be very difficult to provide effective solutions to eradicating illiteracy and providing fundamental education.

Since its independence in 1947, India has been making tremendous efforts to improve the living conditions of its people and to develop the national economy to provide everyone with a richer life. On the economic front, the progress has been considerable. India is said to have had a "green revolution" in agriculture with the production of food grains increasing from about 75 million tons in 1966-67 to an estimated 110 million tons in 1971-72.[1] The national income is expected to grow to $45 billion by the end of the Fourth Five-Year Plan in 1974 from $18 billion at the end of the Second Five-Year Plan in 1961. The number of students enrolled in schools and colleges has grown from about 9 million in 1955-56 to over 90 million in 1972-73. However, a great deal of economic progress has been nullified by a rapid growth in the population.

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[1] Major portions of India are now experiencing drought, and the economic dislocation caused thereby illustrates the extent to which the economic success of the green revolution cannot yet overcome dependence on adequate weather.

The annual rate of growth of the population has accelerated from 1.2 percent during 1941-51 to 2.1 percent during 1951-61 and 2.54 percent during 1961-71. According to studies reviewed by Dhawan (1972), the principal cause of this rapid increase in population is the reduction in death rate as a result of improved health-care delivery; it is not due to a rise in birth rate, which is almost stationary around 42 per 1,000. The death rate is estimated to have fallen from a level of 27 per 1,000 population during 1941-51 to 14 per 1,000 during 1966-71. Rao (1970) traces the bulk of the reduction in death rate to a precipitous fall in specific mortality rate for persons in the age groups 0-1, 1-4, and 5-9. He concludes that this decrease in mortality will ultimately be followed by a decrease in fertility as people come to realize that children have better chances of survival.

If the present growth trend continues, India's population is likely to exceed 1 billion by 1994. This figure is threatening indeed. The gravity of the situation is well understood by the government, which has embarked upon a major family-planning program. In 1971-72, the Ministry of Family Planning had a budget of about $80 million, a large sum for a developing nation like India. For all this, as the ministry itself admits, the program has not been as successful as had been hoped. The 1971 census showed a population of 547 million against a projected population of 561 million. Experts disagree about

whether this lower figure results from a lowered birth rate or setbacks in the health program (Sondhi, 1972). Even if this achievement in curbing the population growth is attributed totally to the family-planning program, it is not yet an effect large enough to make a significant difference. Clearly the family-planning message is not getting across to most of the people. Two principal barriers are the high illiteracy and the taboo surrounding sex in the Indian society. While the problems posed by illiteracy call for a medium of communication that can reach illiterates as well as literates, the Indian attitude toward sex demands a change toward more subtlety and suggestiveness in the message.

India's constitution promises free and compulsory education for all. A careful study of progress of education in India reveals what Dhawan (1972) calls "an admirable, if not enviable, record of expanding school facilities to meet the rapidly rising number of school-going population." In 1950-51, only 15.6 percent of the total population in the 6-14 year age group was enrolled in schools; despite a much larger 6- to 14-year-old school age population in 1968-69, 63 percent of this group was enrolled in schools. Many people believe that the extent to which the constitutional directive remains unfulfilled has less to do with bottlenecks in the supply side than with deficiency in demand for education. Dhawan (1972) has correctly observed that it is primarily

girls who remain out of schools. The lack of demand for education for girls seems to stem primarily from the lack of appreciation of the value of educating girls on the part of their parents and society in general.

Apart from the possibility of changing the attitudes of parents toward educating girls, which would create a need for substantial increases in facilities, the biggest problems seem to lie in the quality of education, its relevance to the life and tune of independent India, and the wide gulf that apparently exists between the purposes of the present education system and the concerns of national development (Education Commission, 1967). In a way these problems point to a dire need for quality training of new teachers, retraining and continuous updating of in-service teachers, and inculcating new ideas and goals into the curriculum.

In addition to the need to educate the female population, to upgrade education in rural areas, and to increase the pace of social and economic development so that it equals the rate anticipated by the national planners, India faces severe social and domestic problems because of the narrowing of loyalties to regions and languages, a situation that threatens the integrity of the republic. Government leaders are consequently increasingly

concerned about promoting and sustaining unity. For all these reasons, India seems to be an ideal setting for applying mass media.

Many Indian officials have long held the view that economic changes automatically bring about social changes. However, many failures in implementing programs of economic development and technological change have shown the national planners that even well-conceived projects of modernization may fail to register with the people and to produce desired results unless they are supported by skillful and adequate communication. There seems to be greater realization among high-level government officials that the ambitious goals in the Five-Year Plans cannot be realized except by the fullest participation of the population and that the inequalities in education cannot be removed and the quality speedily upgraded by using only the conventional means of teacher training and inservice development.

Currently,a great deal of interest in many circles in India, ranging from the Ministries of Information and Broadcasting and Education to the Indian Space Research Organization (ISRO), is focused on applying television for national development. At present, the development of television on a nationwide scale is being advocated

for eradicating illiteracy and creating social awareness, for obtaining greater participation of masses in programs of economic development and technological change, for bringing females into the educational system, for improving education, for promoting national unity, and for providing agricultural and extension training.

One must recognize from the very outset that television is only one of the means for mass communication and education. Mass communication and education objectives briefly discussed earlier can be realized to various extents with the help of other mass media, such as radio and mobile and fixed motion picture units. Of course, the visual communication inherent in television may help a great deal in crossing the barrier of illiteracy and in communicating skills. There is considerable debate, inside as well as outside India, about whether India can afford television when many such basic needs as shelter, clothing, and food are unmet. While many critics think of television as a luxury, others are concerned with its cost and side-effects. Some believe that fixed and mobile motion picture units can perform the same functions as television, and at a lower cost. In this chapter, we refrain from joining the motion picture vs. television controversy except to note that a recent study (Dhawan, 1972) has concluded that motion picture systems would be more

expensive than television systems and that the spontaneity and simultaneous access afforded by a nationwide television system may have value in promoting national integration.

Our purpose in this paper is to review briefly the development and current status of television in India, plans and proposals for its expansion, issues related to the choice of the technology for a nationwide expansion of television, satellite studies conducted to date and their application to India, and the forthcoming SITE experiment. We shall, in particular, focus on the ATS-F SITE experiment in India and describe its evolution, objectives, configuration, management, and evaluation plans along with the associated costs of the hardware and software components. We conclude with a discussion of the role of SITE in providing information for planning the future evolution of mass communication in India.

II: TELEVISION IN INDIA

Development and Current Status

Television came to India in a small way in 1959 with the assistance of UNESCO. In 1956 the Indian delegation to UNESCO submitted a proposal regarding the establishment of a pilot television center to further educational and community development. The UNESCO General Conference authorized the organization of pilot projects that would assist member states in "...the fuller use of press, film, radio and television for educational, scientific, and cultural purposes." The center was established in Delhi, and the transmitter and studio were completed in August, 1959. With a total of 71 sets, 40 of which were supplied by UNESCO, television came to Delhi. The original transmitter had a range of 24 kilometers and served selected schools and community viewing centers in Delhi, New Delhi, and a few neighboring villages.

Television was not launched without criticism. Critics argued that India could hardly afford the luxury of television when basic needs for food, clothing, and shelter remained to be fulfilled. They argued that the enormous capital outlay required for the television project

could very well be used to alleviate the hardship of masses and that television could well have undesirable side-effects. The two experiments conducted over the Delhi television in the period 1959-1965, one with the support of UNESCO and the other with that of the Ford Foundation, succeeded in mollifying some of the criticism. These experiments demonstrated the social and educational potential of television in a developing nation like India (Borra). The success of these experiments, one dealing with the theme "Responsibilities of Citizenship" and the other with classroom instruction, did not completely satisfy the critics, but it did help generate support for the cause of television in India.

Up to August 14, 1965, the Delhi television station was involved only in experimental transmissions related to social and cultural education and in-school instruction. Daily TV programming began on August 15, 1965 and catered mainly to the area of Delhi city and its suburbs. In 1971, with the installation of a new antenna tower (100 meters high) and a new transmitter, the range of the station was increased to 60 kilometers.

At present, the number of television sets in Delhi homes, schools participating in in-school TV instruction, and community viewing centers has grown to 65,000 from the original 71 in 1959, when the station was begun. All India Radio (AIR), the organization responsible

for television as well as radio broadcasting in India, estimates the growth rate for television sets in Delhi as 1,000 sets per month. Based on an audience figure of 7.5 persons per set, the figure given by the Audience Research Unit of AIR, the current "General Service" audience is in the range of 375,000 to 400,000. The general service broadcasts extend from 6:30 p.m. to 10:00 p.m. daily and 6:00 p.m. to 10:00 p.m. on Sundays. The Delhi station also caters to community viewing centers (251 in 1972), established as part of the social education experimental program, and children in schools. School television lessons are broadcast for grades 6 to 11 in physics, biology, chemistry, social studies, English, and mathematics. Viewing in schools is compulsory, and it is estimated that more than 250,000 students watch television lessons daily in 415 participating schools (out of a total of 494 schools in the Delhi area) (Chander, 1972). The total number of lessons broadcast per week is 16, with repeat transmissions for schools working in the afternoon.

In 1967, the Delhi TV station introduced agricultural telecasts twice a week, each of 20-minute duration (Vepa, 1969). The series is named "Krishi Darshan," meaning agricultural television. Its frequency was increased to three times a week in 1970. Currently,

some 80 teleclubs in neighboring villages participate in the telecast, which is said to have a viewing audience of 8,000. The project was started initially to assess the effectiveness of TV in improving agricultural productivity. A secondary objective was to gain insights into the social and organizational problems of using TV for developmental tasks. A systematic field evaluation was conducted in 1968 by the Department of Adult Education of the National Council of Educational Research and Training (NCERT) (Vepa, 1969). Evaluation confirmed that TV was of value in effectively disseminating improved agricultural techniques. The experiment showed that satisfactory 20-minute agricultural programs can be produced for a cost as low as Rs 3,000 (U.S. $416), but it also demonstrated the problems involved in organizing an effort of this nature in India. For example, it took 11 months instead of a scheduled 2 months to install 80 sets. Normally 10 percent of them were out of order, with this figure going up to 20-25 percent during the monsoon season; and the provision of physical supplies, such as improved seeds, fertilizers, and insecticides, was poorly coordinated with the telecasts.

On October 2, 1972, a second television station was opened in Bombay. At present, it is on the air for 2.5 hours every evening,

which is to be increased to 3.5 hours in the near future. Within the next few months, the Bombay station expects to start services in schools and urban and rural teleclubs. Srinagar, Amritsar, and Poona will soon have television service. The television transmitters at these locations are already being tested. Stations at Madras, Lucknow, Calcutta, and Jullunder are under construction and are expected to go into service by the end of 1974, along with eight off-air pickup relay transmitters.

To meet the manpower requirements in television-related occupations, the Film Institute at Poona has developed special programs in television programming and production, where a television training institute has been set up with the assistance of the United Nations Development Program (UNDP). Television receivers are now being manufactured in India by a number of private industries without foreign collaboration and a minimum of imported know-how. The import content in the TV sets manufactured in India is now at a relatively low figure of Rs 90 (U.S. $12.50) per set, excluding the picture tube (Department of Electronics, 1973).[2] Bharat Electronics Ltd. (BEL), Bangalore, has started manufacture of picture tubes and is gradually expected to replace Hungary as the major supplier of

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[2] The price of TV sets in India still continues to be high, the factory price of a 19" TV set being around Rs 1600 (U.S. $220).

picture tubes to Indian manufacturers. At present, the Department of Electronics has approved 10 large-scale and 67 small-scale units for manufacture of TV sets with a total capacity of 196,000 per annum. The domestic manufacture of television equipment -- both for studio origination and control and for transmission -- is also being gradually organized. A number of research organizations are engaged in developing television equipment for domestic production; these include Bharat Electronics Ltd. (BEL), the Central Electronics Engineering Research Institute (CEERI) in Pilani, the Electronic Systems Division of the Indian Space Research Organization (ISRO), and the Research Laboratories of All India Radio.

Plans for the Expansion of Television

Terrestrial distribution. Until the beginning of the Fourth Five-Year Plan in 1969, television in India enjoyed a low priority. Although it was introduced in India in 1959, it was confined to the Delhi area for about 15 years until the inauguration of the second television station in Bombay in October, 1972. As mentioned earlier, Srinagar and Amritsar will have television service in the near future, and television stations at Madras, Calcutta, Jullunder, and Lucknow are to be operated by the end of the Fourth Five-Year Plan in 1974

along with eight off-air pickup relay stations. With the completion of these projects, it is estimated that the television signals will be available over 10 percent of the nation's area and will reach 17 percent of the population (Chander, 1972).

Television coverage in India so far has been extended along the lines of development plans projected by the All India Radio, a summary of which is contained in a paper by Jamison (1972). According to the AIR plan, the mainstay of the country's TV network would be the terrestrial system, which is to be evolved on a regional pattern. Twenty regional TV stations with program production facilities would be established to provide the nuclei of the regional networks. Each regional network would comprise a series of off-air pickup relay stations. Original plans, made public in 1969, called for establishing 20 regional stations and 80 relay transmitters in the Phase I, which was to last 7 years. Phase II, covering a period of three years, was to complete the relay network by adding another 70 transmitters. The target population coverage for Phase I was 65 percent and for Phase II, 90 percent. At current prices, the total capital outlay envisaged for Phases I and II was on the order of Rs 112 crores (U.S. $146 million).

The Post and Telegraph (P&T)Department has prepared a draft Fifth Five-Year Plan for wideband microwave links in 4 and 6 GHz bands covering major areas of the country (Planning Commission, 1973). In light of this plan, a further study has been made by the All India Radio (AIR) to employ the proposed microwave network to the fullest possible advantage for linking the terrestrial TV transmitters in order to provide maximum population coverage. With the microwave links made available as a result of the Fourth and draft Fifth Five-Year Plans of the P&T Department, it should be possible to link 104 transmitters to provide TV coverage to about 66 percent of the population. The revised AIR proposal for the Fifth Five-Year Plan, yet to be approved by the Government, calls for 15 regional stations and 30 relay transmitters for a total expenditure of Rs 134.1 crores (U.S. $186 million). It would extend TV coverage to approximately 40 percent of India's area and about 50 percent of its population.

Satellite distribution: previous studies. AIR plans for expanding domestic use of television were first submitted in 1964-65 to the Bhabha Committee, which was surveying the

status, potential, and scope of governmental initiatives for developing electronics in India. The late Dr. Vikram A. Sarabhai, a member of the Bhabha Committee and then Chairman of the Indian National Committee for Space Research (INCOSPAR), was struck by what he called the meager requirements projected for television by AIR (Sarabhai, 1969). Instead of starting from very large metropolitan areas and moving progressively to smaller urban areas as called for in the AIR plan, he was interested in serving rural areas and linking isloated rural communities to centers of population. In 1967, the Indian Space Research Organization (ISRO), then a division of the Department of Atomic Energy (DAE), organized a study of the cost and significance of a synchronous satellite that would link isolated rural communities and distant centers of population through a national system for mass communication using television. The study team had the benefit of cooperation from the National Aeronautics and Space Administration (NASA) as well as the participation of specialists from many Indian establishments and departments of government. The study concluded, after looking into the feasibility and cost of four system alternatives -- from an exclusive terrestrial system to an exclusive satellite broadcasting system -- that a hybrid system with direct satellite reception in thinly populated

rural areas and rebroadcast stations in relatively dense areas would be the best alternative (See Rao, 1969, or Menon, 1972).

In 1969, the Department of Communications of the Government of India formed a committee to study plans for long-term television coverage of India. The committee consisted of its own representative and representatives of the DAE and the Ministry of Information and Broadcasting (I&B), the parent organization of AIR. AIR proposed a terrestrial distribution plan to the committee, while DAE presented a more detailed development of satellite possibilities. DAE emphasized that using a satellite is the only way to cover certain parts of the country in 1974-79; that a satellite makes it possible to be non-discriminatory between villages and the cities; that the programming requirements of villages are different from those of cities; and, that with a multipurpose satellite, the whole national TV system could, in effect, be put up free of cost, i.e., the revenues accruing through the telecommunications payload can pay for the national TV system.[3] DAE also argued that a satellite system would enable the country to enter a new and sophisticated field of technology at

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[3] It should be noted that there are strong economic arguments <u>against</u> taxing telecommunications to pay for public television.

an early date and that it would enable India to leapfrog over intermediate technologies in an effort to start catching up with more advanced countries in the field of technology. According to DAE, its proposal would have been much less costly than the AIR proposal by 30 percent and, over a 10-year period, would have earned Rs 790 crores (U.S. $1.020 billion) more in revenues.[4] (In making its proposal for a satellite-based national television system, DAE had the benefit of two cooperative studies by U.S. aerospace companies -- General Electric (1969) and Hughes Aircraft Company (1969).)

In 1969, the Systems Engineering Group at the Indian Institute of Technology Kanpur also conducted a study for an advanced communication and mass education system for India (Prasada and Singh, 1969 and 1971). It proposed a hybrid airborne satellite television and communication system -- satellites for linking 16 regional stations that originate television programs and for interconnecting four major Post and Telegraph switching centers.

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[4]Jamison (1972) has argued that this additional revenue claim for a satellite system is misleading; with comparable demand assumptions a terrestrial microwave system could provide the same telecommunication service.

Unlike the Midwest Program for Airborne Television Instruction (MPATI) in the United States, where TV programs originated within the airborne transmission facility from recorded tapes, this proposal called for a ground-to-aircraft UHF link to feed the airborne TV transmitters so that live programs could be accommodated as well.

Other specific studies of the potential use of a satellite for a national television system include those made by Rosenberg (1966), the Stanford Research Institute (Schramm and Nelson, 1968), and Stanford University (ASCEND, 1967). In 1970, the Indian Space Research Organization (ISRO) and the Massachusetts Institute of Technology (MIT) initiated a joint study of a feasible spacecraft design for delivering at least two to three broadcast TV channels with multiple audio channels in the 800-960 MHz frequency band to community direct reception terminals while also providing for point-to-point, multiple access, and TV distribution channels (ISRO and MIT, 1971). Recently, Butman (1972) looked into the techno-economic factors involved in satellite-based television for India and concluded that satellite interconnection of terrestrial transmitters is best in terms of cost, low technological risks, and gradual system growth.

Satellite distribution: present thinking. No consensus about the strategy for expanding television has yet been reached among the Indian official circles (Department of Communication, Ministry of Information and Broadcasting, Indian Space Research Organization, and the Department of Electronics). The system costs projected by DAE and AIR for their respective systems have been much debated. Neither DAE nor AIR estimates include studio equipment and programming costs. There remain questions about costs quoted in the DAE proposal for direct satellite reception terminals (See Rao, 1969, or Science Today, 1970). These considerations, along with the slight revenue advantage of DAE system in the system cost comparison, make the two proposals about the same in costs (about $210 million) for the signal distribution components of the system; programming and television sets are not included in $210 million estimate.[5]

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[5]Jamison (1972) cautioned about cost-overruns, which in U.S. programs of this sort, according to studies by the Rand Corporation (Glennan et al.), can push costs up by factors of three or four. A cautiously optimistic assumption, according to Jamison, would be an overrun factor of only two. Thus, the real costs of the signal distribution for either the AIR or DAE plan would likely be around $420 million, with substantial margin for error.

In August, 1972, ISRO convened a national seminar on Indian Programs for Space Research and Applications. The seminar was attended by over 200 participants from all over India representing a total of 78 different organizations, government agencies, and institutions. The Working Group on Communications in this seminar, composed of representatives of All India Radio, P&T Department, the Ministry of Defense, and academic institutions, recommended an integrated television coverage plan combining the best elements of coverage through terrestrial microwave links and transmitters and an S-band (2500 MHz) satellite with five spot beams, each on a separate frequency, covering the entire country (Department of Space, 1973). The major recommendations of the Working Group on Communications were (Department of Space, 1973):

- Since the Indian National Satellite is to follow SITE very closely, decisions approving the plan as a whole as a national commitment should be made early.
- Steps should be taken early to arrange international frequency coordination for the S-band and to obtain agreement among the countries whose services might be affected.

- A vigorous program of research and development should be begun on the whole range of problems extending from development by 1981 of full launch capability and satellite electronics to development of TV projection systems for community viewing, digital modulation, and multiple access systems.

- It is urgent that an energetic manpower development program be begun to have in position, on a progressive basis, the required number of persons having the necessary skills.

Since implementation of an Indian National Satellite System (INSAT) represents a major investment both in space and ground segments during the Fifth Five-Year Plan period and since the use of satellite for national TV coverage involves many ministries and governmental departments, the Planning Commission has set up a task force, with Professor M. D. K. Menon, Chairman of the Electronics Commission and Secretary of the Department of Electronics of the Government of India, to examine all aspects relating to INSAT (Department of Electronics, 1973). The aim of the task force is to examine the scope and possibilities of using the first generation of INSAT, INSAT-1, for television broadcasting as well as telecommunications and earth resources survey, and to analyze the cost-effectiveness of the INSAT system for these purposes in relation to other options. The Planning Commission has indicated

the following priorities in the utilization of facilities made available by INSAT:

- Natural resources survey,
- Telecommunications, particularly related to rural areas, and,
- Television.

The main participants of the INSAT Task Force are (1) the Department of Space, which will be concerned with the space segment and earth stations; (2) the Department of Electronics, which is concerned with the overall electronics development and production activities in the TV and telecommunications connected with such a program; (3) the Ministry of Information and Broadcasting (I&B), which has the prime responsibility for the national TV coverage and broadcasting; and (4) the Ministry of Communications, which will make use of INSAT for general telecommunications. User departments of the Indian Government, such as Agriculture, Education, Health and Family Planning are also participating in the Task Force. The Task Force has established two separate working groups, one for hardware and another for software. The major objectives of the group working on

hardware are as follows:[6]

- To look into the detailed plan proposals of ISRO, Ministry of Information and Broadcasting (I&B), and with the Posts and Telegraphs (P&T) Department.
- To examine the proposed total system capabilities and recommend the hardware that would meet the requirements of the various users.

A draft version of the report of the INSAT hardware group (Planning Commission, 1973) has recently been released in India. Although the basic concept of INSAT has remained the same as in the first proposal made in 1969, the cost details, capabilities, and operational frequency for broadcast channels have somewhat altered. According to the draft report, issued in May 1973, INSAT satellite is to be located in geo-synchronous orbit at 79° East longitude. INSAT satellite is to have five spotbeams (See Figure 1 for the integrated TV coverage plan proposed by ISRO), each about 1.6° wide and operating on separate frequencies in the S-band (2.50-2.69 GHz), with an Equivalent Isotropic

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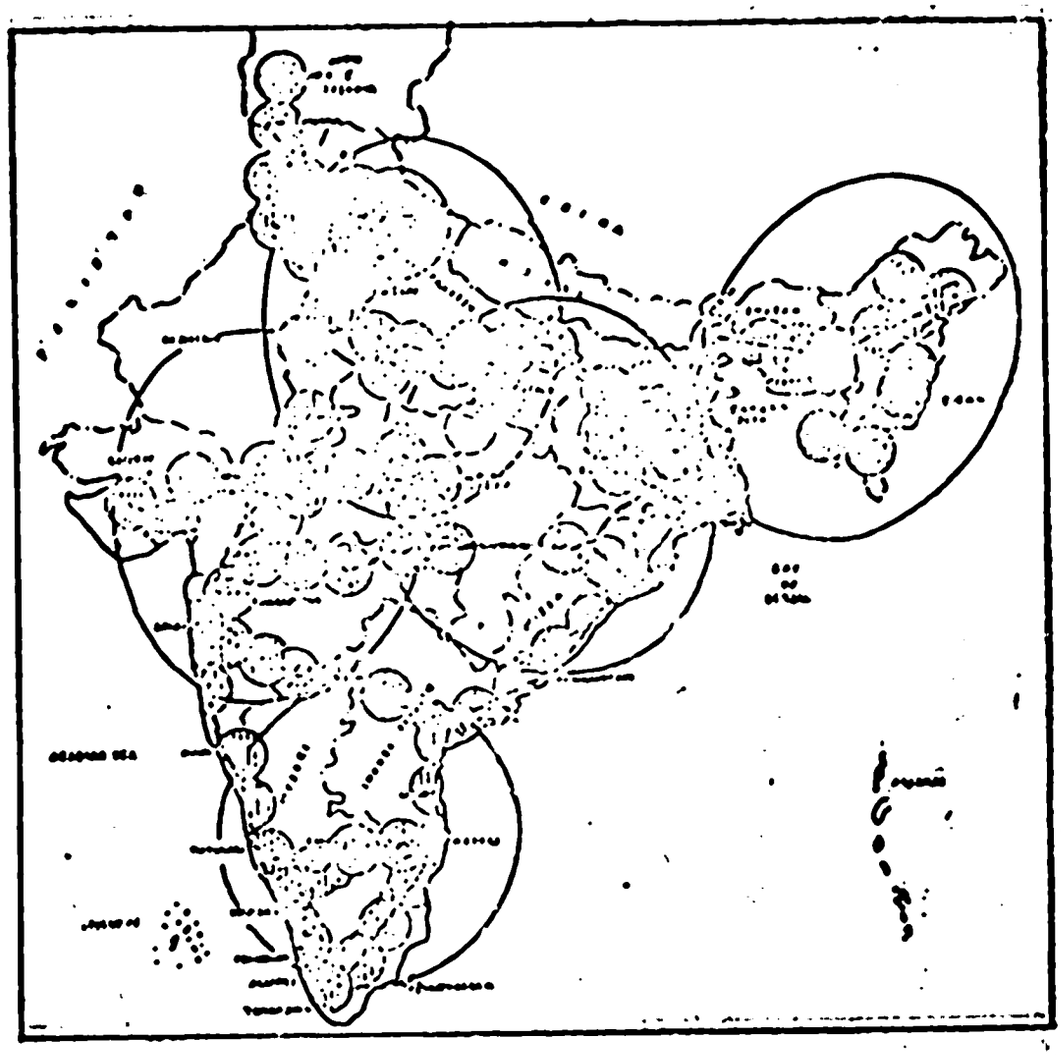
[6]At this writing, the authors had access only to the report of the hardware working group.



LEGEND:-

- IV PLAN MICROWAVE LINKS
- V PLAN MICROWAVE LINKS
- COVERAGE BY MOTHER STATIONS
- COVERAGE BY CTCP RELAY STATIONS
- COVERAGE BY OTHER RELAY STATIONS
- COVERAGE OF REMAINING AREAS BY SATELLITE

Figure 1. Integrated National TV Coverage Plan (1976-1981) proposed by ISRO

Radiated Power (EIRP) of 51 dbW (equivalent 125 KW). This EIRP is adequate to facilitate direct reception by augmented community satellite television receivers. INSAT-1 is to have a total of five transponders available for telecommunications for the use of P&T Department -- four of which are to operate in spotbeam mode in the C-band (4 and 6 GHz) to interconnect four major P&T switching centers; the remaining one, with a 6° beam, is to be used for remote area communication. The former are to handle three carriers each (38 dbW EIRP/Carrier and 450 one-way voice channels/carrier), whereas the latter is to have two transmitters (33.8 dbW EIRP/transmitter). The satellite is to be launched using a Thor-Delta launch vehicle.

The proposed INSAT configuration offers scope for relay broadcast of television programs both within the regions illuminated by the spotbeams and, when necessary, on a nationwide basis. The spotbeam technique is particularly attractive from the viewpoint of software because it can respond to distinct regional needs without affecting the possibility of a national hook-up. In addition to the interconnection of master and slave TV transmitters, which are to serve conventional Very High Frequency (VHF) TV sets,

the revised proposal calls for 150,000 community TV sets augmented for direct reception from the satellite. Also included in the revised INSAT proposal are 200 low-power rebroadcast VHF transmitters, which are to serve about 60,000 villages in areas with relatively high village density, but which are not included in the Fifth Five-Year Plan of AIR.

The group working on INSAT hardware has recommended the launch of the INSAT satellite in the fourth quarter of 1976. The total cost of the hybrid satellite-terrestrial television expansion in India during the Fifth Five-Year Plan is estimated as Rs 181.35 crores (U.S. $252 million); programming costs are not included in the $252 million estimate. The Planning Commission is expected to make its decision on the strategy for expansion of mass communication in India during the Fifth Plan (1975-79) shortly. The chances for the approval of INSAT seem to be fairly good. Although system cost estimates are important, perhaps central, if massive expansion of TV is decided upon, satellite and terrestrial costs would probably differ little. Thus, the authors believe that in India, the final decision might well depend upon such nontechnical considerations as:

- Which plan would most promote national unity while allowing for regional differences?

- Which plan shows promise of bringing the most creative talents to bear on the problem of programming?

- Which plan would allow for the type of detailed and ongoing critical evaluation that would lead to constructive evolution of the system?

- To what extent does each of the plans contribute to national security -- through technology creation and/or through creating dependence on foreign powers?

- How important is it to reach villages soon? (Speed of implementation is not universally considered desirable -- some claim that the development process could be thrown out of balance. Also, what are the implications of acquiring 570,000-1,400,000 television receivers in a short span of time?)

- Which plan is most compatible with the management structure capable of assessing and implementing national objectives?

The SITE experiment should provide information relevant to a number of these questions that could help guide the development of mass communications in India during the Fifth Plan and thereafter.

III. ISRO-NASA ATS-F SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT (SITE)

Introduction

On September 18, 1969, the Department of Atomic Energy of the Government of India, the agency responsible for space research in India at that time, and the National Aeronautics and Space Administration (NASA) of the United States signed a memorandum of understanding to conduct jointly an instructional television experiment using the ATS-F satellite.[7] The experiment will use direct satellite television broadcast to rural community receivers and limited rediffusion through Very High Frequency (VHF) transmitters in areas with relatively dense receiver population. The Department of Atomic Energy decided to engage in this experiment in order to follow up their 1967 study, which had concluded that a hybrid system with direct community reception and rebroadcast stations would be the best alternative. Originally, the ATS-F satellite was to be

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[7] Memorandum of Understanding Between the Department of Atomic Energy of the Government of India and the United States National Aeronautics and Space Administration, September 18, 1969.

available to India for experimentation in late 1972 or early 1973, some 6 months after its launch in the second quarter of 1972. Difficulties in satellite subsystem procurement and integration have caused the satellite launch to be delayed until April, 1974. The subsequent delay in initiation and scheduling of U.S. domestic educational technology demonstrations for the Rocky Mountain States, the Appalachian region, and Alaska for the first year of the satellite life have moved the starting date of the Indian ATS-F experiment to the middle of 1975.

After its first year over United States at 94° West longitude is completed, ATS-F will be moved to 35° East longitude for coverage of India. NASA will maintain control of the satellite, while the use of the satellite for the ITV experiment will be under the exclusive control of India. For 1 year, ATS-F will be made available for SITE for 4-6 hours each day. The appropriate authorities of the Government of India are solely responsible for coordinating radio frequencies, earth-to-satellite and satellite-to-earth transmissions, for the experiment.

A frequency-modulated TV carrier at 6 GHz will be transmitted to the

ATS-F earth-coverage antenna from one of the two earth stations: Ahmedabad or Delhi. The signal is to be processed and retransmitted at both 4 GHz and 860 MHz by the satellite-borne transponder. The 4 GHz downlink is to be used to monitor the system performance only on a limited time basis. The 860 MHz downlink will be used to test the concept of the hybrid system described earlier -- direct reception by low-cost augmented TV receivers as well as higher sensitivity (and cost) earth-stations for rebroadcast at VHF to conventional TV receivers. System design parameters are such that an equivalent TASO Grade I picture will be received by the direct reception terminal while a CCIR-recommended quality signal will be received by the rebroadcast earth-station. A total of 2,400 direct reception sets will be located in 2,400 villages. The direct reception terminals will be located in clusters of about 400 each in the various parts of India while, in addition, 3,000 conventional TV sets will be located in areas near existing or planned Very High Frequency (VHF) TV transmitters, and will receive SITE programming via rediffusion of satellite TV broadcast signal.

The ATS-F MHz antenna beam coverage of India for SITE is shown in Figure 2, along with the rediffusion and direct reception terminal

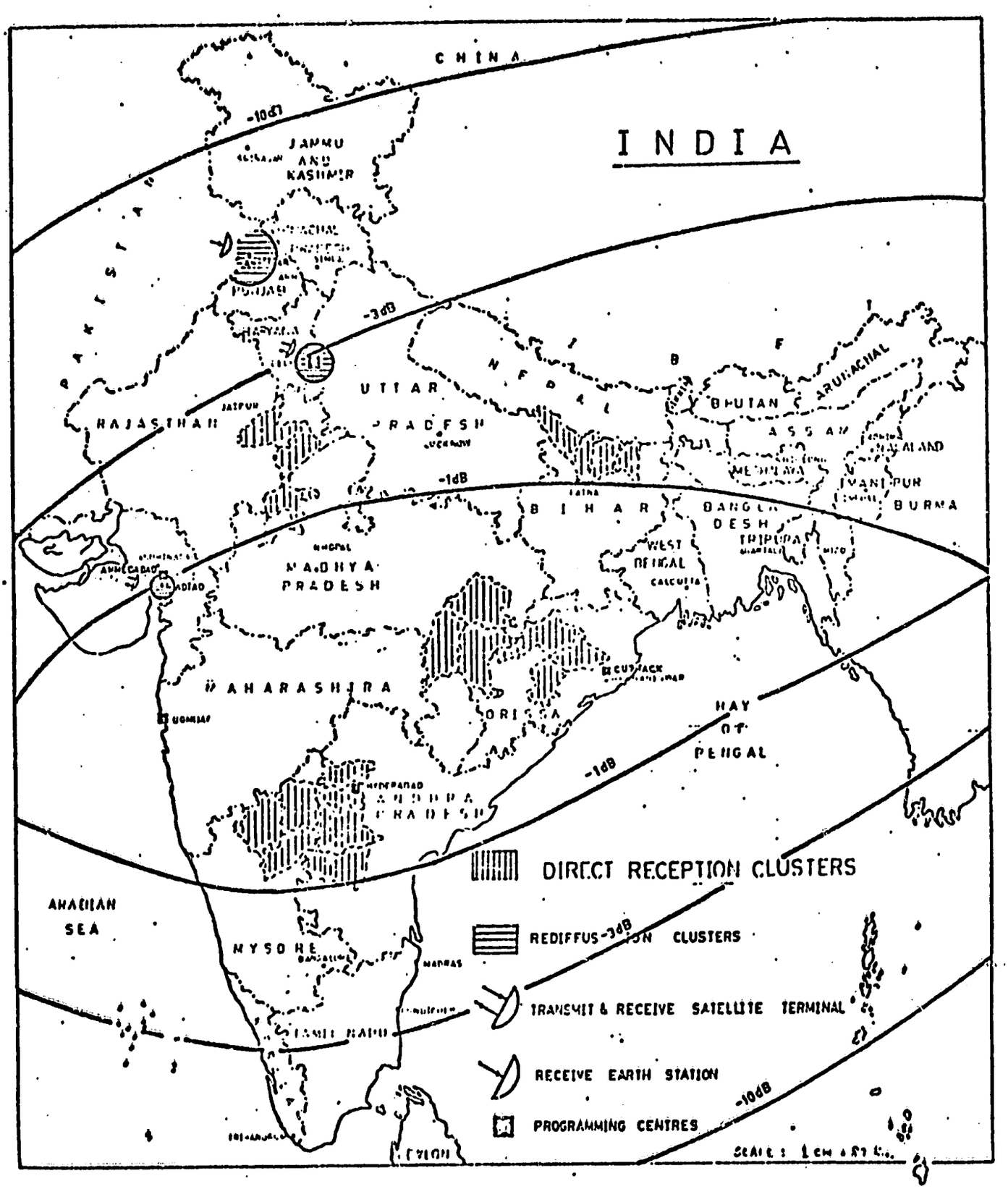

Figure 2. ATS-F Coverage of India at 860 MHz and Receiving Cluster Locations

clusters. Figure 3 shows centers of SITE activities in India, while Figure 4 shows a schematic diagram of site configuration.

Description of SITE

Objectives. The objectives of SITE can best be summarized by quoting directly from the DAE-NASA Memorandum of Understanding; these objectives still appear in official statements, e.g., Rao (1972).

General Objectives

The general objectives of the experiment will be to:

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

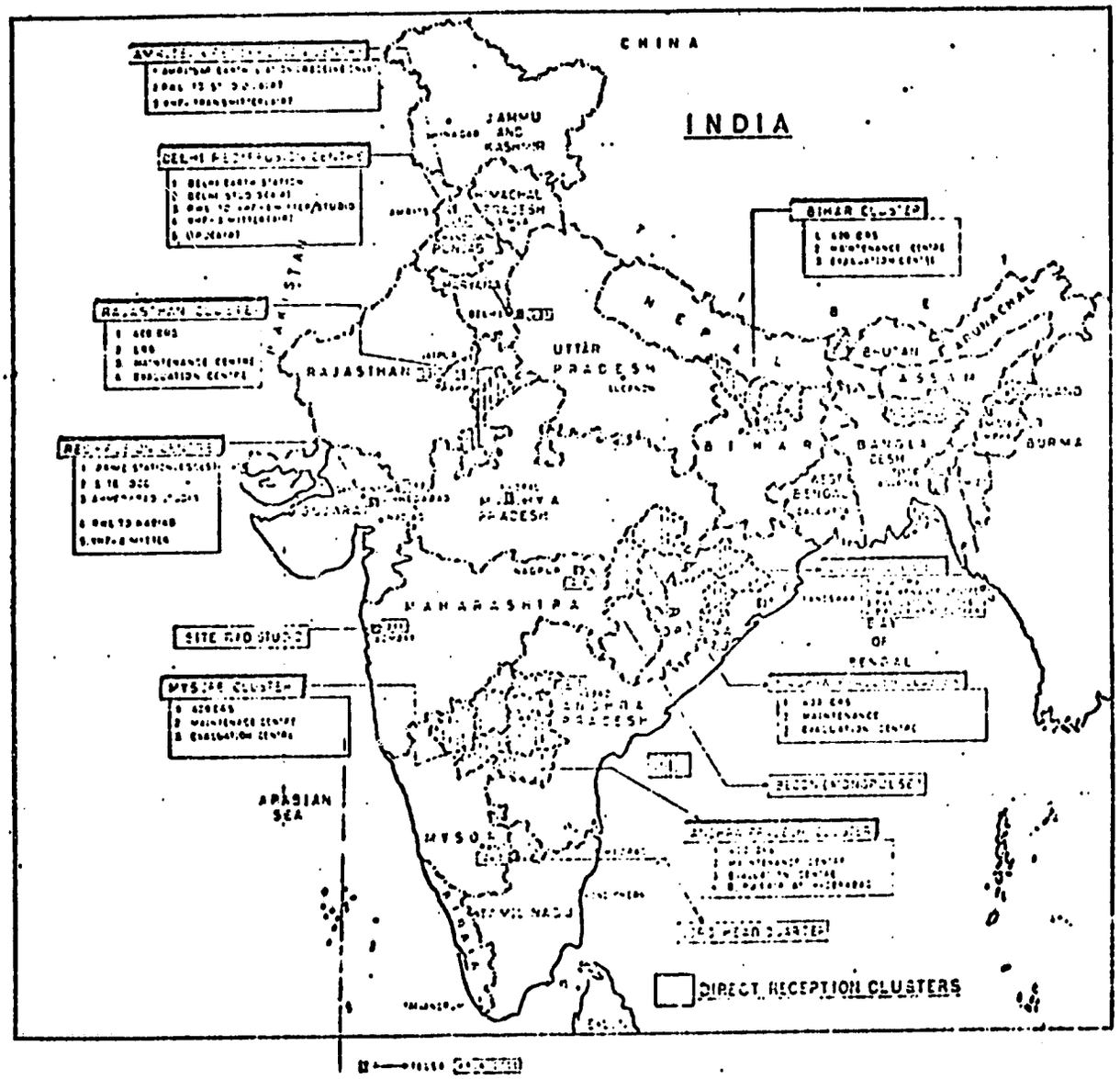

Figure 3. Centers of SITE activity in India

Specific Objectives

Indian Instructional Objectives

Primary

- Contribute to family-planning objectives.
- Improve agricultural practices.
- Contribute to national integration.

Secondary

- Contribute to general school and adult education.
- Contribute to teacher training.
- Improve other occupational skills.
- Improve health and hygiene.

Indian Technical Objectives

- Provide a system test of broadcast satellite TV for national development.
- Enhance capability in the design, manufacture, deployment, installation, operation, movement and maintenance of village TV receivers.
- Gain experience in the design, manufacture, installation, operation and maintenance of broadcast and/or distribution facilities to the extent that these are used in the experiment.

- Gain an opportunity to determine optimum receiver density, distribution, and scheduling, techniques of audience attraction and organization, and to solve problems involved in developing, preparing, presenting and transmitting TV program material.

United States Technical Objectives

- Test the design and functioning of an efficient, medium-power, wideband space-borne FM transmitter,[8] operating in the 800-900 MHz band, and gain experience in using this space application.

Target audience. As mentioned earlier, about 2,400 direct satellite TV broadcast reception sets will be deployed in six clusters of approximately 400 sets each by the Indian Space Research Organization (ISRO). Over 3,000 conventional TV sets in Amritsar, Delhi, Nadiad, and surrounding areas will also receive SITE programming through rediffusion of satellite TV broadcast signal by terrestrial TV transmitters. In consultation with the concerned departments of the Government of India, SITE management has recommended that the direct reception clusters be located in Orissa, Madhya Pradesh, Mysore, Andhra

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[8]This transponder is also to be used for Television Relay Using Small Terminals (TRUST) experiment in the United States. The purpose of this technological experiment is to advance and promote the technology of wideband satellite communications to small ground terminals by developing and demonstrating a pilot system using the ATS-F spacecraft with its high-gain parabolic reflector. Details of this experiment could be found in The ATS-F and -G DATA book (1972).

Pradesh, Bihar, and Rajasthan. Important considerations said to have weighed in selecting the cluster areas are (See Sarabhai, 1969, or Lal, 1969): (a) provision of TV service in these villages on a continuing basis even if there is no plan for an on-going national television satellite system; (b) availability of matching facilities on the ground so that the aspirations or expectations created through television programs could be satisfied; and, (c) maximum common agro-economic-socio conditions to get across the message. Using those criteria, ISRO and AIR, in consultation with user Ministries, have selected clusters to be located in parts of the following districts:

1. Hyderabad, Kurnool, Medek, and Mehboobnagar (Andhra Pradesh)
2. Champaran, Darbanga, Muzaffarpur, and Saharsa (Bihar)
3. Bilaspur, Durg, and Raipur (Madhya Pradesh)
4. Bijapur, Gulbarga, and Raichur (Mysore)
5. Dhenkenal, Phulbani, and Sambalpur (Orissa)
6. Jaipur, Kotah, and Sewai Madhopur (Rajasthan)

Since direct broadcast to community receivers would be most advantageous in isolated communities where receiver density is low and the

scope for development greatest, the low level of development of various states is reflected in the selection of direct reception clusters. The conventional TV receivers are to be located in three clusters around the existing TV stations at Delhi and Amritsar and a transmitter at Nadiad in Gujrat currently under construction.

The proposed areas present a fair cross-section of the different stages of economic development -- they include comparatively developed areas as well as those that are least developed. The selection of villages in these areas where direct reception and conventional TV sets will be installed has not yet been completed. It is being made final in consultation with the states involved and depends on such factors as accessibility, available power supply, and the existence of a suitable location for installation of a TV receiver.

Because available satellite time is limited (4 hours a day), it has been decided that programming for some of the target areas be undertaken jointly. Programs for Orissa and Madhya Pradesh will have a common picture, with Oriya and Hindi on the accompanying audio channels. Programs for Andhra Pradesh and Mysore will carry a common picture with two different languages on the

audio channel, whereas programs for Bihar and Rajasthan will be broadcast independently.

As discussed previously, the experiment has many, varied instructional objectives although they all deal with gaining insights into practical instruction of village inhabitants in family planning, agriculture, national integration, school and adult education, teacher training, occupational skills, and health and hygiene. Since the instructional objectives are varied, the audience for the total experiment includes illiterates, farmers, housewives, preschool children, school children, and classroom teachers. A broad program pattern for SITE has been worked out in collaboration with user agencies, including the Ministry of Agriculture, the Ministry of Family Planning, the Ministry of Education, and the Ministry for Information and Broadcasting. Because of the working and living conditions in Indian villages, the programming pattern makes the time for community viewing available in the evening (Chander, 1972). Because viewing time is limited, a composite format, about 2.5 hours long, has been planned. According to the latest available information, half an hour is to be devoted to a composite program on

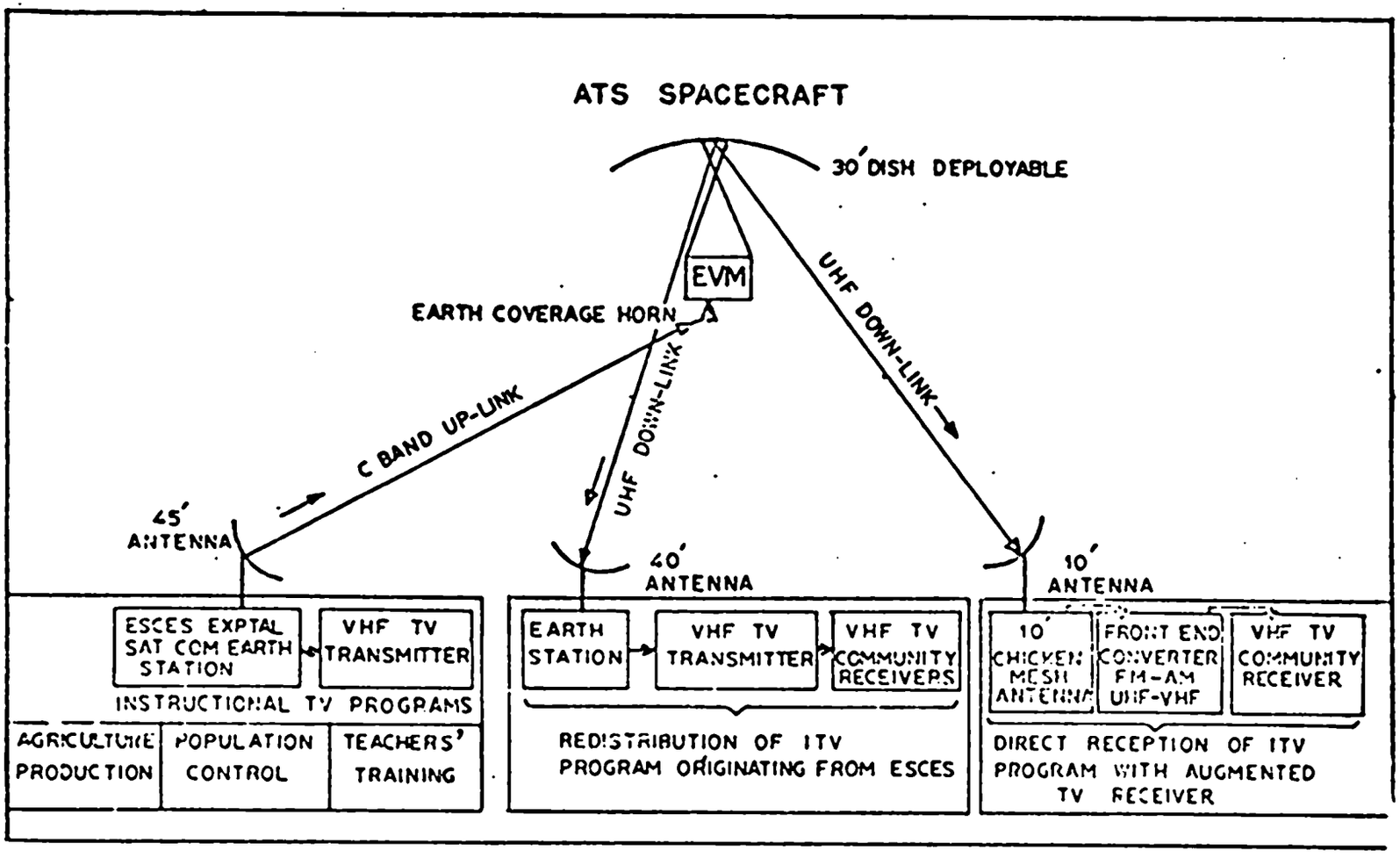

Figure 4. SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT
(Chitnis et al 1971)

agriculture, health and family planning; half an hour to a weather report, market rates, and news items of particular interest to rural communities; and, about an hour or so to what has been described as general meaningful entertainment. The utility programs will be directed to specific language groups, and general entertainment programs are to be common to all the groups and broadcast in Hindi, the national language of India.

For 1.5 hours every day, programs are planned for school age children and for teacher training. We have been unable to find any information on the specific objectives of these segments. In December 1972, Romesh Chander, who as Director of Television (Satellite) at the All India Radio is responsible for overall development of SITE software and evaluation of the experiment according to instructional objectives, mentioned that these programs will be designed to meet specific objectives decided by the educators; he did not mention the specific objectives and whether progress had been made on developing these programs (Chander, 1972).

Nature of Information that SITE Is Intended to Provide. SITE provides a system demonstration and test of broadcast satellite television for national development. Its basic purpose is to demonstrate

the feasibility of the hybrid concept -- direct satellite reception by community receivers in rural areas and rebroadcast at VHF in areas with relatively dense receiver population -- proposed by ISRO for extending television coverage to all of India in a short time span. Apart from building a constituency of supporters of the concept in the event of a successful implementation and operation, it will provide ISRO management with valuable insight into the design, manufacture, deployment, installation, operation, and maintenance of community receivers in rural areas. Such experience would be of great value not only in properly estimating the operating cost of an Indian national satellite television system but also in laying out the implementation and logistics for such a system. It will also yield very valuable information on the design, manufacture, operation, and installation of rediffusion facilities and provide an opportunity to determine optimum receiver density. The information it provides on cost, implementation problems, and village reactions to mass communication by television will be valuable in ascertaining whether massive investment in television is appropriate for India now or sometime in the future.

SITE will also provide an opportunity to determine effective techniques for attracting and organizing audiences and an opportunity to solve problems involved in developing and presenting bi- and unilingual.

TV program messages for practical instruction. In India, as pointed out earlier, the use of television for practical instruction of villagers has been quite limited. When TV has been used, it has been in villages near large metropolitan areas like Delhi. Little is known about the problems of perception and comprehension of the inhabitants of isolated rural areas far away from the major metropolitan centers. Also, SITE is an experiment in bringing change to isolated rural areas. Any rapid change in a setting that has been unchanged for long will undoubtedly be accompanied by a cultural shock. SITE experience can be helpful in determining techniques for presenting programs that make any accompanying shock palatable.

In brief, SITE is being looked upon in India as a giant case study to find answers to technical and programmatic problems encountered in planning, designing, organizing, and creating a viable system of educational broadcasting by satellite. However, the implications of SITE extend far beyond India. The experience and information it yields, especially in system hardware and organization areas, are likely to be of considerable interest to decisionmakers in other developing nations that have large areas, large populations, and the opportunity to use space communications systems for national needs.

Management of SITE

The Memorandum of Understanding between the Department of Atomic Energy (DAE) of the Government of India and the U.S. National Aeronautics and Space Administration (NASA) spells out the respective responsibilities of the DAE and NASA for conducting the experiment. The DAE[9] is to develop, provide, and maintain in service the ground segment of the TV satellite experiment system; to develop and use ITV program materials that will carry out the instructional objectives of the experiment; to develop and implement a mutually acceptable experiment evaluation plan; and to make available trainees for such training (at NASA facilities) as may be agreed upon by the Indian and U.S. program managers. NASA is to place into geostationary orbit the ATS-F satellite, position it at 35° East longitude to provide coverage to India, and maintain it on station for approximately 1 year. The time allocated for SITE is 4 hours a day.

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[9]Since 1972, the Indian Space Research Organization (ISRO) has been separated from the DAE and brought under the newly created Department of Space of the Government of India. Consequently, all DAE responsibilities cited in the Memorandum of Understanding in regard to SITE are now the responsibilities of the Department of Space.

NASA is also to provide the DAE training and consultative services agreed to between program managers. DAE and NASA are to meet all costs associated with their respective participation in SITE, and no exchange of funds between India and the United States is involved.

The Office of Communication Programs of the NASA Office of Applications is in charge of managing the U.S. responsibilities. William Robbins of this office is the U.S. program manager for SITE; Anthony Sebelhaus of the Goddard Space Flight Center's ATS Project Office serves as U.S. Project Manager and Leader of the Operations Working Group; and John E. Miller of Goddard Space Flight Center, the U.S. Principal Investigator of SITE, is primarily responsible for technical matters. The Program Manager coordinates the U.S. effort and carries out day-to-day project requirements in collaboration with the Indian Program Manager, the ATS Project Office at the Goddard Space Flight Center, and NASA's Office of International Affairs.

In India, the development, implementation, and evaluation of Satellite Instructional Television Experiment (SITE) is the responsibility of the Space Applications Center of the Indian Space Research Organization (ISRO). ISRO has set up a SITE Policy Committee chaired by

Professor S. Dhawan, Chairman of ISRO, to provide policy guidelines for SITE planning, implementation, and interagency coordination. The Space Applications Center has established a SITE Management Board for the management of SITE. It is chaired by Professor E. V. Chitnis, the Program Manager for SITE. In contrast to NASA, which has only one Project Manager for SITE who is primarily concerned with the ATS-F spacecraft, SITE Management Board has three Project Managers, one each for Earth Stations, Electronics,and TV Hardware and Software. The overall SITE operations in ISRO are the responsibility of the Operations Manager. A systems engineering group provides systems support for SITE, particularly for activities like system integration, systems checkout, deployment, etc. ISRO coordinates its responsibilities with those of NASA through an ISRO resident representative at the Goddard Space Flight Center of NASA and through periodic ISRO-NASA SITE review meetings held alternately in India and the United States.

The All India Radio (AIR) has the prime responsibility for SITE software, although the Audio Visual Instructional Division (AVID) of the Space Applications Center has been given a major role in software R&D.

AIR has set up a special unit to fulfill its responsibilities. Since a number of other ministries[10] are providing inputs to SITE, a SITE Inter-Ministerial Coordination Committee has been established under the Chairmanship of Professor S. Dhawan, Secretary of the Department of Space and Chairman, ISRO.

The Electronic Systems Division (ESD) of ISRO has responsibility for the ground segment required for the experiment. The ESD is also responsible for developing ruggedized solid state TV receivers that can be used for community viewing in unelectrified villages, and front-end converters required for direct satellite reception. Prototype models of the solid state TV sets have been developed by the ESD, which is currently involved in developing low-power VHF TV transmitters for rediffusion.

The Experimental Satellite Communications Earth Station (ESCES) of ISRO will serve as the prime station during the experiment. It will be used for transmitting TV program material to ATS-F and

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[10]These ministries include Education, Family Planning, Agriculture, Health, and Information and Broadcasting.

for monitoring these transmissions and the performance of the spacecraft. ESCES will also coordinate with NASA and other Indian earth stations being set up for the experiment at Delhi and Amritsar. ESCES has been modified for the purposes of the experiment with the assistance of the United Nations Development Program (UNDP). The chicken mesh antenna required for the direct satellite reception -- 3.04 meters in diameter -- has been designed by ESCES. ESCES is also responsible for setting up a receive-transmit earth station at Delhi and a receive-only earth station at Amritsar for SITE.

ISRO has created an Audio Visual Instructional Division (AVID) for SITE. AVID, which is located at Ahmedabad with an R&D Studio in Bombay, is to look after the instructional aspects and objectives of the experiment, primarily those related to research and evaluation. AVID, along with the All India Radio's (AIR) Television (Satellite) section, is engaged in the planning of instructional prototype material and in evolving an optimum research-cum-production methodology for production of programs for SITE.

Field units are planned for installing and maintaining receivers, for providing film inserts to bring the telecasts within the day-to-day experience of the audience, and for ensuring proper use of the programs.

The details of the programming and utilization field units are not yet available, but those for receiver maintenance are fully developed. Figure 5 shows the three-tier maintenance system for SITE that has been proposed by Rao and Karnik (1972).

The first tier will be at the village level and have only the bare minimum of equipment required. The second tier will be larger both in terms of equipment and manpower and will be located in a reasonably large town. The third or top tier will function as a central office of administrative control and maintenance planning and inventory control. At the lowest level the maintenance unit will act mainly to identify and replace the faulty modules. The modules will not be repaired at this level unless the fault is a simple and obvious one. They will be sent to the next level (tier 2), which will look after the repair of modules and their return to the sender for reuse. Only if the defect cannot be traced by the tier 1 technician will the set itself be removed and sent to the tier 2 center. Tier 3 will function mainly as a central control office for administration, inventory control, and planning and data analysis. It will collect all the necessary data on set failures, which will be passed on both to the lower level centers and the set manufacturer. There are no plans for providing tier 1

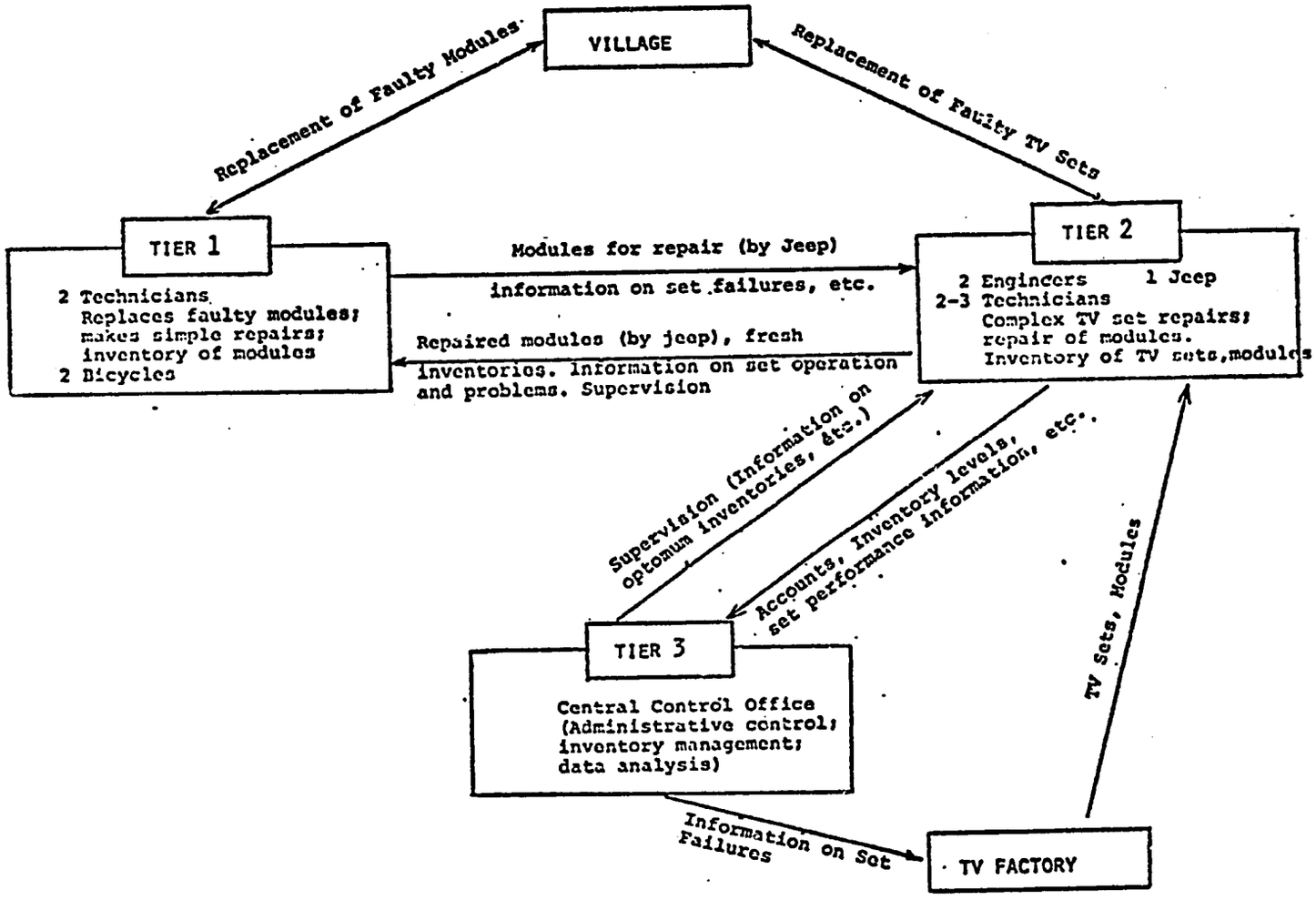

Figure 5. Maintenance System for SITE (Rao and Karnik (1972))

technicians with mechanized transport except bicycles. Tier 2 centers, one in each cluster of villages participating in SITE, will have a jeep for transporting sets and administering four to six tier 1 centers.

SITE Hardware

The hardware needed for the SITE experiment includes receive and transmit earth stations at Ahmedabad and Delhi and a receive-only station at Amritsar; ruggedized solid-state TV sets with low-power consumption; receive antennas for direct reception; the front-end converters for receiving wideband FM satellite signal at UHF and delivering to the TV set a VHF AM-VSB signal; power sources for sets in unelectrified areas; and, VHF rediffusion systems. Except for some of the subsystems of the three earth stations, all the hardware systems for SITE have been designed by ISRO and are to be manufactured in India. This is no small feat for a developing nation like India whose electronics industry has limited experience in the design and manufacture of VHF, UHF, and microwave components and systems and has only recently initiated production of television receivers and other related equipment.

As far as the earth stations are concerned, ISRO engineers are responsible for systems design, installation, maintenance, and management of earth stations for SITE at Delhi and Amritsar. ISRO engineers have already acquired experience in these tasks by setting up the Vikram Earth Station at Arvi, which is a part of the INTELSAT system. The United Nation's Development Program (UNDP) has provided assistance through the International Telecommunications Union (ITU) for upgrading the Experimental Satellite Communication Earth Station (ESCES) at Ahmedabad, which is to serve as the prime earth station for SITE. Hughes Aircraft Company is participating in this effort, which is being coordinated in India by an ITU Technical Coordinator.

A Compendium of Monographs on the hardware aspects of Satellite Instructional Television Systems by Rao et al. (1972) and the Annual Report (1972-73) of the Department of Space (1973) present an excellent overview of the research, design and development problems of the various aspects of the hardware requirements of the SITE ground segment and provide a progress report on the various hardware projects and the development of a maintenance system for servicing receiving systems. These reports indicate that the hardware systems have gone

through a successful developmental and laboratory prototyping phase. What remains to be seen is how successfully these prototypes can be put into quantity production, which undoubtedly would take place outside of ISRO (at the Electronic Corporation of India Ltd.).

The Electronic Systems Division (ESD) of ISRO has completed the prototyping and testing of community receivers (a direct reception antenna, a UHF front-end, and a conventional television set). Solid state ruggedized TV sets suitable for use in villages during SITE have been developed by ESD and the Electronics Corporation of India, Ltd. ISRO has decided in favor of ECIL design. ECIL is to manufacture 2,400 solid state ruggedized TV sets for use in SITE. These sets are designed for operation from 24-volt battery in unelectrified villages. The set design is modular for ease of servicing and maintenance. ECIL has been engaged in manufacture of regular TV sets for use in cities. Based on ECIL's experience with manufacture of regular TV sets, a Mean Time Before Failure (MTBF) of 2,000 hours is anticipated for ruggedized sets.

The three approaches proposed for powering receiving systems in unelectrified villages are:[11]

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[11] At present, less than 20 percent of the villages in India are electrified. The receiving systems to be installed are DC/AC type and, in unelectrified areas, use lead-acid type batteries for electric power.

1. Wherever possible, existing power distribution be used; where a village is situated within 2 miles of existing lines, extensions to the villages be made.

2. For distances greater than 2 miles from a power source, engine/generators be used for central battery charging with capacity large enough to service villages within distances up to 5 miles.

3. To service all villages and battery-operated sets at distances greater than 5 miles from a power source, a dedicated engine/generator be provided in each such village.

The community receiving systems for direct satellite television reception at UHF from ATS-F will use a 10-foot diameter chicken-mesh paraboloidal antenna (25 dB gain with 40 percent efficiency). The antenna developed by ISRO engineers is completely steerable, easily transportable, and simple to install. The cost estimates for 7- and 10-foot antennas are Rs 375 (U.S. $52) and Rs 500 (U.S. $70), respectively. The antenna and supporting structure are designed to withstand a wind velocity of 50 miles or greater. The UHF front-end has a 30 MHz band-width in the 790-890 MHz band and the noise figure of the complete receiving system is 6 dB. The size of the television set is to be 23" diagonal. Although the receiving system will be capable of receiving both audio channels transmitted along with the video signal,

only one of the channels could be selected for hearing at any given time.

The limited rebroadcast systems, contemplated for use in SITE to reduce ground equipment costs in small areas (300 square miles or so) with high receiver densities, will have a 15-foot parabaloidal antenna similar in design to that used for direct satellite reception, a transistor preamplified with 4.5 dB noise figure, a converter to extract the baseband from the FM satellite signal, and a conventional TV transmitter. The AM-VSB rebroadcast transmitters will operate in Bands I & III (Channels 4-7) with a 100-watt peak power with a transmitting antenna having a gain of at least 5 dB and antenna tower height of about 150-250 feet. A superturnstile antenna structure has been chosen for AM-VSB rediffusion. The 100-watt peak power AM-VSB rediffusion system, including satellite reception antenna, preamplifier, converter, 100-watt peak power solid state transmitter, 150-foot antenna tower, and a superturnstile antenna, is projected at Rs 175,000 (U.S. $23,000).

Software for SITE

An examination of the programming that has been proposed for SITE (see Chitnis et al., 1971 and Chander, 1972) suggests that SITE is

really an experiment in educational television with both instructional and what has been described in the United States as public components. SITE is concerned not only with practical instruction but also with cultural enrichment.

A total of 4 hours a day of programming is planned for SITE -- 2.5 hours of it in the evening and the remaining in the day. In the evening, half an hour is to be devoted to a composite program on agriculture, health, and family planning, etc., half an hour to news and current affairs, and about an hour to general "meaningful" entertainment. During the day, programs will be addressed to school age children and classroom teachers.

As mentioned previously, programs for some of the target areas are to be grouped together. Programs for Orissa and Madhya Pradesh will have a common picture with Oriya and Hindi on the two audio channels. Participating villagers in Andhra Pradesh and Mysore will receive a common video signal with two different languages (Tamil and Telegu) on the audio channels, while the programs for Bihar and Rajasthan states will be put out independently with only one audio (in Hindi). The utility programs in the evening, i.e., programs dealing with agriculture, health, family planning, etc., will be directed to specific language

groups -- Tamil/Telegu, Oriya/Bengali, and Hindi. The general entertainment program would be common to all the groups and in a language (most likely Hindi, the national language of India) that may to an extent be understood in all the regions. Thus, the general entertainment programs are also to serve to promote national unity.

Table 1 gives the proposed evening broadcast schedule for SITE. In the winter months, the programming is advanced by half-hour as the day ends earlier. The above time allocations give a viewing time of 60 minutes to the Andhra Pradesh and Mysore audience, 60 minutes to the Orissa audience, and 120 minutes to the Madhya Pradesh, Bihar, and Rajasthan audience. AIR feels that even though the instructional programs of one region like Madhya Pradesh may not have much relevance to another region like Rajasthan, the very fact that the audience would be exposed to television for an appreciable length of time might give a more observable impact.

A clear picture of the daytime programming for SITE is yet to emerge. Apparently, the SITE programming group is still busy sorting out what the focus for "in-school" satellite television should be, since the various states follow different curricula. The SITE group is reported to be examining the possibilities of teaching a

Table I

SITE EVENING BROADCAST TIME-TABLE

PERIOD	TIME (P.M.)	REGION
June 3, 1975 to September 30, 1975	6:30 - 7:00	Andhra Pradesh and Mysore
	7:00 - 7:30	Common Program to all Regions
March 1, 1976 to June 2, 1976	7:30 - 8:00	Madhya Pradesh and Orissa
	8:00 - 8:30	Bihar
	8:30 - 9:00	Rajasthan
October 1, 1975 to February 29, 1976	6:00 - 6:30	Bihar
	6:30 - 7:00	Rajasthan
	7:00 - 7:30	Madhya Pradesh and Orissa
	7:30 - 8:00	Common Program to all Regions
	8:00 - 8:30	Andhra Pradesh and Mysore

common language through the satellite television. Anyone knowledgeable in the problems involved in organizing instructional television across school district and state boundaries in the United States can easily appreciate the problems that SITE management might be facing in this area, especially when the satellite has only one channel to offer, for only 4 hours a day. Recently, suggestions have been to do away with the "in-school" component and instead focus on adults (U.N. Panel Meeting on Satellite Instructional Television Systems, (1972). However, as pointed out by Chander (1972), since the farmers are not likely to be available for more than 2.5 hours every evening, the remaining time could best be used for a school TV. Indications are that the daytime programming will not be designed for use as an integral part of the classroom teaching and that it would not be directed at a particular grade. Instead, it would aim at a broad age group. The Ministry of Education is reportedly coordinating school schedules in the cluster states. The absence of a clear picture of the daytime programming is disturbing when one considers that the experiment is to start in only 20 months. The consolation lies in the fact that AIR has previous experience in in-school programming, and some of the initial learning would be reduced.

On the basis of a 4-hour transmission schedule every day, the total program requirements for the experiment will be in the neighborhood of 1,500 hours. A substantial part of these, some 300-400 hours worth, are to be prepared before the experiment begins, and the remainder are to be developed during the year as the experiment progresses. AIR has decided that the programs must use the regional idiom and should be oriented to local needs if they are to effectively support developmental efforts (Chander, 1972). Because of the grouping of programs for some of the target areas, off-screen commentary will probably be used, which, as Chander (1972) has pointed out, is not the most effective way to use an intimate medium like television. To make the pictures on the TV screen relevant to the environment in which the viewers live, field film units will be set up in each area where direct satellite television receivers are to be installed. The field units will not only provide film-inserts, etc., for final production of programs at the base production units at Delhi, Hyderabad, and Cuttack but also support the feedback and provide feedback material.

The program material for SITE will be produced at the base production units at Delhi, Hyderabad (Andhra Pradesh), and Cuttack (Orissa).

Delhi will provide overall coordination. The programs will be sent, by mail or air freight, to Experimental Satellite Communication Earth Station (ESCES) at Ahmedabad, the prime earth station for SITE, where ISRO is setting up a continuity studio to be used for transmitting recorded programs to ATS-F from Bombay and Delhi.

SITE programming group is reported to be moving ahead with developing audience profiles and identifying the viewing needs of the target audience. Before launching into production, a number of programs for each region, on a variety of subjects, will be prepared for pretesting, which will be carried out in selected villages in the cluster areas with the help of portable video tape play-back units. These programs during the pretesting stage will also be used to train teachers and monitors in using television sets at the receiving end. Aware that pretesting programs is important, SITE programming management is seeking to involve sociologists and other social scientists concerned with mass communication who may participate in formative evaluation of SITE and impact studies from the start.

The Indian approach to software development for SITE has been the same as for the hardware. As described by Chitnis et al. (1971),

it has been marked by a reliance on indigenous resources and norms and by stress on an innovative approach in harmony with the Indian environment rather than on importing ready-made solutions and turn-key operations. While the need for preserving the traditional culture and exploring the adaptation of the traditional forms of communication used in village India is well recognized, the importance of bridging the gulf between urban and rural life by trying to find a common denominator, as far as possible, in the field of entertainment is also accepted. In developing programs with "developmental messages," SITE programming management seems to be relying heavily on some 6 years of successful experience with "Krishi Darshan," an agricultural teleclub program broadcast by the Delhi TV station since 1967 with the support of ISRO and in collaboration with the Indian Agricultural Research Institute (IARI) and the Delhi municipal administration. The Audio Visual Instructional Division (AVID) of ISRO, too, has initiated experiments to determine effective formats for program presentation. One such experiment was carried out in Bombay where three formats of a nutrition program presentation were tested for a comparative message registration and acceptance by the audience (U.N. Panel Meeting on Satellite Instructional Television Systems, 1972). SITE programming personnel are also reported

to be preparing for an image perception and comprehension study to provide information needed for producing programs for rural audiences.

Those involved in developing software for SITE are interested in new techniques and tools of program production. Near-term plans call for experimentation with Super-8mm film technology in collaboration with the Department of Family Planning. Collaboration with the Ministry of Education's new Centre for Educational Technology and the National Centre for Educational Research and Training (NCERT) for different types of programs for children of different age groups and for functional literacy is also being discussed.

In brief, contrary to some report of confusion in SITE software planning and production, there is indication that personnel responsible for SITE software seem to know, to a large extent, what they are doing. What is bothersome is the slow pace of developments to date and the fact that the software production is yet to take off. Some 1,400-1,500 hours of programs are needed for SITE, and only 1,800-2,000 working hours are left before ATS-F becomes available for SITE. The situation is considerably brightened by the fact that the agency responsible for SITE software is not new to the programming business, that at least four studios would be working on

SITE software (Delhi, Hyderabad, Cuttak, and Bombay), and that some of the programming would be farmed out to other sources in India that have prior experience in television or cinema.

Evaluation Design for SITE

The information available on the evaluation aspects of SITE is meager and rather sketchy. Although a number of activities that relate to formative evaluation have begun or are planned, no design for the summative evaluation for the experiment has yet emerged. Formative evaluation -- pretesting program material, tapecasting roughs ahead of actual broadcast, and feedback through the film and utilization support field units -- is expected to provide some measure of the performance for continuous improvements in the design of program material and utilization support before and during the experiment. Since a substantial portion of the program material is to be developed before the experiment begins, the formative evaluation during the experiment will primarily be concerned with the organization and services of the utilization support units and the logistics of receiver maintenance.

Details regarding the plan for evaluation of SITE are reportedly being hammered out jointly by ISRO and AIR. Plans call for contracting of quantitative evaluation involving such areas as knowledge, acceptance, and practice (KAP) to an independent institution in India with good professional standing. ISRO plans to undertake some of the valuation, particularly, in the field of communication research and studies related to the impact of the project on rural communities with the participation of Indian social scientists and academic institutions. ISRO is building a core research staff of 40-50 persons including 30 field investigators to carry out the communication research and to maintain liaison with the independent agency doing quantitative KAP evaluation.

SITE Costs

ISRO and NASA are meeting all costs associated with their own participation in SITE and are not exchanging any funds. It is hard to give any account of the costs incurred by NASA in SITE because NASA has not procured any hardware exclusively for SITE. Even the 80-watt 860-MHz UHF transponder onboard ATS-F has a dual purpose; it is to be used for experiments in the United States and for SITE in

India. If one can allocate a suitable proportion of the satellite integration, testing, launching, and orbit-keeping costs of ATS-F to SITE, an estimate of $12 million would not be too far from the actual figure.

The Indian Space Research Organization (ISRO) had originally budgeted approximately Rs 6.5 crores (U.S. $9 million) for SITE hardware, management, software R&D, and receiver maintenance, which reportedly has been revised to Rs 9 crores (U.S. $12.5 million). All India Radio, which is responsible for SITE software, is currently carrying out the activity on a nonproject basis, with the funding being made available from regular budget. In addition to ISRO and AIR, the United Nations Development Program (UNDP) has contributed to SITE, perhaps indirectly, by establishing a television training institute and providing for additional hardware for the Experimental Satellite Communications Earth Station (ESCES) at Ahmedabad. In view of these, the actual cost of the experiment to India is likely to run anywhere in-between $17-20 million.

Current breakdown of the costs of the system hardware, software, evaluation, management, maintenance is unavailable. In 1968 the estimate for the hardware and facilities costs alone was $6.7 million

(Rao et al., 1968). Table 2 presents itemized hardware and facilities cost estimates for SITE as of 1968. However, the revisions in the experiment plan since then and the experience gained in the design of the experiment have caused an increase in hardware and facilities outlay. To the extent we have been able to ascertain, the funding for the experiment is not a problem. There seems to be a national commitment to SITE, and the necessary financial resources required to make this complicated and important experiment succeed are being made available.

Table 2

Estimated Hardware Costs of SITE
(Rao et al., 1968)

Item	Costs in U.S. Millions
One earth station (transmit and receive capability)	$1.50
Three earth stations (receive-only capability)	0.30
Three VHF transmitting stations	3.00
3,300 (3,000 + 10 percent as standbys) conventional TV receivers ($240)	0.792
2,200 (2,000 + 10 percent as standbys) TV receivers for direct reception ($345 each)	0.764
30 Jeeps for receiver maintenance	0.080
Five receiver maintenance centers	
Land	0.040
Buildings	0.133
Test equipment	0.133
TOTAL	$6.742

In each area we have surveyed -- management structure, hardware and software development, and evaluation plans -- we have found that SITE shows promise of meeting the objectives established for it, except for software production which has been slow in taking-off; it should be remembered, though, that this case study is based on secondary sources. Nevertheless, as far as we can ascertain, the financial, technical, and management resources required to make this complicated and important experiment succeed are being supplied.

Although we are optimistic about the potential for success of SITE, we are concerned that the information that SITE will provide may not be complemented by a searching analysis of the long-term mass communication needs of India. It is important to remember that SITE's function is to provide information to decisionmakers as well as to stimulate the development of expertise in Indian communication industries. SITE will be successful to the extent that it provides accurate information to decisionmakers on the costs and benefits of satellite-distributed television; SITE could be as much of a success if the information it provides gives a firm basis for not proceeding with satellite-distributed television as if the information suggests the desirability of proceeding. How adequately the information

~~provided by~~ SITE will be used depends critically on whether it is used to analyze India's mass communication needs and alternative ways to meet those needs. This task is already being begun by the Planning Commission.

The principal conclusion of this case history is, then, that the Indian Planning Commission should continue to undertake, either in-house or partially on a contract basis, cost-benefit analyses of alternative paces and methods for developing mass communication in India. Studies should be made of how to get the most out of the information provided by SITE. For a given level of financial commitment, what returns could be expected from different ways of using television? or radio? In which areas do the quality advantages of television outweigh radio's advantage of being able to reach many more people for the same budget? What, then, is the optimal mix of radio and television? How does satellite transmission compare economically with all alternative means of television distribution as a function of the fraction and geographical distribution of the population to be served? How costly would satellite distribution of radio (perhaps multichannel) be? Would this be attractive primarily in terms of providing a networking service to a dense grid

of local stations that would also originate some of their own programming? The SITE experience will provide valuable empirical data for analyzing some of these questions and alternatives. If, however, an objective outside body, such as the Planning Commission, fails to continue vigorously with these analyses, a great deal of the information value of SITE will have been lost even if it is a technical and programming success.

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AN EDUCATIONAL TELEVISION SATELLITE EXPERIMENT:

FEDERATION OF ROCKY MOUNTAIN STATES

by Bert Cowlan

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INTRODUCTION

"In writing history, we know the end before we can consider the beginning and we can never fully recapture what it was to know the beginning only."

Anon.

This quotation is particularly appropriate for trying to relate the aims, objectives, and projected modus operandi of what will be the first use of the ATS-F (Applications Technology Satellite "F") set for launching in April or May 1974. Taking part in this project will be the Federation of Rocky Mountain States -- representing Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming -- which was established in 1966 to jointly solve regional problems. The Federation seeks to initiate, stimulate, and support "commercial, scientific, technological, economic, civic, cultural, and educational activities necessary to the orderly development of the region." Of particular interest here, of course, is the Satellite Technology Demonstration, which will use the National Aeronautics and Space Administration's ATS-F satellite to broadcast educational and two-way communication throughout the Rocky Mountain States.

The project has had a stormy history: its objectives, which have not always been clearly defined, have changed, as has the amount of its funding. At the outset,

it was intended to test a new technology. Later, its purpose became testing the delivery of social services to a number of audiences. Its funding was approximately $7.5 million from August 1973 through launch and one year of operation, including the cost of various components. The projected budget had once reached $26 million.

But even as the launch date nears, new plans are being formulated and new adjustments to fiscal and other constraints are being made. Detailed budgetary information is still not public since the concerned government funding sources have not yet "signed-off" on a final budget. The project has been operational in one form or another for about two years. As for the management team, some of its members have been associated with the experiment for a considerable length of time, but the project manager is new to his post. The reasons for this mercurial state of affairs are complex.[1]

Much of what is described here is tentative; many parts of the project are only in the planning stages or are just beginning. It is certainly too early to predict the success of specific plans. It does seem important, though, to state that goals and objectives for projects using new technologies are not easily formulated. Nor is the management of large, complex, and untried systems easy to analyze. The planning, management, and maintenance of a project of the scope of the Rocky Mountain experiment require not only money, but also manpower. Furthermore, the manpower must be highly skilled,[2] and the team must be able to learn and appreciate vocabularies of different disciplines, so that it can deal with the forces that can result from education, communication, and technology.

If this case history is to be useful to countries that may be considering using an educational television satellite, the "message" lies in the previous paragraph. The suitability depends on the country and the culture, on the availability of managerial skills, and on whether several nations plan regional or consortium activity (the Rocky Mountain States, while having great individual differences, share a common language, culture, and Federal legal system). It is hoped that this study will indicate the kind and level of problems to be considered by nations contemplating satellite use.

HISTORY OF THE PROJECT

This history is drawn largely from internal documents of both the Satellite Technology Demonstration and the Federation of Rocky Mountain States.[3]

In late 1970 (or 1971) Federal policy planners formulated a plan to increase the Corporation for Public Broadcasting budget by about $150,000 for the purchase of a half-dozen satellite ground receivers. It was expected that these receivers would be used to broadcast "Sesame Street," a television program for youngsters aged 3 to 5, to isolated areas not served by public (noncommercial) broadcasting stations. The plan presumed the allocation by the World Administrative Radio Conference of the 2.5 GHz frequency.

As far back as 1969, the Federation of Rocky Mountain States had expressed interest in a project that would use satellite-based broadcasts to improve

the quality of education in small isolated schools in the region. In 1971, NASA (National Aeronautics and Space Administration) and HEW (Department of Health, Education, and Welfare) planners were looking for regional organizations to carry out an Educational Technology Demonstration using the ATS-F satellite. The Federation, based in Denver, Colorado, had indicated its desire to participate in some such activity, that it was aware of the potentials of the satellite. Discussions of mutual interest began.

While this was happening, another important step was taken. At its Geneva meeting in the summer of 1971, WARC allocated the 2.5 GHz band exclusively for space and terrestrial noncommercial broadcasting. This meant that, for the first time, on a worldwide experimental basis, a satellite broadcast signal could be received by low-cost ground equipment.

Funding the Project

Even before WARC, the Federation had been awarded a contract to prepare plans for a 1973 (the original target date) HEW-CPB-NASA experiment, as above. "The Historical Record" (which has been quoted) deals at length with the funding history. Since many of the same kinds of problems encountered by the project are apt to be encountered in other countries -- and for similar reasons -- the history of the funding is detailed here.

> Organization of funding for the STD has not been a simple process. Paradoxically, the factors which have complicated the process of obtaining funding for the project are the same factors which have justified funding for the project.
>
> There is a rising cost pressure on public services, particularly education, and this is a major reason the STD is being funded. The cost of education is rising at a time when taxpayers appear unwilling to pay much more for it. /This situation is not dissimilar to the inability of the developing nation to allocate any further percentage of its budget to education./ If the quality of education in the United States is to be increased, or even maintained, more cost-effective means of delivering this service must be developed. Technology is one potential avenue of relief. In order to eventually save public money, public money must be spent to explore the potential of technology applied to the delivery of educational services on a relatively large scale.
>
> But obtaining public money to spend in this way when the funds for education are increasingly scarce has been a complicated process. Project funding has had to be organized in a context of tightening federal budgets prompted by voter displeasure with high taxes and inflation. During this period the budgets of federal agencies have generally either remained at the same level or decreased, greatly increasing the competition within and among agencies for funds for new projects, even for projects which might provide information to help save federal funds.*

The first proposal to obtain funding resulted from a meeting in April, 1971 between the Federation, HEW, and the Commissioner of the Office of Education's Bureau of Libraries and Educational Technology. A proposal was submitted by the Federation to develop organizational structure and planning, and $35,678 was awarded. A project manager from the Bureau was appointed. In July, a budget request was submitted for $26,284,627 for a three-year project.

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*All single-spaced paragraphs so set off from the text are block quotations. In accordance with standard editorial practice, block quotations do not bear quotation marks. Quoted sentences or phrases run into the text are, of course, enclosed in quotation marks.

There were major differences in conception of scope regarding the balance between a technology demonstration project and a service delivery project. A supplemental $21,808 contract was awarded for further planning to reconcile these differences. In October, a tentative commitment of $5 million from fiscal year 1973 funds was made by the Office of Education.

In January, 1972, the National Center for Educational Technology was created and responsibility for funding was shifted from the Bureau of Libraries and Educational Technology to it. In that same month, the Federation requested planning period funding of $800,000; in February, a contract was let for $500,000. (Included in this contract was a subcontract to the Education Commission of the States for an early childhood education project component; this has been dropped from the experiment's current agenda.) The $500,000 was released in increments; incremental funding -- the history claims -- presented some problems to the project since "funds were not always available as needed."

Further complications resulted in July, when Congress raised HEW's funds in excess of those requested by the President; the President vetoed the appropriation. As a result, the project's funds could not be increased and the project could not expand its staff or activities. The "complex and competitive process of securing and budgeting funds" continued.

Other agencies were contacted for additional funding: the Public Broadcasting Service, the National Science Foundation, the National Endowment for the Arts, the Office of Economic Opportunity, the Department of Housing and Urban Development, and the Department of Labor. Of these, only the Department of Labor and the Department of Manpower Development and Training (which is within the Office of Education) supplied support. The National Science Foundation furnished $300,000 as a planning contract; the Department of Labor provided $50,000.

An attempt was also made to obtain supplemental funds from private sources, a precedent for which had been established by the combined public and private funding provided to "Sesame Street." This has not proved successful.

The cost of the satellite is not charged to the project; the satellite is being provided by the National Aeronautics and Space Administration, and NASA's view of the project will be discussed separately. Further, this experiment is only one of many to be carried out simultaneously on the ATS-F.

If the one-time budget request for $26 million seems excessive, in light of current funds ($7.5 million), it should be remembered that, at the time the $26 million was being sought, the project consisted of three components:

early childhood, career development, and higher education. In addition, the number of locations in which community receivers were to be placed was several times greater. Further, at that time, there was hope that two-way video installations would also be part of the project.

The Planning Process

A wide variety of organizations were involved in planning, besides those mentioned. The specifics of what had been planned and of how the project reached its current level of funding are not as important as understanding the process involved. It was a complex one of needs assessment, changing focus, fiscal realities, legislative complications, managerial and staffing problems, and altering priorities. The preferences of the individual states and cities Federal policy planners entered into this process. So, too, did technological problems and limitations.

Closely allied with needs assessment, which involved surveying conditions in the possible sites for the experiment, was determining what the scope of the project could and should be. Decisions had to be made about what information to collect, how to collect it and from what sources, and how to process it and use it effectively.

To do this, archives were searched, experts were consulted, and selected

segments of the people in the area were asked to help in planning the project. One project document[4] makes an important point:

> Collection of information from the first two source types was relatively easy, but the third was potentially the most valuable source. Some information essential to planning could only be supplied by persons from the region, experts by virtue of being the intended beneficiary of the plan. In the planning period, a major portion of the information collection effort was devoted to obtaining information from regional sources.
>
> ...project planners hoped that this involvement would produce greater support and cooperation within the region, and that the service provided by the project would eventually be more effectively used by persons in the region because they had learned about it beforehand and had assisted in its planning.

This planning centered primarily on meetings with officials representing existing regional organizations, primarily governmental and educational organizations. The project would have liked to have involved more people who were to be the direct target of services to be offered; it did not, partly because of lack of time and money. The effort did encompass state agencies, state legislatures, teacher education groups, teacher groups, school administrator groups, students, business leaders, minority representatives, and broadcasters. Five of the region's six governors and three chief state school officers attended a planning meeting with the Secretary of HEW and the Commissioner of the U.S. Office of Education.

After the award of the January, 1972 planning grant, a Satellite Advisory Committee was formed; its members were prominent persons in state government, regional broadcasting, and business. The governor's office of each state was asked to designate a single contact for the project. An effort was made to coordinate all state government contact, through the planning period, in the office of the chief state school officer. These chief state school officers were convened for a briefing and discussion of goals. Following this, the project planning directors visited all of the state capitols to meet with the chief state school officer and his staff, with the governor or his representative. This planning was concerned mostly with policy; almost equally complex steps took place to plan the other parts of the experiment -- broadcasting and engineering, career development, early childhood, and utilization. (Early childhood has been dropped as one of the objectives of the experiment.)

Contact was established with the Navajo Nation through its Tribal Council Chairman. Consultants were brought to Denver, and project personnel reviewed existing development materials and surveyed existing ways of evaluating career education programs.

The collection of information about the region began with a survey of demographic data, for the utilization component. A public relations strategy was devised. Multilingual field staff were considered.

Broadcasting and engineering collected data about the design and operation of terrestrial communication equipment to be used with the satellite. Experts in government, private business, and education were consulted. A survey was made of existing facilities for regional broadcast transmission, including public broadcasting stations and their connecting links, translator, and cable television systems. Available production facilities at public broadcasting stations were surveyed, as were possible signal, receiving, and satellite uplink sites. This survey involved collecting and examining data on frequency allocations and on area coverage of frequencies for possible interference.

While all of this was going on, a management information monitoring system, which extensively used Program Evaluation and Review Techniques, was installed. It was linked with an automated accounting system. Weekly reports were fed into the system of amounts expended and percentages of tasks completed. These figures were compared with planned progress figures. This system, however, did not accurately reflect project activity or help in facilitating internal communication and coordinating tasks. A second version of this system has been put in place. It has been totally automated and has a full-time staff member assigned to it. One of its significant features is a centralized document file containing detailed information about major decisions, open to all staff members. It remains to be seen how effective this system will be.

The Federation of Rocky Mountain States

Since the Satellite Technology Demonstration is a project of the Federation, it is necessary to understand the Federation and its role in the region. The organization evolved from the perception that, while each state has unique problems, each has problems similar to those of other states. In 1966, the governors of these states formally established the Federation in the hop that it would aid in problem-solving. Its Board of Directors then created council to operate in the area of major regional concerns. The Councils, in turn, established committees to examine specific problems. Each state is represente on the councils and committees with equal representation from the government and business communities. The Federation:

- Works to increase communication between the states, its businesses, public and private agencies, and the federal government, for cooperative action and effective exchange of workable ideas.
- Seeks cooperative efforts in all areas -- from developing a broad industrial base and stimulating foreign trade to improving education and cultural activities.
- Gives each member -- whether it be a small business or large corporation -- a share in molding public policy that affects the development of the Rocky Mountain region.
- Provides an opportunity for the private sector to become involved in government policy (the Federation's voice in policymaking becomes stronger with each new member).
- Tries to solve any topic of current regional concern (regional business has profited in many ways from the Federation).

- Is governed by a board of directors consisting of the governors, directors of development, one state legislator, and four business representatives from each state. The Federation maintains a permanent office in Denver, Colorado.

- Operates on costs shared by state dues and private sector membership. Individual state support is determined by a population formula based on the current census. The private sector in each state matches the state government appropriation through membership dues based on the number of employees. [5]

The councils established by the Federation are also of interest:

- The Regional Planning Council, which is responsible for the Federation's Regional Planning Program and gives specific attention to housing, community development, and business research.

- The Telecommunications Council, which works with education, health, civil defense, and public broadcasting agencies with the goal of establishing a total communications network to link the region.

- The Market Development Council, which directs its attention to industrial development, foreign trade, agribusiness, and travel promotion.

- The Natural Resources Council, which deals with land, energy, minerals, and forests and with applying science and technology to the development of natural resources.

- The Human Resources Council, which is concerned with career development programs and education coordination among the states.

- The Transportation Council, whose goal is a well-planned regional and surface air transportation system; its committees are concerned with highways, air transport, carriers, shippers, and regulatory agencies.

> The Arts and Humanities Council, which promotes and sponsors traveling art exhibits, touring symphonies, dance companies, repertory theaters, and the development of young talent within the region.

These councils which might be viewed as part of the management structure, were established even when preliminary discussions for using the ATS-F were taking place. Potential assets to the planning and manpower needs of the demonstration, the councils were to provide liaisons which in other projects might have to be developed and paid for. Their costs, which do not appear as part of the project's budget, can quite properly be considered part of the total cost of going from the planning stage to an operational experiment. Further, it must be remembered, communications and transportation in the area, except for some few isolated areas, are generally good, particulary so compared to conditions in some developing nations.

The Federation views the satellite project as "an example of a regional approach combining scientific, technological, economic and educational information":

> This project, the first of its kind in the world, too big for one state alone, provides each of the Federation states with tremendous potential benefit for the future. It will provide them with information for future investment decisions as to the feasibility of satellite telecommunications covering a wide range of social delivery systems. [6]

Although the scope of the experiment has been scaled down -- it is no longer being thought of as a testbed for social delivery systems -- it may still produce many of the results hoped for by the Federation. If nothing else, it should clearly demonstrate the nature and scope of the problems to be dealt with.

A Look at the Region

Probably as a result of the satellite's "footprint" capability,[7] the experiment grew to include two states in addition to six in the Federation -- Arizona and Nevada. The satellite option seemed worth considering because the total area of the eight states is more than 860,000 miles, one-fourth of the total area of the United States. (This area is larger than Central Europe.) The population of 8,250,000, however, presents only 4 percent of the national total. "More people than that live in the state of Michigan. Density per square mile is 9.7 people, compared with 953.1 in (the state of) New Jersey -- nearly 100 times greater."[8]

The area is one of contrasts both topographically, with its timbered and granite-like heights, semi-arid plains, rough-hewn valleys, and sweltering deserts, and ethnically, with its cultures and subcultures of native Americans, Spanish-Americans, Mexican-Americans, Basques, blacks, and Anglos.

> People live here on the slopes and in the foothills, on the floors of valleys and gorges, on plateaus and mesas, on plains and deserts -- half hidden in their mountain fastness, in the haze, or in the sweep of space. The radio, the television, the automobile and aircraft have expanded their worlds, to be sure, but thousands of communities still exist in relative isolation.
>
> The mountain states are as diverse ethnically as they are geographically. About 234,000 or 30 percent of the nation's Indian population lives here, most of them on 70 reservations, representing more than 30 tribes and occupying 38 million acres of land. The Blackfeet and Crow are in Montana, Nez Perce and Bannocks in Idaho, Shoshone in Wyoming, Utes in Southern Colorado, Paiutes in Nevada, Hopi in Arizona, Pueblo in New Mexico and Arizona, and the Navajo -- the largest Indian tribe in the United States -- in Northeastern Arizona and Northwestern New Mexico. The mountain states also contain 30 percent of all Mexican-Americans in the United States. The highest concentrations of Chicanos, as these Americans are called, are in Arizona, New Mexico, and Colorado. Blacks are the smallest in number of the major ethnic groups in the region, ranging from 0.3 percent of the population in Idaho and Montana to 6 percent in Nevada.
>
> The major challenge of the demonstration: to extend educational communication into presently inaccessible places through the nation's first coordinated, widespread trial of educational space technology, to apply new tools and techniques for the benefit of the public at large in surely what is the largest but least populated experimental site in history. 9

When the project was first being planned, it was believed that there were communities with no access to television, either commercial or educational.

Examination in depth failed to find communities that did not have some television signal, although choices were extremely limited. First, secondary source documents -- tables of frequency allocations, transmitter coverage maps, and the like -- were examined. The literature, however, had not kept up with the technology: cable systems and translator stations were in place that hadn't yet been reported. While this may have rendered the researcher's task more difficult, it should really not have caused surprise. For television in the United States is virtually omnipresent -- its penetration figure in the continental United States (excluding Alaska) is calculated at 96 percent (64 million of 67 million households have television). Obviously, with an overall average that high, even isolated communities must have television.

This figure has important implications for any nation seeking to duplicate the ATS-F experiment. Although the ATS-F receiver is a "community receiver" priced at about $3,000 and not an ordinary household television set, the presence of so many ordinary sets indicates that the areas are already electrified, that manpower is available to carry out repair and maintenance tasks, and that television is not a startling new technology to the people. They are accustomed to watching it and to drawing lessons and perceptions from it. Also, since so many sets are in place and so much of the capital investment has already

been made, perhaps at some point after ATS-F, a technology should be developed that will permit broadcasting from satellites to ordinary television receivers, unaugmented by special antennas and unencumbered by the need to convert a satellite signal into a usable television signal. It is highly unlikely that many countries will be able to afford this level of television penetration for some time to come. However, this experiment may prove that community receivers can successfully be used, even in areas with greater population density, and that such receivers are as satisfactory for disseminating education as the privately owned receivers located in individual homes.

In the Rocky Mountain States, however, there are areas in which the TV penetration figures fall far below the overall national average. In six of them, the average penetration figure for the eight states is at least one to three percentage points below the national average. One county in Arizona has a penetration figure as low as 60 percent; one Colorado county has a low of 81 percent; two counties in Idaho have a low of 87 percent; four counties in Montana have a low of 86 percent; one county in Nevada has a low of 84 percent; one county in New Mexico has a low of 73 percent; one county in Utah has a low of 88 percent; one county in Wyoming has a low of 91 percent. (Arizona has 14 counties; Colorado, 63; Idaho, 9; Montana, 56; Nevada, 17; New Mexico, 32; Utah, 29; Wyoming, 23.)

Radio is also omnipresent, and the experiment will use satellite-distributed radio signals as part of its total plan, both for distribution of information and as part of the feedback process. Telephones, of course, serve many essential functions in a system as large and complex as the experiment's. For example, they facilitate managing, conveying data, and clarifying problems. The United States is most fortunate, for as of January 1, 1972, it had 125,142,000 telephones, or 60.13 per 100 persons, out of a total of 291,329,000 telephones in the world. Contrast the statistics for India and Brazil, nations that are also contemplating the major use of satellites for education -- India has 1,351,200 telephones, or 0.25 per 100 persons; Brazil, 2,064,950 telephones, or 2.12 per 100 persons.[10]

The Federation plans to use the ATS-3 satellite (in addition to the ATS-F) to carry audio feedback, both during programs and in hours when programs are not being transmitted. The availability of the ATS-3 and the virtual omnipresence of telephones mean that the audience can respond, if so desired, and that another major capital investment has already been made; the project need not pay this cost. (The assumption is that the capacity for feedback is a desirable aspect of the educational process. Most evidence seems to indicate that it is. The feedback <u>effect</u> can certainly be designed into a satellite system; however, it must be paid for in terms of installing ground terminals capable of transmitting to the satellite. The Rocky Mountain experiment <u>is</u> going to do just that to some extent, but not as much as it might have to if telephones were not already so numerous.)

THE EXPERIMENT

Goals

The Satellite Technology Demonstration is designed to "extend educational communication into presently inaccessible places through the nation's first coordinated, widespread trial of educational space technology. . . ." This is not to say many of these areas do not have access either to education or to television. Indeed, all of the sites that have been selected for the experiment are schools, and the communities in which the schools are located already have television signals available. (They do not all have educational television, though.) The "Memorandum of Understanding" between the Office of Education, the Federation of Rocky Mountain States, and the National Institute of Education,* signed in Washington on June 8, 1973, states, in part:

> Goals
>
> (1) To demonstrate the feasibility of a satellite-based media distribution system for isolated rural populations.
>
> (2) To test and evaluate user acceptance and the cost of various delivery modes using a variety of materials.
>
> Among the delivery modes will be included real-time viewing of satellite transmissions, and delayed viewing of video cassettes transmitted by satellite.

*The National Institute of Education has recently become the Federal government agency responsible for the project.

The materials will be a mix of off-the-shelf, modified, and new educational.

A research and evaluation design to achieve these goals will be submitted to the Federal project officer at an early date.

An independent external evaluation will be separately funded.

Budget

A total project budget of $4.5 million is proposed within the terms of this memorandum.... It is intended that this budget include the cost of a Denver uplink, access, studio and staffing for Fiscal Years 1974 and 1975.

This budget does not include the cost of a digital data-gathering activity associated with the research and evaluation design, and will be negotiated separately at the request of the Federation of Rocky Mountain States once a design is submitted and approved.

NASA's Goals

The National Aeronautics and Space Administration has formulated its own goals for the satellite in the experiment:

- To demonstrate the feasibility of deploying a 30-foot diameter parabolic antenna in space;

- To provide a satellite with fine pointing, slewing (turning, twisting, or swinging about), and tracking capabilities;

To provide an oriented, stable spacecraft platform at synchronous (stable) attitudes for advanced technological experiments.

The Federation's experiment is not the only educational experiment being carried out with the ATS-F. Two major components deal with the delivery of educational programs to Alaska and the Appalachian states. A Veterans' Administration Hospital program is planned for 10 hospitals. NASA groups its other activities for the ATS-F into four basic categories: communications, meteorological, scientific, and technological. Of most concern here are those that will:

- advance state-of-the-art in space communications by demonstrating quality wideband signaling between ATS-F and inexpensive ground stations;

- demonstrate the relay by geosynchronous satellite of quality television from a high-powered program transmitting station to small modified standard TV receivers located throughout rural India and to urban rebroadcast stations;

- evaluate a system that will permit relay of television programs through the satellite to facilities such as schools, CATV systems and cities.[11]

The Audience

The principal audiences for the Satellite Technology Demonstration are junior high school children in some 56 cities, seven in each of the eight states. In each state, receive-only terminals will be placed in four schools; terminals capable of transmitting audio back to the control center will be placed in three schools. (The audio feedback will be via the ATS-1 and -3 satellites. The frequency on which to "return" audio to the center, via the ATS-F, was not available for the use of the experiment in the eight states.)

The children are to receive material on career development (see Figure 1 for overview and for present programming constraints). A substantial amount of time in the broadcast schedule is therefore reserved for a secondary audience composed of parents, teachers, community, business and industry leaders, and others whose actions and feelings bear an impact on adolescents' decisions. While the children (all in rural, isolated communities) will be reached through the receivers in their schools, the adults will be reached through existing public broadcasting stations, which will add the same programs to their schedules. Many sites, over and above the 56, will receive their programs via one of 12 public broadcasting stations in the region rather than via in-school satellite receivers. (The in-school receivers may also possibly be used during nonschool hours by adults watching rebroadcasts of the programs or programs designed for an adult audience.)

Figure 1 OVERVIEW

PRESENT PROGRAMMING CONSTRAINTS AS THEY AFFECT CAREER DEVELOPMENT CONTENT, BASED ON THE PRESENT DEFINITION OF THE PROJECT:

1. The Demonstration has an average of 14 hours 24 minutes of broadcast time per week available to it on the satellite. (7 hours 12 minutes per footprint).

2. Any given time block within a week will consist of a combination of original pre-recorded materials, live broadcast, and existing materials, with appropriate interaction.

3. The rural Junior High School adolescent has been identified as the audience for a series of eighty-one 35-minute programs broadcast five times a week per footprint during morning hours. This audience can be described as "closed" (intensive/R.O.T.) and "open" (P.B.S. - cable). This audience will receive two programs weekly of "core" content materials which will be directly related to performance objectives, and three programs of "enrichment" materials which will support, reinforce, and enhance objectives.

4. A second audience, consisting of interested professionals, parents, and other members of the community, will receive one program per week per footprint on Tuesday or Thursday evening during each 16-week semester period. This audience can be described as both closed (intensive/R.O.T.) and open (P.B.S. - cable). This programming will generally consist of approximately 15 minutes of career education materials distilled from morning programs and 30 minutes of live and existing materials specifically designed for adults. A 15-minute individual interaction period will be followed by one hour of adult-oriented enrichment materials.

5. The third audience will be the faculties of the participant schools. They will receive one program broadcasted twice per week on alternate weeks to each footprint during the 32-week academic year broadcast schedule. Each footprint will receive 16 one-hour original programs on Thursdays with alternate viewing times scheduled on Mondays. This audience will receive in-service training programs relating career education concepts to various academic disciplines.

6. Each week, on Tuesday and Thursday mornings, an additional one hour per footprint per semester will be made available for materials distribution to any of the above audiences requesting access to further career information.

For explanation of "footprints," see the section on the satellite, p. 43, and footnote 7.

R.O.T., receive-only terminals. Intensive/R.O.T., sites that have transmitting capability.

The area encompasses two time zones -- Pacific and Rocky Mountain standard -- which have a one-hour difference. This difference, school starting times, and school lunch schedules may account for what looks like irregular starting times.

With a few exceptions, the 56 sites chosen for the experiment are sites that do not receive any educational television signal. Each site is a community; the smallest of the 56 has a total population of 31; the largest, 7,995. In the final analysis, the sites were chosen by the educational authorities in the states themselves from among a list of many more submitted by the project's utilization component and subject to the site's ability to have a receiver installed and other technical considerations. (One site selected which already receives an educational television signal was chosen because the schools in that community already have an excellent career development program, one of the few exemplary projects of its kind in the United States. It seems that this choice may serve as a control, to some degree, on the success or failure of the project's own efforts in career development.)

At each site, the local school has agreed to make an audience available, as well as to purchase (if it does not already have one) a television set to be attached to the satellite antenna, receiver, and converter. The project will provide and pay for the last three items. The size of these audiences ranges from a minimum of 15 students to a maximum of 875. For larger groups, it seems that either local school authorities will choose those who will participate or, possibly, more than one television set will be used in several classrooms.

Taking the seven states (excluding Montana) for which figures are currently available, the totals of the potential viewers by ethnic categories are:

Arizona: 162 Anglo; 0 black; 46 Spanish language or surname; 1,160 native American Indian.

Colorado: 684 Anglo; 35 black; 46 Spanish language or surname; 2 native American Indian.

Idaho: 417 Anglo; 0 black; 33 Spanish language or surname; 21 native American Indian.

Nevada: 127 Anglo; 2 black; 13 Spanish language or surname; 266 native American Indian.

New Mexico: 105 Anglo; 0 black; 215 Spanish language or surname; 116 native American Indian.

Utah: 1,198 Anglo; 0 black; 18 Spanish language or surname; 51 native American Indian.

Wyoming: 1,641 Anglo; 0 black; 37 Spanish language or surname; 72 native American Indian.

Out of the total audience in seven of the eight states available to the project (6,965 students), 4,444 are Anglos, 37 are blacks, 728 speak Spanish or have a Spanish language surname, and 1,788 are native American Indians.[12] (The subtotals slightly exceed 6,965 because ethnic figures were, in some cases, quoted in ranges, rather than as exact figures.) This breakdown and these totals assume programmatic importance in the way they affect the decision of whether to use English -- or another language -- on the broadcasts. The decision has been made to use English; despite the fact

that 25 percent of the total audience is native American Indian, all of this primary target audience is in school, where the teaching language is English. (Besides, were one to consider using an American Indian language, more than one would probably have to be used; there are 30 separate tribes within the eight states. In addition, other languages are used throughout the area.)

If the project were more of a social delivery system and less of a technology demonstration, the language question would probably have to be rethought. The total population of the communities to be reached is 98,318. Although there are no data on the ethnic character of the communities, there are ample data on the ethnic breakdown of the larger counties. The total population of all the counties in which the sites are located in all eight states is 1,638,960. Of this number, 35,639 (2 percent) are black; 81,387 (5 percent) are native American Indian; 250,161 (15 percent) are Spanish language or surname; 5,995 (.36 percent) are Oriental; and 7,327 (.44 percent) are "other." 1,207,549 (74 percent) are Anglos. (Because of rounding off and the fact that certain ethnic groups are reported in ranges rather than absolute numbers, the figures do not quite total 100 percent.)

If the project expands, language choice becomes more of a problem. This seems true whether the audience is being sought via satellite or via programs

carried on educational television stations. At some point, the project is apt to encounter audiences that are not English speaking. Although the school situation is relatively controllable, the "open audience" situation is less so. The problem is not one of language alone; cultural differences must be taken into account as part of any expansion. Probably, to meet the audience's needs, programs would have to be culturally as well as linguistically suitable. (At one point, multiple language programming was being seriously considered. This was one of the factors that had raised costs to the previous high level.)

Career Development

Career development was selected as the major content area for programming because the total number of those who leave the formal education system in the United States each year without adequate knowledge of, or formal preparation for, some kind of career is more than 2 million.[13] (The total U.S. population is 208,232,000;[14] the total school age population, assuming this to be the ages 5 to 20, is 59,908,000. Those ill-prepared for careers, then, constitute 3.38 percent of the school age group. Although this percentage is small in terms of the total population, it represents a great number of people whose economic and human potential is being wasted.)

Career development, according to the project document, ideally increases the relevance of school by focusing on the student's career choice. It shows

students a great range of occupational options and helps them develop positive attitudes toward work. Some career education has already begun at the elementary school level in the Rocky Mountain States. However, school officers and teachers in the region have indicated that career education programs are needed for the upper grades. While this need has been partially met in senior high schools, surveys in the region have shown that it is the 7th, 8th, and 9th graders who score low in career knowledge while at the same time expressing a keen interest in such knowledge.

By presenting meaningful as well as entertaining broadcasts, the Satellite Technology Demonstration hopes not only to help adolescents make decisions but also to lead to better utilization of educational and training resources in the region's rural schools. These goals were based on the belief that (1) adolescents should develop skills and collect information that will help them to make educational and career choices early enough to have sufficient time to consider and explore alternatives before making important decisions; and (2) it is desirable for parents and other persons who aid in the decisionmaking process to be informed of career options and career preparations.

Content structure. A staff of educators and communicators -- technical as well as creative production personnel -- has been assembled in the Satellite Technolog Demonstration production facilities in order to develop the content structure and the production design to meet these aims.

The content structure (as outlined in Figure 2) emphasizes three areas: self-assessment, assessment of environment, and assessment of the world of work. This outline is detailed as appendix A because the career development program is the only content area of the project. When the approach to career education was modified to reflect the investigation of the career exploration process rather than the exploration of specific careers, a decisionmaking paradigm was developed (Figure 3).

OUTLINE FOR CAREER DEVELOPMENT CONTENT

MAKING DECISIONS

ASSESSMENT

A. Assessment of Self

1. Interests
2. Aptitudes
3. Temperaments
4. Skills
5. How do interests, aptitudes, temperaments, and skills relate to personality?
6. Staying Healthy
7. Setting Goals

B. Assessment of Environment

1. Relating to people
2. Relating to your community
3. Being a knowledgeable consumer

C. Assessment of the World of Work

1. Why People Work
2. People and Careers
3. Careers and the World of Work
4. Drawing Conclusions

UNDERSTANDING CAREERS

1. Work Performed
2. Education and Training
3. Salary Range
4. Self-employment vs. salary
5. Job Outlook and Stability
6. Career Ladders and Relationships
7. Education, training and skills necessary for advancement
8. Career and Job Mobility
9. Specialization
10. Skills
11. Tools, Equipment, Machinery, Materials
12. Aptitudes and Careers
13. Interests and Careers
14. Temperaments and Careers
15. Physical Demands
16. Working Conditions
17. Unions and Organizations
18. Licensing Requirements
19. Seasonal Limitations
20. Geograhpical/Regional Restrictions
21. Products and Services
22. Drawing Conclusions

IMPLEMENTATION

A. Education and Training

1. For Personal Fulfillment
2. Educational Counseling
3. Formal Education and Training

B. Applying For Jobs

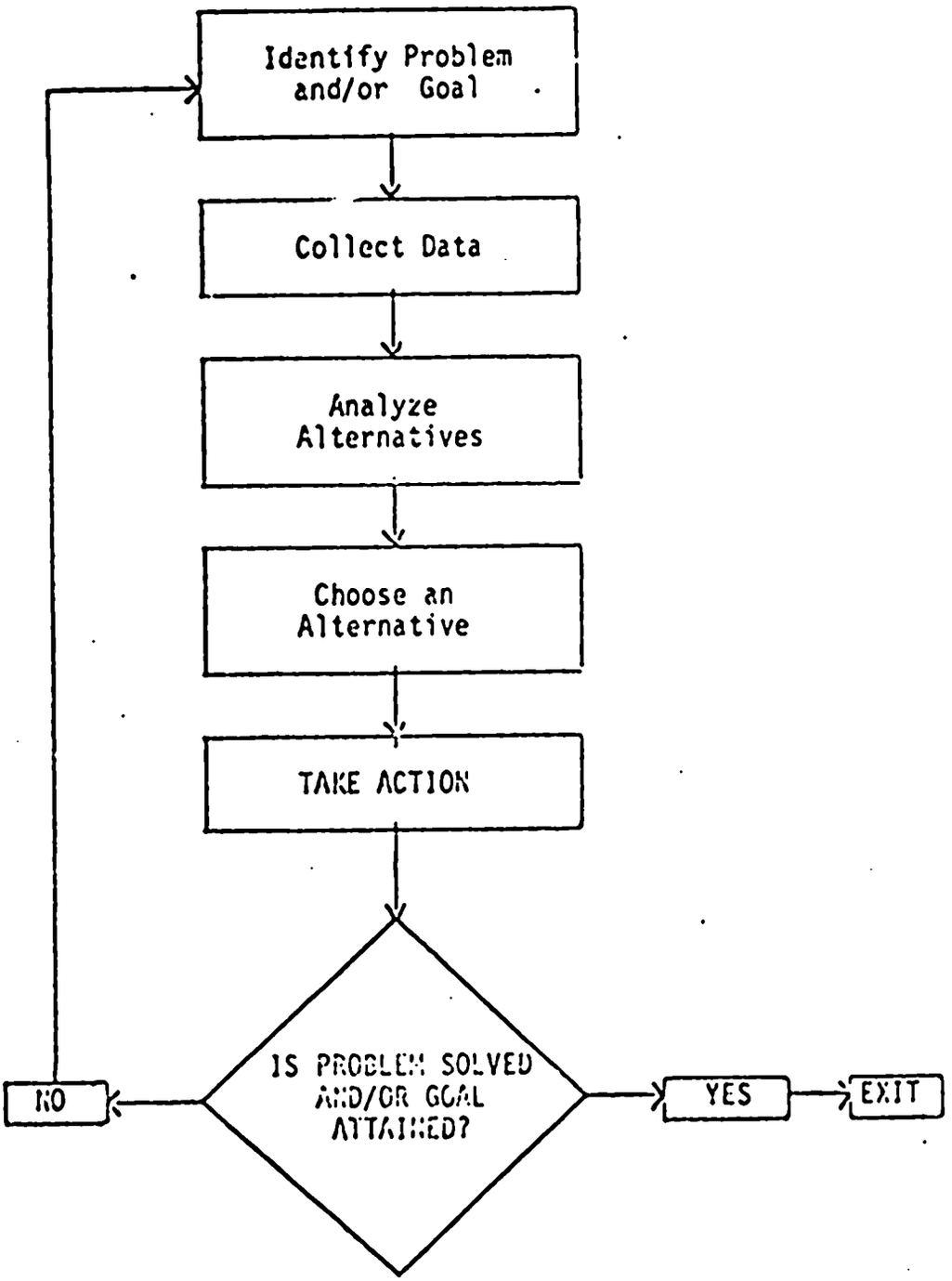
1. Locating job openings
2. Resumes and Job Applications
3. Job Qualification Exams
4. Job Interviews

C. Being a Knowledgeable Consumer

1. Budgeting your money
2. Paying for things
3. Locating Social Services

Figure 2

Figure 3


Identify Problem and/or Goal
Collect Data
Analyze Alternatives
Choose an Alternative
TAKE ACTION
IS PROBLEM SOLVED AND/OR GOAL ATTAINED?
NO
YES
EXIT

The project is expected to produce the programs (or to acquire them), which will carry the appropriate information:

> The production design will consist of a minimum of 18 hours of newly-produced material, conceived and executed by the program staff and based on specific user needs; a minimum of 30 hours of existing materials, auditioned and gathered in an intensive nationwide search and adapted, if necessary, to suit specific content needs and specific audiences; the balance of the programming hours will be "live."[15]

Supplementary materials. Three audiences will receive printed supplementary materials: students at all intensive and ROT sites and at selected PBS sites; teachers and staff working with students in STD programs; and general faculty at site schools.

The students will receive a monthly program log which will preview the subject matter to be covered in the upcoming month. The student guide will also contain articles, puzzles, games, and illustrations which will help to reinforce the materia. the student has been exposed to in the television programs.

The teacher's guide will be delivered in two stages. First, a large introductory packet will be distributed in a loose-leaf binder. This will contain background information on the demonstration, a discussion of the career education idea, project and educational objectives, a list

of available supplementary materials in the career field, and a glossary of terms. Second, every two weeks, the teacher will receive a 16-page supplement dealing with the specific programs that will appear during the the upcoming two weeks. The supplements will suggest coordinated pre- and post-broadcast classroom activities, explain the specific educational objectives for each program, and list new vocabulary and practice exercises.

Separate materials necessary to support the 16 in-service training programs now planned will be sent to all professional faculty at the site schools. These materials tie in regular school subjects and activities to career education and elaborate on the individual program topics. They will further serve as program notes, enabling the teacher to refer back at a later time to points made in the program. This will prove especially helpful if the in-service training course is approved for college credit.

Teacher training. In one intensive week of broadcasting in late August, the STD will broadcast preservice training for all school personnel directly related to school year broadcasts for the primary audience, e.g., the teacher in charge of a group of students designated to receive our career education programming on a daily basis. Such preservice training will include an introduction to the concepts of career education, an introduction to the project itself, and specifics on the "hows" and "whats" of the project, e.g. schedules and hardware.

During the school year itself, the STD will offer inservice training broadcasts for all school personnel, including administrators. Inservice training programming will, it is hoped, motivate and provide assistance to a teacher in integrating career education concepts in a regular English or science class.

Audio and digital systems. At this point, it is estimated that the Federation experiment will broadcast about 14 hours a week for the 48 weeks of the experiment. During these live hours the interactive capability of the satellite system will be used.

The interactive system has two components: the audio, which is a funded portion of the experiment, and the digital data-gathering activity, which is to be funded separately upon acceptance of a suitable research and evaluation design by the National Institute of Education. The two-way system will be used to deliver information to teachers and students and to collect data on their reactions to the materials and the method of delivery. This system, as a prototype, also can help determine the costs involved in developing and implementing an integrated two-way information system.

According to the Memorandum of Agreement,

> The voice communications system will provide two-way communication between the Denver Center and users at

> intensive sites /the three two-way sites in each state/. Each intensive site will be equipped with a (voice) transmitter and receiver. A site will initiate contact by pressing a call button, and, after the transmitter has been activated by a signal from Denver, a microphone and speaker at the site will carry the conversation. One intensive site at a time will be able to transmit to Denver, and this signal can be retransmitted to all of the sites. The ATS-1 and ATS-3 satellites will be used to relay the transmissions between the sites and Denver.

Also, according to the document, the two-way audio system might be used as part of program content, as feedback from users to staff on the content, and for such nonprogram-related communication as site coordination and news dissemination. Students will be able to ask questions, read short items, and express opinions over the audio link. This material could be prerecorded or presented live. People at the sites (professionals) will be able to review material and ask questions, and to communicate information of value to the program producers, such as the results of class discussic held after broadcasts. The possibilities for dissemination of project news are self-evident; the audio can also be used for troubleshooting hardware malfunctions.

The two-way audio system, however, has some inherent limitations: it is available to only one person at one site at a time; coordination with the Denver Control Center makes frequent use during programming impractical; and quantifying and analyzing the information which comes over it is difficult.

Consequently, the project staff regards the addition of a digital system as appropriate. A proposal specific to this application has been submitted to NIE. The digital system would, if approved, allow a large number of users to use the system simultaneously, require much less coordination during the program by the Denver Control Center, and gather data numerically so that they are relatively easy to analyze.

The digital part of the communications system at each site would consist of a small minicomputer, which would control a 12-button, touch-tone pad at each student desk. The digital pads would have one push button for each number from zero to nine, a visual indicator to show which number was pressed, a "right," a "wrong," and an audio "ready" light. When students are answering questions, the "ready" light will indicate the pad is ready for input. Then either the "right" light or the "wrong" light would be illuminated to indicate whether the student gave the correct answer. The Denver Center computer could, on command, immediately tabulate all the student responses and overlay a table of results on the video signal. The Control Center would also control all the hardware at the sites by a large minicomputer that would send commands through the satellite signal channel.

Because both the voice and digital systems would use ATS-1 and ATS-3, this resource would be available throughout the day. When the video programming is in progress, the student pads can be used to collect data on

student performance. They can also enhance the scope of content and format in the programs by making possible real time interaction. The short response time of the system (less than 12 seconds) would make it possible to use the system in many other interactive formats (quizzes, games, opinion polling, etc.) The digital system could also support a teletype at the intensive site, which could be used as a data entry terminal and which would make it possible to transmit hard copy from the Central site in Denver.

This digital system could be used as an aid to learning to remember specific information and to increasing attention and motivation. Students can be tested on each part of the material they have been exposed to. (Programs are to be shown to site personnel, as well.) In addition, with this setup, the staff can test all of the systems involved, collect data on the effectiveness of a given program, and pinpoint groups of students who do not understand the content. And, all of this can be done quickly. The system also obviates the need to depend on the mails, which are slow in rural areas such as those in which the sites are located.

The hardware costs for the audio system are, based on purchase rather than lease, about $9,000 per site -- $220,270 total (although a basic tone control hard-wired system may be used, as a major savings approach at a total cost of about $15,000 for the audio two-way system). The total cost for

the audio and digital system (allowing an average of 32 user pads per site at the 9 sites) is calculated at $321,260 optional teletype terminals would raise the figure to $344,660 on a purchase basis. The cost of personnel is included. The audio-only system will need a systems designer, a programmer, a librarian/documentarian, and a machine operator. The combined system needs all of them, plus an additional systems programmer. (Appendix B describes the two-way audio system; appendix C describes the audio and digital system.)

Programs and Production: Functional Operations

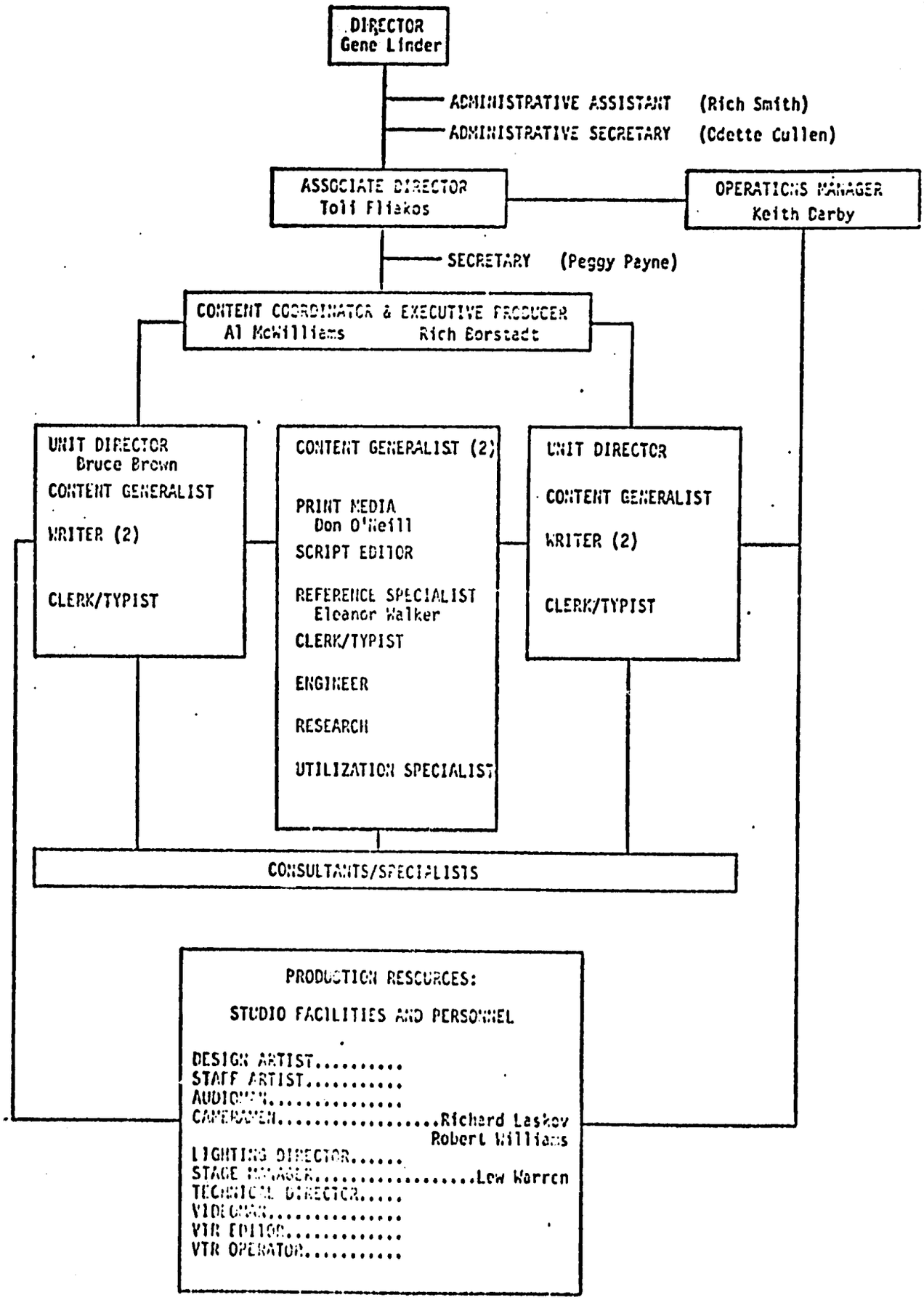
The functional operation of the program component is patterned after the much-acclaimed "course-team" concept of the British Broadcasting Corporation and the United Kingdom's Open University. It is designed to eliminate an assembly-line method of production, whereby an educator defines content specifications which are then turned over to a writer whose script is, in turn, delivered to a third party for execution. Instead, under the course-team concept, an experienced television director "drives" the daily efforts of an educator and a writer, overseeing a program element from its concept through its design and, finally, directing its execution. The conceptual and design tasks of production are assigned to two such course units, each staffed by a unit director, a content generalist, two writers, and a clerk/typist. Each unit can call on two groups of individuals for tactical support and input as needed: (1) a program support staff, consisting of a print media specialist, two content generalists, a script editor, reference specialist, a researcher, a utilization specialist and an engineer assigned from other parts of the Satellite Technology Demonstration; (2) a pool of special consultants in career fields for specific help as the need arises. An executive producer supervises the total production effort, and the STD's career

development content coordinator ascertains and defines content needs and scope.

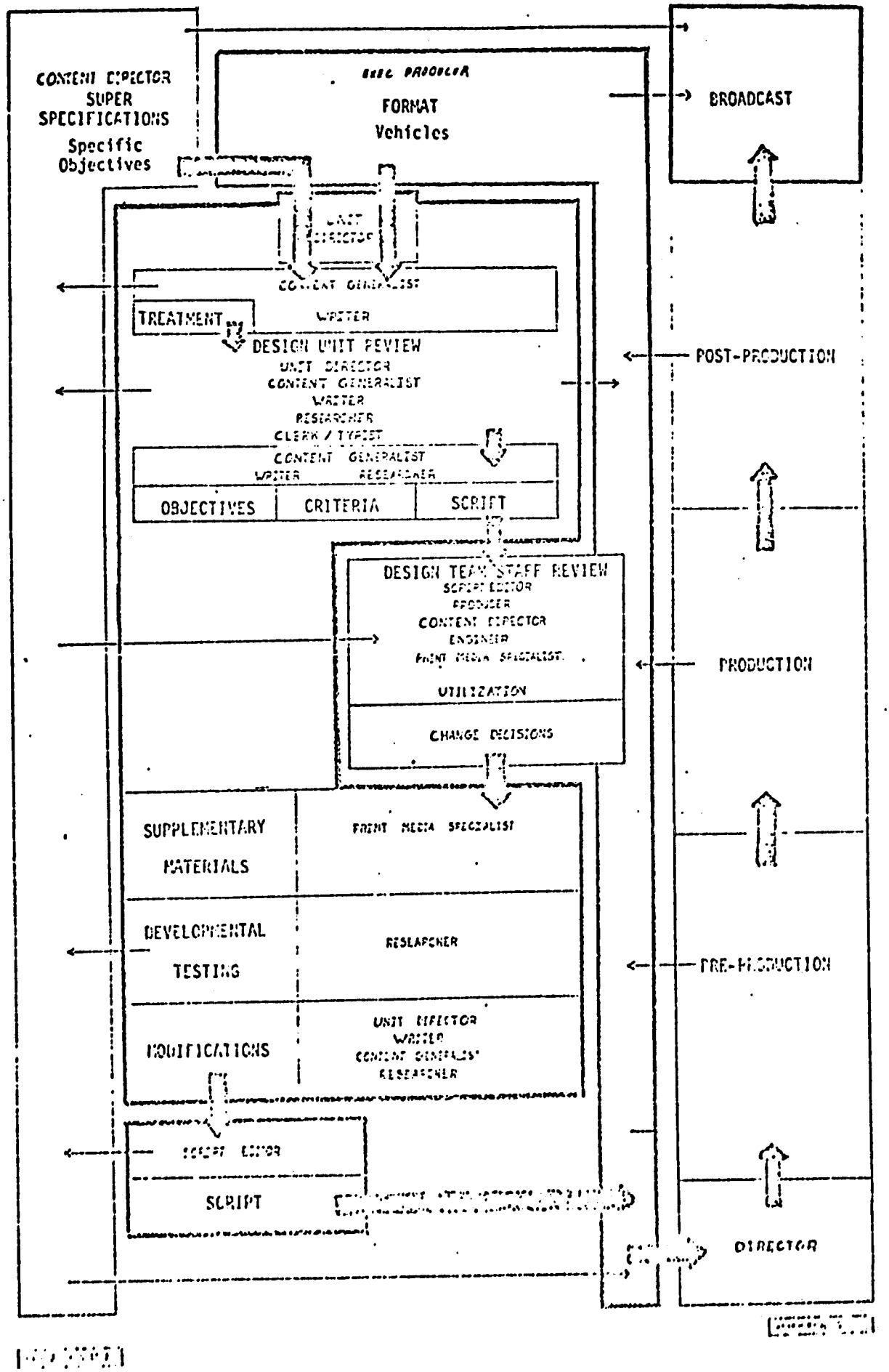
Such an arrangement provides for the input of expertise throughout the conceptual and design process. The engineer, for instance, can assure maximum utilization of the satellite's unique features in any specific script. The researcher, being thoroughly familiar with any particular program element, can meaningfully interpret feedback and channel it toward future design or modifications, if necessary. In addition, being thoroughly familiar with the research plan, he can ensure that individual program elements reflect that plan. Similarly, the content generalist can continually provide input for the writer to ensure that user-based content objectives are being met. The print media specialist can design supplementary materials (teachers' guides, pamphlets for students, etc.) for each program element as it is being designed. Finally, the unit director can ensure that the design and scripting of program elements are not running counter to realistic production limitations.

Figure 4 indicates the management structure, and Figure 5 indicates the way in which the program elements flow through that system.

PROGRAMMING ORGANIZATION



PROGRAM ELEMENT FLOW



Programs and Production: Studio Operations

A studio is to be built, on the premises. At the time of this writing, an attempt was being made to lease equipment from a commercial company's studio, which is no longer in use. Perhaps the best way to characterize what will finally develop is to describe it as about the equivalent of a medium-sized public broadcasting facility. It will be housed in a room about 35' x 45' and of normal height, as contrasted to the high grid ceilings usually associated with television production facilities. All of the backup and supporting materials necessary will be housed in an adjacent space. The studio will be a two-camera operation, and all production will be recorded on broadcast-quality 2" quad video tape. There will be a full complement of time-code editing equipment.

Personnel required to operate this facility will include the director (of the component), an associate director, an executive producer, an administrative assistant, an administrative secretary, a secretary, two unit directors, a clerk/typist, an operations manager, a design artist, a staff artist, a lighting director, a cameraman, a videotape operator, a videotape editor, a video-man, a floorman, and a technical director. (Other workers not directly concerned with the production of television programs in the facility are listed in Figure 4.)

The production schedule calls for four hours a month of finished scripts using

both new and available material, plus one hour a week to be put on video tape, plus the live daily material, for which an exact figure is not yet known.

Programs and Production: Schedules

Table 1 lists the programs and production schedules in detail. For an examination of some of the problems in arriving at this schedule, see appendix D.

Table 1

CALENDAR	AUDIENCE	PROGRAM SCHEDULE	WHERE	PROGRAM CONTENT
School Year 9/9/74-1/17/75 Except for 11/27-28-29 Thanksgiving 12/20-1/5 Christmas 1/20/75-5/16/75 Except for 2/17, Washintons Birthday 3/26-27-28 Easter	Junior High School Students	M T W Th F 9:20-9:55 RME 10:00-10:35 RMW	56 sites (available to PBS - cable)	Program specific to junior high school audience in areas of career development and decision-making
	Teachers, site personnel, counselors, principals	Monday, Thursday RME 3:30-4:30 (repeated once during week and 2nd week RMW 3:30-4:30 PM 4:30-5:30 (repeated once during week and 2nd week) (exception: school vacations)	56 sites (could be made available to PBS)	Inservice training to complement the programming received by students in the junior high audience

Table 1 (continued)

CALENDAR	AUDIENCE	PROGRAM SCHEDULE	WHERE	PROGRAM CONTENT
Summer, 1974* June 10 - August 9	Specific groups of adults (different audience on each of the 3 days)	Tues Wed Thurs 12:15-1:00 RME 1:05-1:50 RMW (except week of July 4)	convened at 56 sites	Programming to be specific audience oriented; e.g., the aged, consumer ed., cultural and ethnic studies
	General adult audience	Tuesday evenings 7:30-8:30 RME 8:35-9:35 RMW (including week of July 4)	56 sites (also available to PBS-cable)	Programming to be general audience oriented, e.g., regional and local planning, on site documentaries, town council of the air, selected regional PBS material
August 20, 21,22	Teachers, counselors, and school administrators	Tues Wed Thurs 9:30- 10:25 9:30- 10:25 9:00- 10:25 RME 1:30- 2:25 1:30- 2:25 10:30- 11:25 10:30- 11:25 10:30- 11:55 RMW 2:30- 3:25 2:30- 3:25	56 sites (may be made available to PBS)	Preservice training program to orient school personnel to future career development programming
Starts week of Sept. 9, 1974 and concludes May 15, 1975	General adult-parents, business personnel, service clubs, unemployed etc.	Tues 7:30 - 9:30 RME Thurs. 7:30-9:30 RMW	56 sites (available to PBS-cable)	General career development program in which will highlight segments of student programming, but capitalize on live and packaged material specifically appropriate for adult viewing audiences. Some programming will reflect segments dealing with minorities, etc. but the intent of program is to be general.

* Tuesday, May 21 there will be a cosmic preview and orientation
9:25-9:55 RME
10:00-10:30 RMW
[illegible]
2:00-2:30 RMW
7:30-8:00 RME
8:00-8:30 RMW

Broadcasting and Engineering: The ATS-F

The ATS-F satellite is being assembled at the Fairchild industries complex in Germantown, Maryland. Its on-board sensors, torquers, and controllers are backed up by duplicate or even triplicate components. Its major subsystems are assembled and tested independently of each other. It can be accurately stabilized and pointed, and will carry high-gain antennas and more powerful transmitters than any satellite before it.

The spacecraft, which is scheduled to be lifted into space by a Titan III-C rocket, will eventually be positioned 22,300 miles above the equator -- more specifically, at 94 degrees West longitude (west of Ecuador and above the Galapagos Islands). It will orbit the earth every 24 hours in the same direction as the earth's rotation; thus, it appears to be stationed permanently in one spot in space in relation to the earth. For about 30 days after reaching orbit, the satellite will undergo numerous tests; then it will be declared operational and be renamed ATS-6.

For the next 11 months or so, in addition to the Rocky Mountain Federation, the Alaskan and Appalachian regions will use the satellite for separate health and education experiments. All these experiments will operate through a Network Coordinating (or Control) Center to be operated by the Satellite Technology Demonstration in Denver. A total of 23 states will use the ATS-F.

From NASA's viewpoint, a number of unknown factors make the entire planning process quite complex. Among them are

- The underlying communications technology, while well established, has never been applied in the manner contemplated for this overall project;
- Never before have so many satellite earth stations, more than 100, been implemented across a 23-state region (including Alaska and Appalachia);
- The project represents an ambitious attempt to create a user-based information system.

The Satellite

The ATS-F will weigh about 2,600 pounds and will consist of five major structural elements: a solar array, an earth-viewing module, a structural hub, a reflector support truss, and a reflector. It will develop its power from an array of more than 21,000 solar cells. Excess power from these will be captured in two batteries, which will provide power when the craft is on the side of the earth away from the sun.

The earth-viewing module houses antennas and other experimental devices; contains the attitude control, propulsion, telemetry, and command mechanisms, as well as parts of the power supply subsystems; and houses the signal receivers and emitters.

The structural hub supports the antenna/reflector and serves as the mounting surface for the solar array trusses.

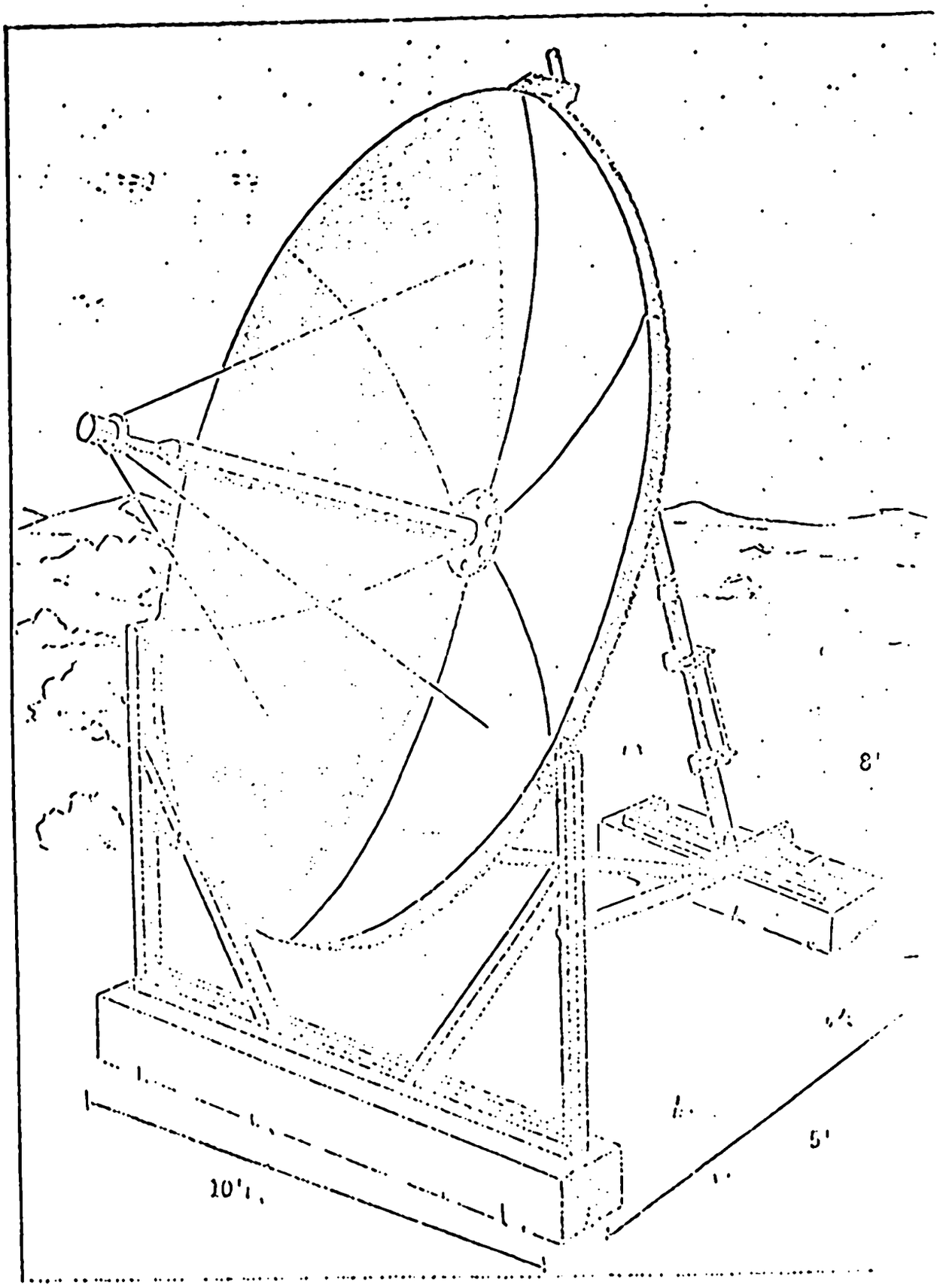
The reflector is a structure which, after orbit, is deployed into a parabolic configuration 30 feet in diameter; it will be the largest reflector yet carried into space.

This reflector will concentrate signals so that they are so powerful they can be picked up by a relatively inexpensive ground station. The satellite will carry two high-powered transmitters (operating in the 2500 MHz range). Each transmitter will bounce a signal off the parabolic reflector to produce a southern beam and a northern beam forming a giant "footprint" on the earth, each beam approximately 500 miles long and 300 miles wide. Another transmitter will enable STD engineers at the earth station in Morrison, Colorado (near Denver) to monitor all transmissions. This unit produces a "global" beam capable of being received by the high performance earth station near Denver as well as NASA control stations in Rosman, North Carolina, and Mojave, California.

Present plans call for the STD to broadcast within the eastern half of the Rocky Mountain region, then for the satellite to be repointed and the footprint shifted to the Western half. The shifting will be done by the ATS Operations Control Center at Greenbelt, Maryland. It takes about 5 minutes of maneuvering to change the viewing axis of the spacecraft and about 15 minutes to shift from the Rocky Mountains to Appalachia or Alaska. (This maneuvering time also helps to account for what has been previously mentioned as irregular program hours and time slots; see Figure 1.)

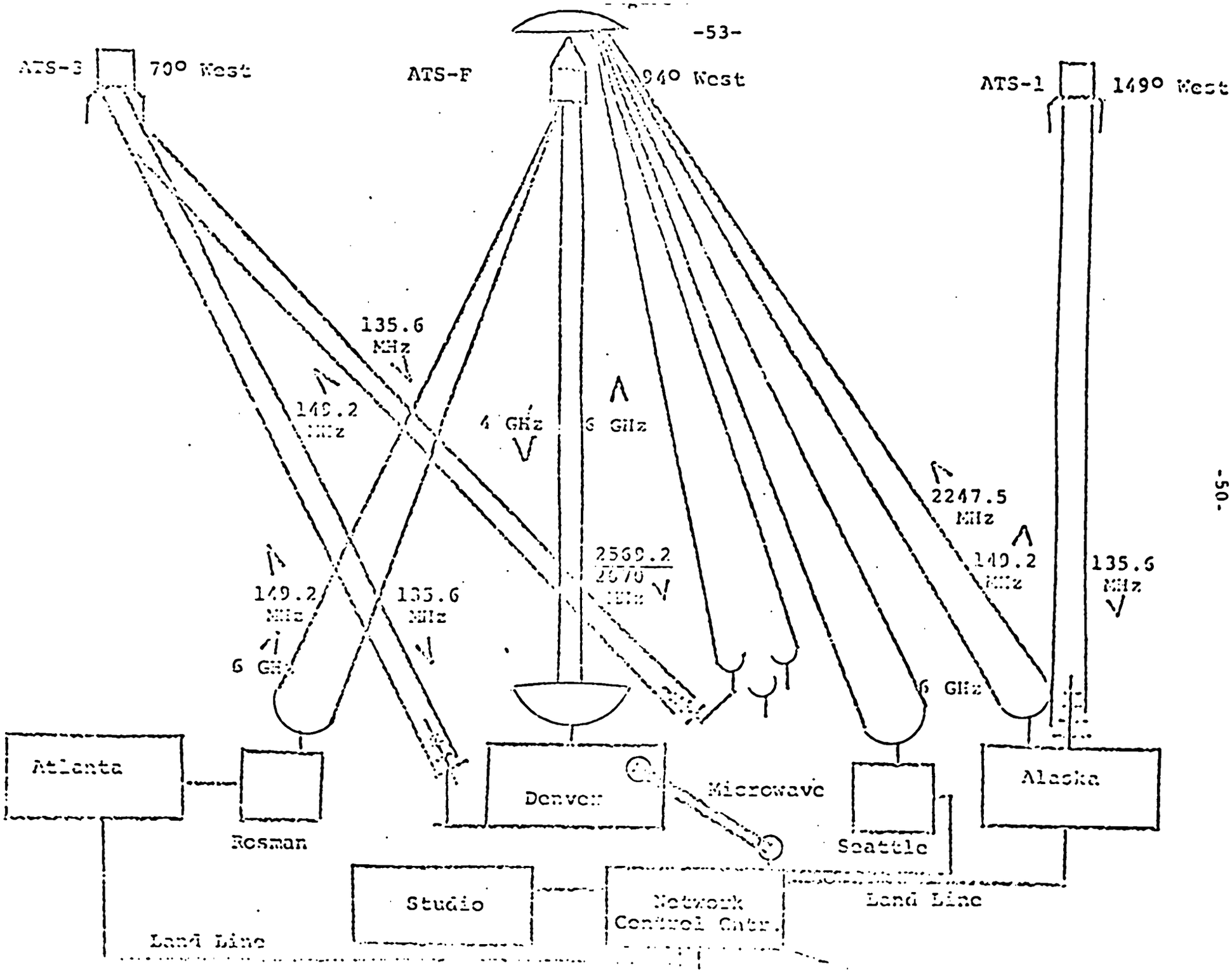
Antenna/receivers, developed by the STD's Denver-based engineers, will cost about $3,000 apiece. They have been designed to withstand the region's weather pattern of sometimes intense wind, snow and rain, and bleaching sun. These antennas and other ground terminal mechanisms convert the signal so it can be picked up by an ordinary television set. In addition to the antenna-receiver units, the transmitter equipment add-on cost is about $1,000. A color TV signal, accompanied by two voice channels of broadcast quality, can be transmitted to cover the entire region. (This second voice channel does provide the opportunity, if it is later deemed necessary, of broadcasting simultaneously in a second language, other than English.) The receiving equipment consists, as mentioned, of an ordinary television set (a rather large one, costing about $300, is being recommended for in-school use), an antenna (Figure 6 diagrams the 10-foot receiving antenna), and a converter (the converter is necessary because the frequency of transmission and the modulation procedure to be used to communicate via the satellite are incompatible with the ordinary set).

Figure 7 shows how the system operates.



10' PARABOLIC DISH ANTENNA AND MOUNT

Figure 6


ATS-3
70° West
ATS-F
94° West
ATS-1
149° West
135.6 MHz
149.2 MHz
4 GHz
6 GHz
2247.5 MHz
149.2 MHz
135.6 MHz
2569.2
2670 MHz
149.2 MHz
135.6 MHz
6 GHz
6 GHz
Atlanta
Rosman
Denver
Microwave
Seattle
Alaska
Studio
Network Control Ctr.
Land Line
Land Line

Broadcasting and Engineering: Other Functions

In a book intended for the lay reader, it is impossible to provide a detailed picture of the role, responsibilities, and functions of the engineering component of the project. As we have seen, the engineers participated in program production and designed the low-priced satellite receiver. They are also concerned with installing the antennas and receivers on the sites in the Rocky Mountain states, Alaska, and Appalachia. This task is far from simple because of the terrain and the fact that all the antennas have to be "sighted" to the satellite.

The broadcasting and engineering department will supervise the building of the new studio and the installation, testing, and maintenance of its equipment. It must design and build the Denver Uplink Terminal. It is required to prepare license applications for all frequencies to be employed throughout the system. It must determine what terrestrial lines it needs, design them, and contract for them. It has prepared an operating manual for the Control Center, and it must train both Control Center operators and people who have access to two-way equipment in the remote sites in the use of the devices and the systems. One of its engineers designed the digital pads.

The broadcasting and engineering component has had to maintain constant contact with federal agencies, regional broadcasters, and manufacturers.

It has supervised the conduct of field site surveys. It has designed and is building prototype test equipment. Its budget, which is distinct and apart from the educational experiment budget, is for $930,000 in fiscal 1974; $600,000 in fiscal 1975. This budget includes allocations for management, the network control center, some manpower for the studio, and 130 ground stations (including spares), installed.

Installation is to be handled by a crew of three to four men equipped with a motor home and trailer and the tools necessary to install antenna mounts, antennas, and cables. A second crew, probably of two men, will be formed to revisit the sites and install the electronic components. Each site must be surveyed by a member of the broadcasting and engineering staff in advance. Five man-days are estimated for the job at each site; each crew is expected to install the equipment at the rate of one site per day. Further, the crews face the problem of having the worst months of the year, in terms of weather, in which to do most of the installation.

Research and Evaluation

The research design of the experiment was still being revised as of late 1973. We shall describe the project's current -- not final -- plans. Almost from the outset, the project has had a team of outside researchers from Stanford University, one of whose functions was to provide formative evaluation on the basis of a separately funded contract with the U.S. Department of Health, Education, and Welfare.

ns that are now emerging, however, have been developed by staff
r than by outside consultants. The project only recently acquired
rector of research; he assembled a research advisory board which
met, for the first time in mid-July, 1973. It would thus be unrealistic
to expect a firm, or final, design.

Given the little time remaining to mount the entire project, the preliminary plans now being circulated will probably closely resemble the final plans. However, one should remember that these plans are "preliminary." Many of the satellite-related enterprises, now being planned for various parts of the world, are proceeding without the aid of accurate information about the capability of satellite-based systems or the extremely complex problems entailed in putting such systems into operation.

The Satellite Technology Demonstration has been instituted to fill the need for empirical data. For research purposes, the STD can be defined as:

> an exploration of the utility and proficiency of the technological elements of a satellite communications system and related human support elements, as well as an investigation of the feasibility and costs of delivering educational and social services to specific audiences.

The general research tasks consist of collecting and analyzing data on the possibility of developing, implementing, and maintaining the hardware

and hardware support elements of the STD. Research on acceptance by users will focus on opinions about such specifics as the concept of satellite-based media distribution systems; the STD media distribution system and delivery modes; the concept of career education; and the program courses transmitted by STD. Changes in attitudes and interests of individuals and overt signs of acceptance -- such as viewing patterns of audiences, resource allocations, or role changes by agencies and institutions -- will also be studied. Data on the cost of the hardware and support services relevant to the delivery of program will also be collected and analyzed, and efforts will be made to assess "at a minimal level changes in students' career related knowledge."

To provide information on the procedures that have characterized the development, implementation, and maintenance of the satellite communications system, key management personnel, component directors, state coordinators, and other important staff members will be asked periodically to record their assessments of the critical incidents and decision-points that have occurred throughout the demonstration. Project management, with the aid of the research team, will have primary responsibility for this data collection.

Some general subject areas to be explored include:

1. Overall project and component goals and objectives
2. Project, component, and field organization
3. Project and component operational procedures

When critical incidents are identified within a category associated project personnel will be asked to address the following kinds of specific questions:

1. What changes in goals, structures and/or procedures occurred as a result of this incident?
2. When did such changes occur? In what sequence?
3. Who was involved in the major decisions related to this incident?
4. What were the implications of these changes for the demonstration?
5. What allocation or reallocation of resources was entailed in these changes?

Analysis of this historical record will yield invaluable information to future decisionmakers in analogous programs.

Description and Analysis of Costs

In order to obtain data on the costs related to the development of the various elements of the satellite communications system and related support systems, dollar expenditures will be calculated for these elements. For example, the following are the kinds of accounting data which will be reported:

1. Cost per hour of producing new career development programming
2. Cost per hour of adapting preexisting materials for programming
3. Cost per hour of live programming
4. Cost per site of field support services
5. Cost per student of digital response system
6. Cost per hour of developmentally testing program
7. Cost per user of collection of research data

8. Cost per teacher of training
9. Cost per site of hardware (by configuration)
10. Cost per unit of hardware of maintenance
11. Cost per viewing audience of public information services involved in attracting audiences
12. Cost of participation in the communications system accrued by the receiving sites

These data, in conjunction with the data on major decision points, will constitute a much-needed empirical base for future decisionmakers.

Although the research and evaluation plan is still only preliminary, it has been the concern not only of the project team, but also of many distinguished consultants who had had long and varied experience with similar experiments and with research projects as sophisticated as that of Britain's Open University.

Since this history is to aid those parties considering establishing such systems as that of the Open University or the Satellite Technology Demonstration Center, dissemination of the material that has already been prepared would be helpful. In fact, current funding patterns for similar projects tend to demand, as an early step, the design of a research and evaluation plan. We have therefore offered, as appendices, several of these preliminary research papers: a detailed chart of the "Variables" to be considered in the operational year (appendix E); a paper on "The Developmental Process," which deals with the validation of products and services (appendix F); a highly specific paper on "Project Research Goals" and how to measure their achievement (appendix

G); and, finally, a paper on "Population to be Studied," which contains more detailed information than has appeared heretofore on programming and site details and characteristics (appendix H).

Utilization and Field Services

During the planning and development stages, utilization and field services personnel have been concerned with gaining a thorough comprehension of the Rocky Mountain West. They have been attempting to establish a network of people throughout the region in selected communities to ensure that the system is responsive to community, state, and regional needs. They recruit and train people to work directly in the demonstration and tie in volunteers to support its goals. The effort in each state is supported by a state coordinator who has established ties in various state agencies. He meets with local school boards, community leaders, and spokesmen for ethnic groups, assists in demographic studies, and supervises the selection of sites. His duties are varied, for he is the direct link between the system and the people. His efforts are supported in each state by the governor's office, chief state school officers, telecommunications councils, departments of human resources, and other state agencies.[16]

The utilization component consists of a director, an associate director, a field service coordinator, three field service assistants, an administrative

secretary, two additional secretaries, and eight state coordinators. It has divided the sites to be serviced into four main types. The support service at each site basically is to provide maintenance, instructional support, and community involvement.

Of the "intensive" sites (those sites that can both receive and transmit), eight will have "type 1" field support. "Type 2" support will be provided to another eight intensive sites and to eight of the receive-only terminals. "Type 3" support will be provided to the final eight intensive sites and to 16 receive-only terminal sites. "Type 4" support will be provided to the final eight receive-only sites.

Type 1 support is that of a full-time site coordinator who works eight hours daily and is an additional person beyond school staff. Type 2 sites receive a half-time site coordinator who works four hours daily and is an additional one-half time person beyond school staff. Type 3 sites receive a half-time site coordinator who works two hours daily and is probably to be a teacher who will be reimbursed for the extra time and work load. Type 4 sites will receive support stemming from volunteer efforts (in the community) mobilized by state and local personnel within the community and the school.

The utilization component has indicated that the number of site personnel available will be reflected in the project's ability to attract, hold, and obtain the acceptance of specific audiences. (For more detail, see appendix H.) A flow chart (Figure 8) delineates the field service communications channels within the regional office and between the regional office and the states and local sites.

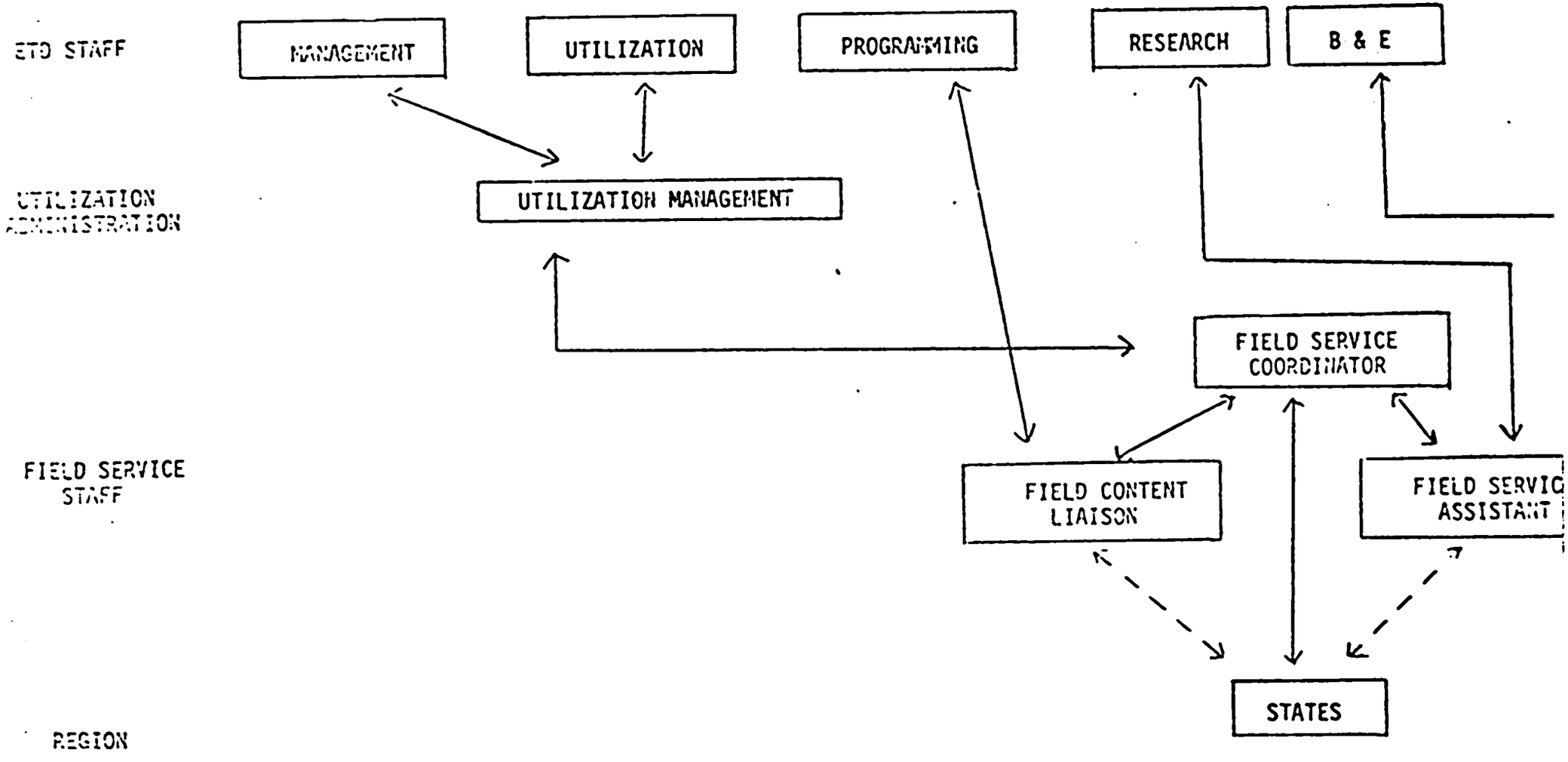
Two-way communications capability is to be available, via the satellite, from the regional office to the intensive sites.

This component is responsible for a wide variety of functions. It makes contact with state and local persons to whom it supplies background information, receives general or specific idea proposals, and obtains reactions to the project's ideas or material. It obtains participation, at this level, in project planning; obtains support for project implementation; and obtains an evaluation of the demonstration.

Utilization nominated all potential sites, based on personal visits, and on having obtained community acceptance after explaining the project. It is responsible for the volunteer efforts in communities and for training the site coordinators. It conducted surveys of the school systems, collected and analyzed demographic data, carried out site negotiation procedures, and is concerned with methods for attracting and holding audiences. (For an indication of the variety and complexity of tasks and data with which it is concerned, on the community level, see appendix I).

Figure 8

FIELD SERVICE COMMUNICATIONS STRUCTURE



Project Management

Management's goals are the goals of each of the components, which have been discussed in detail. According to management, if there is a single overridin goal, it is to implement the component goals expeditiously and economically, to make the project operational, effective, and cost effective.

Since most of top management are new as a team, they have probably not yet had time to articulate a philosophy for achieving these goals. They have, however, made major reorganizations: the "course-team" method of producing (programs described) is a considerable departure from what had been an earlier approach. The new management has had the unpleasant task of scaling the project down from an anticipated funding level of $17 million to its current budget and scope. It has also had to fire people of ability because their functions no longer fit the reduced project.

Management has had, in a very short period, to rebudget and renegotiate its budget with federal agencies and officials, a process which is still going on. At the same time, it has had to remain operational -- certain schedules allow no alterations if the project is to be ready when the hardware is.

Management had not even had time to update its own table of organization. (We have, though, already seen the one for the program component, an organizational scheme which incorporates content

development. This approach, too, was a departure from the previous one. Originally the content components [then both career development and early childhood] had been separate from programming; now both content and production are under one program director.

The new approach, though, calls for a project director and, as his top assistants, a director of public information (a new post) and an associate project director, whose primary concerns are administrative. Reporting through the associate project director are directors of research, utilization, programs, and broadcasting and engineering. Reporting to utilization director are field service, state liaison, user input and site coordinator personnel. Broadcasting and engineering has, reporting to it, personnel and functions for the network control, the Denver uplink, the ground terminals, data processing, and the computer.

A National Advisory Board of individuals skilled in the various components is being formed. It will probably meet to review progress and provide advice several times a year. Some 45 persons (of whom about 13 are primarily clerical) are involved, excluding personnel for the broadcasting and engineering component.

Budget

A final budget has not yet been agreed upon by the project and federal funding sour

No total is available for money expended. It has

been estimated that the total cost of the Rocky Mountain Federation portion of the project, from its start through its various planning phases and through the sum now allotted for completion of the operating year, will amount to some $11 million. (This figure includes the amount spent by the broadcast and engineering component; it does not include the amount allocated by NASA for the satellite or the funding for two major components of the project -- the Alaskan and Appalachian experiments. These experiments are funded at an estimated $1.2 million apiece for the life of the project.)

ASSOCIATED PROJECTS

Alaska.

The Alaska Telecommunications Project is extremely new. A project director, who was recently appointed, is working out of the Office of the Governor in Juneau. Unlike Denver, there has been no opportunity to visit the site first-hand to collect data and conduct personal interviews.

The project has two main goals: to assist Alaska in planning to meet its own specific satellite-relevant telecommunications needs and to acquire information about the feasibility of using video satellite technology to upgrade Alaska's educational programs, i.e., to discover whether the process is viable.

Alaska is an enormous state -- it encompasses four time zones. Of its 265 villages, towns, and cities, two-thirds have no access to railroads or highways. Transportation is by air or sea, or on land by snowmobile or occasionally a dog team. Because these communities are not connected by land to other areas, they also lack adequate communications. More than 100 communities have no communications at all, except for short-wave radio:

> Most of the rural communities are small villages, populated by Eskimos, Indians or Aleuts; native villages where life is very different from the pattern of communities in the other American states. Villagers often rely in some measure upon food-gathering for subsistence, generally supplemented by seasonal employment or public assistance. Year-round jobs are scarce and when they exist are apt to be held by non-Natives. Incomes are very low; the cost of living is high. . . .
>
> In 1971, consulting engineers . . . identified locations for conventional radio and television broadcasting stations, and looking toward interconnection, concluded that the only feasible method by which educational television could be brought to all Alaskans would be via a satellite distribution system. . . .[17]

For these reasons, live television and two-way voice communication will be employed for early childhood language development and basic English oral skills components of the project. There will also be an interactive health education component (which will use off-the-shelf program material resources), supplemented with two-way audio. Viewer-defined programs are also planned; the programs will probably be developed on site, using portable video tape equipment.

Five categories of courseware are to be aimed at various target populations:

1. Early childhood development -- language/mother and child

2. Basic English oral communications skills/preschool and primary (ages 4-7)

3. Teacher inservice training/teachers, administrators, paraprofessionals

4. Interactive health education/students and teachers

5. View-defined programming/Alaska native populations

Fifteen receive-only terminals are planned; two "comprehensive" ones will have two-way video (one of the two is to be shared with the health education program).

Broadcasts will probably begin with the 1974-1975 academic year; some of the teacher-training programs can possibly begin during the summer of 1974. The estimated total budget for fiscal 1974 and 1975 is $1,360,000.

Current plans for broadcasts on the satellite call for two hours a week of "live" material, one hour of "off-the-shelf," and two hours of new production.

Plans to evaluate the project are extremely limited because of the short period of satellite availability, the limited number of sites, and the extremely limited number of potential viewers. (Alaskan communities tend to be small.) Probably context, input, and process will be evaluated to some extent, but not the product.

One major problem has been recruiting key secondary staff. Fiscal 1974 funds have not been committed by the two potential funding agencies for this project (HEW and the National Institute of Education), and without this support the guaranteed year of employment contracts which are necessary to recruit people for Alaskan employment cannot be negotiated.

The Northwest Health Project: Health Service Delivery

The Lister Hill National Center for Biomedical Communications has been conducting programs using the ATS-1 satellite for audio communications to and from remote Alaskan sites. Part of the National Library of Medicine, which, in turn, is part of the National Institutes of Health, the Center is concerned, institutionally, with the best way of bringing health education and delivery of health services to isolated populations.

The ATS-1 program will be extended, using the video facilities of the ATS-F. The project is concerned with finding out what a properly designed medical record system adds to a two-way, consultative audio system.

It also seeks to determine whether video and electronic examination techniques, such as the stethophone, add measurably to the system now being used.

The ATS-F (with two-way video) will be used in two villages. They will be linked to one public health facility and one tertiary consultative facility. In addition, there will be control villages (audio only) plus the aforementioned medical record system, using the ATS-1 satellite's digital information carrying capability.

Approximately $1.2 million will be spent for this activity.

The project works closely with the Indian Health Service, and it is estimated that about one hour a day of programming will be transmitted, audio only, on the ATS-1; about three hours a week of consultation activity on the ATS-F; and, in addition, about one hour a day of digital transmissions on the ATS-1. The medical records system aspect of the project will be linked to a computer at Tucson, Arizona; computer terminals will be located at all sites.

Health Manpower Training

Some states in the Northwest section of the United States have no medical schools. They also lack an adequate number of physicians. This experiment

will determine whether it is possible to train students in remote locations and whether such local training will encourage establishing of practices in local sites.

The University of Washington (State) Medical School accredits various colleges in those states that have no medical school to provide first-year medical courses. The local instructors are supervised from the University. Instruction is augmented by periodic visits from University of Washington faculty. An attempt will be made to see if these procedures can be mediated via interactive video (via satellite) instead. The satellite can eventually tie together the colleges dispersed throughout the Northwest for counseling and interviewing and can allow students to discuss topics of interest with their peers. Communication can obviate the need for travel on the part of instructors and faculty. This experiment also seeks to determine how the satellite system and the present system compare in terms of educational effectiveness and cost.

The anchor point for this component is to be the University of Washington Medical School. One site in Omak, Washington and one in Fairbanks, Alaska, are to be linked with the University of Washington via two-way video on the ATS-F. About 2 or 2.5 hours of satellite time are planned a week. The total cost is estimated at $500,000 to $600,000.

The Appalachian Satellite Experiment

While the project has been some time in the planning stage, it is only in the last few months that a contractor to carry out the activities under the managerial aegis of the Appalachian Regional Commission (an organization not dissimilar to the Federation of Rocky Mountain States) has been selected.

The Appalachian Region, which runs from southern New York to Mississippi, encompasses 13 states and some of the poorest counties in the country. As in the Rocky Mountain region, there are many rural, isolated communities where the terrain hampers transportation and communications. Although excellent interstate highways run throughout the area, local transportation has long been a source of discontent. The area is filled with one-room school houses. Extremes of weather aggravate the transportation problems and keep many children away from school, as does poverty. Often children do not have enough to eat or enough to wear to go to school.

The target audience for the technology demonstration will be school teachers at five sets of three sites each (or 15 sites in all) located throughout the Appalachian region, with sites stretching from the southern tier of New York State to northern Alabama.

The total cost for the programmatic elements of the project (exclusive of

technical costs) is projected at $1.2 million for fiscal 1973 to 1975.

There are six program elements and accompanying technologies in the experiment. In the summer of 1974 it is planned to provide, via the ATS-F:

1. A three-credit college course in the teaching of early elementary grade reading, to consist of:

    a. 12, 30-minute pretaped video programs, followed by

    b. 12, 15-minute programs of four-channel, audio-based programmed instructions, and

    c. 4, 45-minute live video seminars with provision for audio interaction.

2. A three-credit college course in career education for elementary grade school teachers with the same components as above.

Each course will be offered on Tuesday and Thursday during the same six-week period. The pretaped lessons, with audio-programmed instructions immediately following, will be in the mornings. The seminars will be offered during afternoons on four of the days when morning instructions will be provided. Each three-credit course will thus provide a total of

12 hours of courseware.

During the school year 1974-1975, it is planned to provide:

3. 26 live, 45-minute seminars in career education with provision for audio interaction for junior high school teachers once a week after school.

4. 26, live 45-minute video seminars in career education with provision for audio interaction for senior high school teachers once a week after school.

Each of these courses will carry both in-service and college credit.

5. Computer-managed instruction in reading as a service to early elementary grade teachers. Teachers will type in descriptors describing a youngster's reading difficulty and will receive a printout listing available materials prescribed to meet that youngster's problems.

6. Computer-managed instruction in career education as a service for teachers at both primary and secondary levels.

Appalachian Component Health Experiments. One component of the Appalachian project is to be a series of health experiments conducted by the Veterans' Admini tration. Although many of the plans are considered tentative, 10 Veterans' Admin

tration hospitals, ranging in location from Wilkes Barre, Pennsylvania to Dublin, Georgia, are to be linked via satellite. Video briefings, seminar discussions, random computer-assisted instruction access, "grand rounds" in medicine and nursing, and slow-scan facsimile transmission of X-ray plates are to be transmitted to physicians and nurses in these hospitals. The object is to determine the efficacy and cost-effectiveness a domestic satellite as a means for exchanging information in VA hospitals, many of which are remote from medical teaching centers.

Among the subject areas being considered are cardiovascular diseases, genitointestinal diseases, bleeding management, cirrhosis, malignant diseases, pulmonary disorders, mental health and behavior, neurological problems, and genitourinary diseases. Programs on management, the role of the nurse, and on problem-oriented medical records are also being discussed.

One-half of the sites are to have the ability to receive and transmit; broadcasts are planned for two hours and 45 minutes every Monday, starting at 1:00 p.m.

Atlanta, Georgia, where the Foundation for Applied Communications Technology is located, will be the originating point for program productions, and the facilities of the National Medical Audio Visual Center will be employed.

SUMMARY AND IMPLICATIONS

Since none of the projects we have discussed is within five months of becoming operational, it is impossible to make a conclusive summary. At that time, however, it might be instructive to review the performance, plans, and goals of the projects and compare the views of the people directly concerned with implementing those plans. Even before launch day we should have learned a great deal about the complexities of managing new and untried technologies. It may take considerably longer before we learn whether we have managed their effects on people.

The hardest task for the staff involved in these projects is not dealing with or designing for the technology. Rather it is designing the courseware, software, research and evaluation plans, management approach, and utilization and field services and determining how people are to learn of these services and be trained to use them.

These efforts, too, consume the greater costs. And, an important lesson to be learned from these efforts it to watch <u>those</u> costs closely. It is becoming evident that a educational program suitable for one man is not necessarily

suitable for another, in the same culture and country or in a different one. As Carroll V. Newsom, former vice-president of RCA and before that, president of New York University, has so aptly said in "Communication Satellites: A New Hazard for World Cultures":

> With the advent of the communication satellite, the term "internationalcommunications" has suddenly taken on a series of connotations that have introduced to the world a new set of problems of vast complexity and grave consequences. Again we find ourselves dealing with a situation, so common in modern times, wherein technology has outrun man's true understanding of its potential, often potentially disastrous, effects on a society.[18]

There are key questions to be answered. Can multiple management, such as is represented in this project by the STD project managers, by the Federation as a quasi-political body on the State level, and by the managers who represent Federal funding sources, yield effective results? Should projects such as this be controlled by a single entity? If so, which one? What will be the effect of the frequent changes of goals, priorities, and kinds and levels of technology? Will the mixture of personnel on so many levels -- political, technological, managerial, and educational result in smooth and effective operations? Clearly, the stormier aspects of the project's history indicate the need for all those concerned to define and agree upon the goals, objectives, and scale of such an experiment at the outset. Otherwise, as has been shown, duplication of effort and waste of energy results.

In this field, the hardware has so far and fast outstripped the software that one can only take refuge in cliches and folk wisdom and urge that we make haste slowly. While we proceed, we should continually keep before us the question, "Suppose it works?"

I wish to thank all those who have given generously of their time, opened their files, and allowed me to quote from them. In addition, I would like express my appreciation to David Berkman of the U.S. Office of Education for sharing both his time and files, to Robert Shamaskin, Chief, Education Operations of the Education Service of the Veterans Administration Central Office, to Mr. Feiner of the Lister Hill National Center for Biomedical Communications, National Library of Medicine, National Institutes of Health, and to Nancy Freireich, editor.

FOOTNOTES AND REFERENCES

1. The writer was last in Denver, visiting the project, in mid-July, 1973. Virtually all of what follows is based on documents collected on that field trip, augmented by virtually a full week of interviews with project staff, and by a previous trip several months ago, at which time the project was in the process of radical downward revisions in scale and funding.

2. In order that the level of manpower skills can be thoroughly appreciated, the official biographies of key staff members have been attached to this report. They appear as appendix J.

3. The documents were numerous. I would estimate that, on two occasions, more than 2,000 separate pieces of paper were collected, all of which have been read and analyzed. Where direct quotes are used, they are most often identified. In some cases they are not, primarily for stylistic reasons. Three documents have been invaluable. The first, "Goodbye to the Great Divide" by Greg Pearson, Public Information Director of the project, contains background information. The other two documents are "Interim Reports": "General History and Analysis of the Planning Phase of the Federation of Rocky Mountain States Educational Technology Demonstration" by Nancy H. Markle; and

"Interim Report" Part VII, "The Historical Record of the Planning Phase, etc." by David G. Markle, Nancy H. Markle, Douglas C. Hall, Dennis R. Foote, all of Stanford University. (In subsequent footnotes, these reports will be identified as "Pearson" or "Interim Report.")

4. Interim Report.

5. A Brochure on the Federation of Rocky Mountain States.

6. A Brochure on the Federation of Rocky Mountain States.

7. See "footprint" map; attached as appendix

8. Walter Coyne, "Education's Rising Star" in American Education (November, 1972).

9. Pearson, above.

10. "The World's Telephones as of January 1, 1972." A report from the American Telephone and Telegraph Company.

11. "The ATS-F and -G Data Book." Issued October, 1971, revised, September, 1972. Published by NASA at the Goddard Space Flight Center, Greenbelt, Maryland.

12. Project Document. Untitled list of sites and population breakdowns.

13. Pearson, above.

14. "The Associated Press Almanac, 1973."

15. Pearson, above.

16. Pearson, above.

17. "Alaska ATS-F Health/Education/Telecommunications Experiment," Office of Telecommunications, Office of the Governor, February, 1973.

18. As printed in "Educational Broadcasting Review," April, 1973.

CAREER DEVELOPMENT CONTENT

MAKING DECISIONS

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a. The student will identify the main steps in making a decision.

b. The student will identify how he is responsible for the outcomes of his decisions.

c. The student will identify the options available to a person upon leaving school by determining which is most appropriate to a given situation.

I. Assessment

A. Assessment of Self

1. Interests

a. The student will identify his interests.

b. The student will identify the types of reading materials he likes best.

c. The student will identify the leisure activities, hobbies, school subjects and school activities he enjoys the most.

2. Aptitudes

a. The student will identify his aptitudes.

3. Temperaments

a. The student will identify his temperaments.

4. Skills (Present Abilities)

a. The student will identify his personal/ social skills.

b. The student will identify the abilities he has which can be considered technical skills.

5. How do interests, aptitudes, temperaments and skills relate to personality

a. The student will identify ways in which his interests, aptitudes, temperaments, skills, and environment influence his personality.

b. The student will identify factors which make individuals unique from one another.

6. Staying Healthy

   a. The student will identify the factors most important in having good health.

7. Setting Goals

   a. The student will identify the reasons for setting goals.

   b. The student will describe goals for himself which are realistic and personally relevant.

   c. The student will evaluate how well a person in a hypothetical situation achieves his goals.

   d. The student will identify a logical progression of activities leading to the achievement of a given goal.

B. Assessment of Environment

1. Relating to People

   a. The student will identify the personal/social skills that he should use in different interaction situations.

   b. The student will describe ways in which others may perceive him differently than he perceives himself.

2. Relating to your community

   a. The student will identify appropriate ways of dealing with people in his community.

   b. The student will identify the effect products and services have on natural resources and the environment.

3. How can you become a knowledgeable consumer?

   a. The student will identify various fraudulent sales practices.

   b. The student will identify various high-pressure sales tactics.

   c. The student will identify various sales tricks.

   d. The student will identify questions which should be asked of a salesman concerning a given service or product.

   e. The student will identify the better buy after comparing a number of products or services on the basis of cost, quantity, and/or quality.

   f. The student will identify ways in which a citizen can protect himself a a consumer.

   g. The student will identify the most valuable of several given warrantees

h. The student will identify the steps he should take before signing a contract.

C. Assessment of the World of Work

1. Why People Work

a. The student will identify the reasons why people work.

2. People and Careers

a. The student will analyze and rank several occupational alternatives in order of importance to him.

b. The student will select several careers which he would like to investigate further.

c. The student will identify persons in his community who are engaged in careers like the ones he would like to pursue.

3. Careers and The World of Work

a. The student will identify several ways in which different occupations can affect the worker's lifestyle.

b. The student will describe how lack of self-assessment and career assessment can lock a person into an occupation for which he is not suited.

c. The student will identify the effects social and cultural change have upon industry.

d. The student will identify the effects social and cultural change have upon employment practices.

4. Drawing Conclusions

a. The student will identify which type of working conditions would probably suit a given set of temperaments, aptitudes, and interests.

b. The student will identify the employer for whom he would most like to work, given data concerning several employers.

II. Understanding Careers

1. Work Performed

a. The student will identify the work performed in a given career.

2. Education and Training

   a. The student will identify the training or education which is required for a given career.

3. Salary Range

   a. The student will identify the salary range for a given career.

4. Self-employment vs. Salary

   a. The student will identify the opportunities for self-employment and salaried employment in a given career.

5. Job Outlook and Stability

   a. The student will identify the outlook for the future in a given career.

   b. The student will identify correct information about job stability for a given career.

   c. The student will identify ways in which obsolescence can affect certain careers.

6. Career Ladders and Relationships Between Jobs in a Family

   a. The student will identify appropriate lateral and vertical steps for advancement or progression in a given career.

7. Education, Training, and Skills (Necessary for Advancement)

   a. The student will identify additional post-secondary education or training necessary for advancement in a given career.

   b. The student will identify how job performance can be related to advancements and benefits.

8. Career and Job Mobility

   a. The student will identify ways in which changing jobs can contribute to advancement in certain careers.

   b. The student will identify gains and losses involved in changing careers.

9. Specialization

   a. The student will identify how specialization can affect certain careers.

10. Skills

    a. The student will identify the technical skills a person should have to successfully engage in a given career.

    b. The student will identify personal/social skills appropriate to a given career.

11. Tool, Equipment, Machinery, Materials

    a. The student will identify tools, equipment, machinery, and materials associated with a given career.

12. Aptitudes

    a. The student will identify aptitudes characteristic of people engaged in a given career.

13. Interests

    a. The student will identify interests characteristic of people engaged in a given career.

14. Temperaments

    a. The student will identify temperaments characteristic of people engaged in a given career.

15. Physical Demands

    a. The student will identify physical demands typically associated with a given career.

16. Working Conditions

    a. The student will identify working conditions typically associated with a given career.

17. Unions and Organizations

    a. The student will identify unions or other organizations associated with certain careers.

18. Licensing Requirements

    a. The student will identify careers that require licenses.

19. Seasonal Limitations

    a. The student will identify ways in which certain careers are seasonal in nature.

20. Geographic/Regional Restrictions

    a. The student will identify ways in which certain careers are geographically restricted.

21. Product/Service

    a. The student will identify careers which provide products and careers which provide services.

    b. The student will identify how the interaction of products and services can affect a given career.

22. Drawing Conclusions

    a. The student will identify careers suitable to his own combination of interests, aptitudes, temperaments, skills, and working conditions preference.

III. Implementation

A. Education and Training

1. For Personal Fulfillment

    a. The student will identify reasons why a person might pursue knowledge not directly related to his job.

2. Educational Counseling

    a. The student will identify guidance resources which can aid him in investigating educational possibilities.

    b. The student will identify appropriate preparations for a meeting with his counselor.

    c. The student will identify information appropriate to a discussion with his counselor.

3. Formal Education/Training

    a. The student will identify sources of skills training by determining which is most appropriate to a given situation.

    b. The student will identify types of on-the-job training by determining which is most appropriate to a given situation.

    c. The student will identify the application procedures for union apprenticeships.

    d. The student will identify information that he should obtain before selecting a post-secondary school to attend.

e. The student will identify the types of financial assistance available to students.

f. The student will identify the criteria used in awarding scholarships

g. The student will identify the pre-requisites for obtaining a student loan.

B. Applying for Jobs

1. Locating Job Openings

a. The student will identify guidance resources which can aid him in investigating career possibilities.

b. The student will identify sources of assistance in finding a job.

c. The student will identify the factors that should be considered when dealing with private employment agencies.

d. The student will identify proper procedures for using the classified section of a newspaper to locate a job opening.

e. The student will compose an ad to be placed in the classified section of the local newspaper requesting employment.

2. Resumés/Job Applications

a. The student will identify information which should be included in a resume.

b. The student will identify information necessary to the accurate completion of a job application form.

c. The student will identify criteria for selecting personal references.

3. Job Qualification Exams

a. The student will identify those careers which usually require job qualification exams.

4. Job Interviews

a. The student will identify the proper procedures for arranging a job interview.

b. The student will identify behaviors and responses appropriate to a job interview situation.

c. The student will identify the applicant best suited to a given job after viewing several job interviews.

C. Being a Knowledgeable Consumer

1. Budgeting Your Money

a. The student will identify the steps in making a budget.

b. The student will identify reasons people have savings accounts.

c. The student will identify various kinds of insurance.

d. The student will identify various kinds of taxes.

e. The student will identify how Social Security works.

2. Paying for Things

a. The student will identify how charge accounts operate.

b. The student will identify how various types of loans operate.

c. The student will identify how checking accounts operate.

d. The student will identify proper methods of check writing.

e. The student will identify steps in establishing a good credit rating.

3. Locating Social Services

a. The student will identify the function of different health service resources by determining the most appropriate resource for a given situation.

b. The student will identify health services available in his community.

c. The student will identify the types of personal counseling that are available to him.

Appendix B- Description of the Two-Way Audio System

The audio communication system will allow for two-way communication between the Denver Center and users located at the intensive sites. Since the transceiver must use the older ATS-1 and ATS-3 satellites for relay of the transmissions, the sound quality will be about 30 db, which compares with 50 db for a good telephone connection.

The basic equipment required for the audio system site consists of:

1. Television reception equipment to receive the video and audio portion of the programming
2. A 90 watt transceiver for the two-way voice communication capability
3. Antennas for the television receiver and audio transceiver
4. A hardwired digital coordinator which allow operation of the transceiver's controls from Denver. Digital signals transmitted from Denver turn the transmitter off and on.

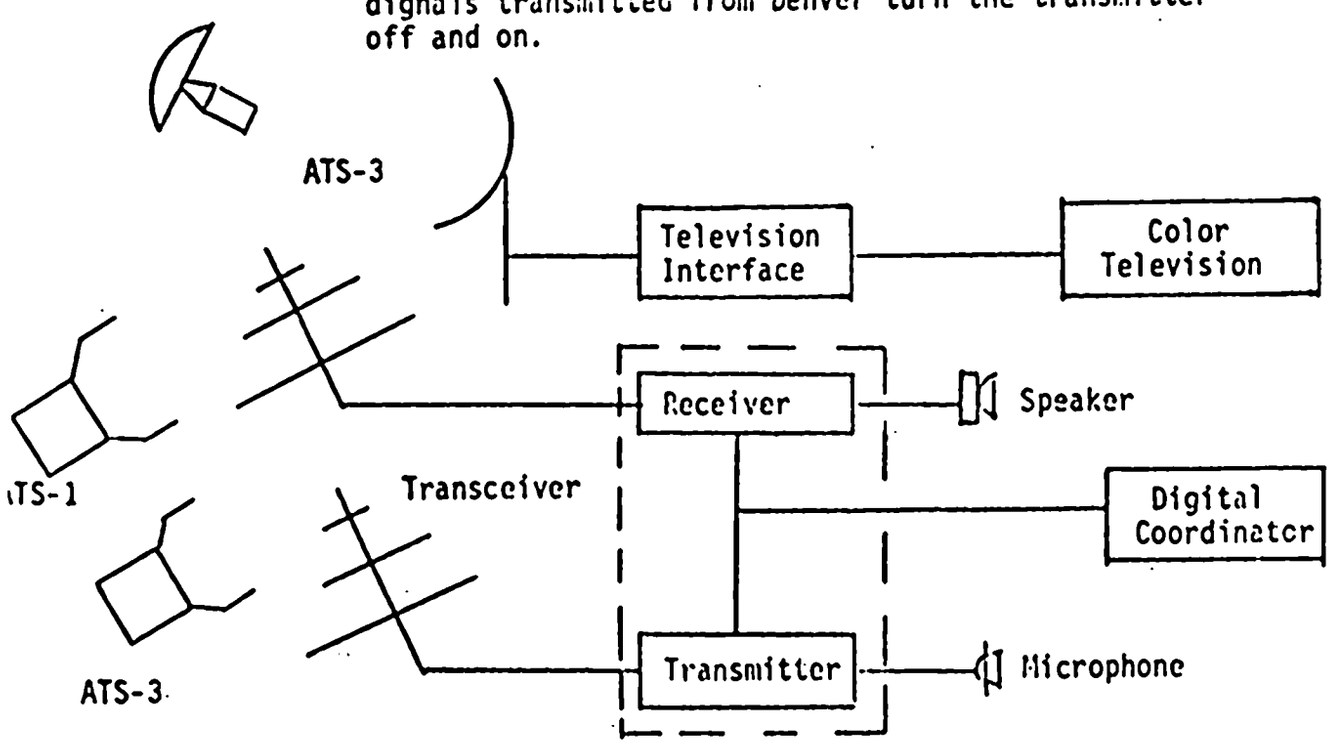


Figure B-1: Basic configuration of a site equipped for two-way audio communication

The Network Control Center (NCC) at Denver will have the following functions:

1. Control of the transceiver at the remote sites
2. Control of the television transmission equipment
3. Interface between the television studio and the transmission equipment
4. Collection and recording of system operation statistics
5. Transmission of data collected to a large computer facility for statistical processing

The basic equipment associated with audio capability required for the Denver Center consists of:

1. The two-way transceiver
2. Antenna for the transceiver
3. A mini computer which is used as a control and data gathering unit
4. Disk storage unit for storage of computer programs and data
5. Punched card reader for reading programs and data into the computer
6. Line printer for printing system status messages for the NCC supervisor and output from programs run on the computer over the remote job service

The NCC supervisor will use a video terminal connected to the computer to give commands to the computer which will in turn control the major components of the system. Periodically, the mini computer will take measurements of the performance of other components of the system and log this data along with all command sequences for later analysis. When the Denver Center computer is not being used as part of the communications system, it will be used as a remote job terminal to send data to a large computer facility for

statistical analysis. Output from these jobs will be returned to the printer at the central facility. This remote job terminal capability can be used by all elements of the Demonstration for statistical or management data processing.

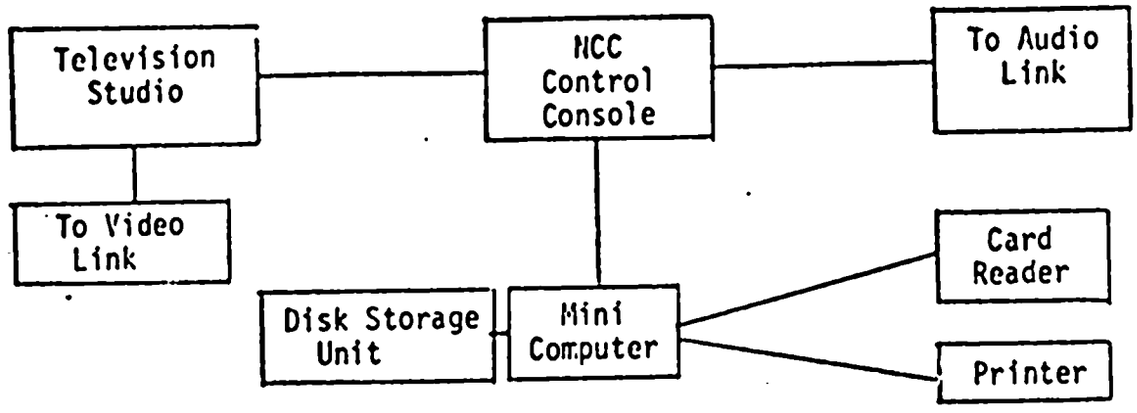


Figure B-2: Basic configuration of the Denver Control Center

In addition to the software supplied with the computer, some software must be written to accomplish the functions outlined above. These will include:

1. The Network Control Center interface
2. The communication channel control task
3. The system measurement and command logging task

The NCC interface will accept commands from the supervisor's terminal and, along with the communications channel control task, will generate the series of instructions required to operate the site voice transmitters and the equipment in the Denver Center. It will also update the status of the map board and supply additional system information to the supervisor's terminal. The measurement and logging task will automatically take periodic measurements of transmission errors, message frequencies, subsystem performance characteristics, and remote site status, which will be logged to data files on the disk drive. Some of these messages will also be written on the

line printer to allow periodic reference by the Center personnel, since the video display on the supervisor's terminal is frequently erased, resulting in the loss of messages logged there.

Appendix C - Description of the Audio and Digital System

The combination of the two-way audio with a two-way digital capability will provide a considerably more flexible tool. The major alterations in the hardware configuration required to support the student digital response system occur at the intensive sites (see Figure C-1). The digital coordinator is replaced by a small computer, which, through its software, can handle all the operations performed by the coordinator of the audio only system, as well as those required to gather data from the user pads. The ability to easily change the computer's software to meet any changes in overall system operation and configuration gives the system's designers and users a flexibility not available with a hardwired, dedicated coordinator. This flexibility also extends the useful life of the system beyond the present satellite availability to ensure the possibility of its use in future similar projects, whether associated with a satellite communications system or cable television.

The equipment required at the site to add the digital capability to the voice consists of:

1. A small mini computer which <u>replaces</u> the individual hardwired digital coordinator
2. The user pads for collection of responses.
3. (OPTIONAL) A teletype terminal to provide two-way hard copy capability

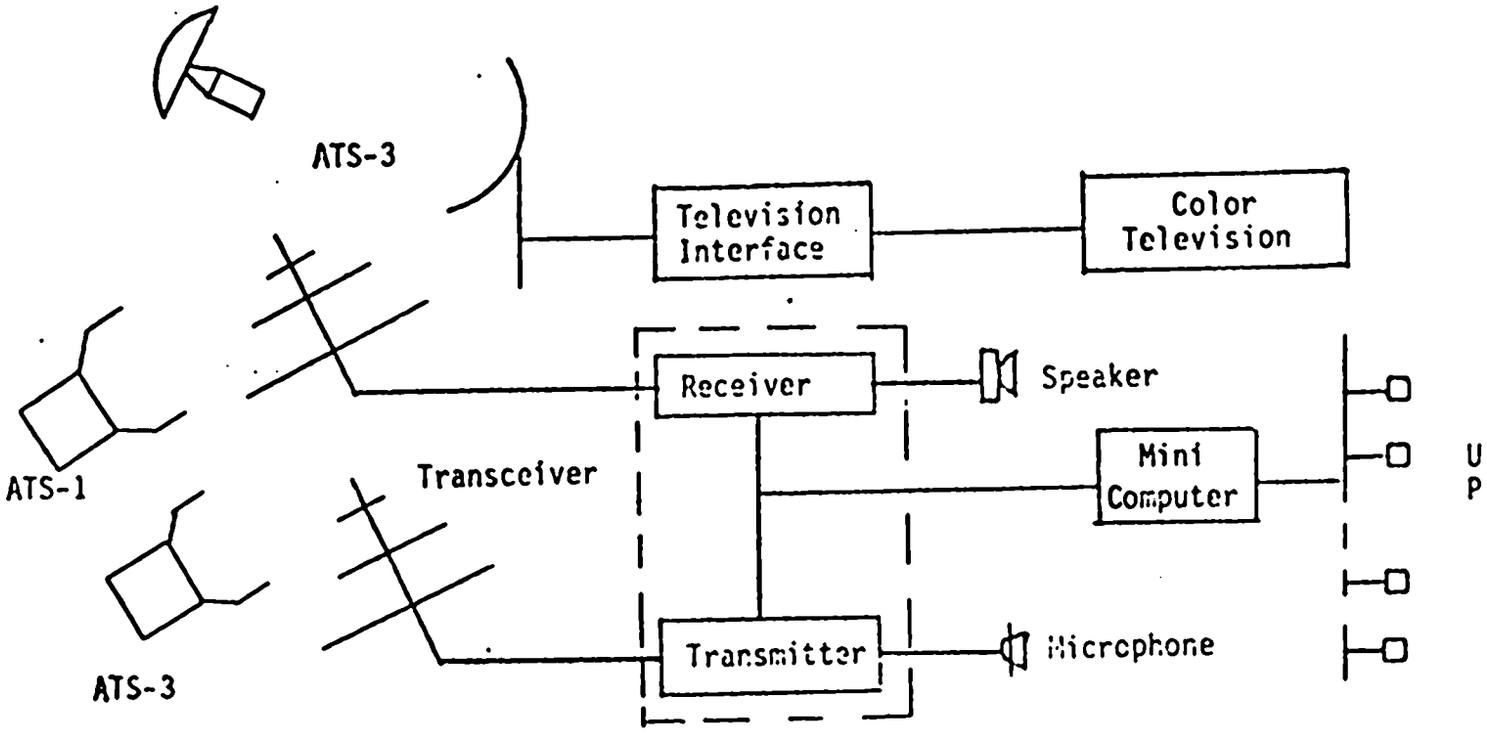


Figure C-1: Basic configuration of antintensive site equiped for audio and digital communication.

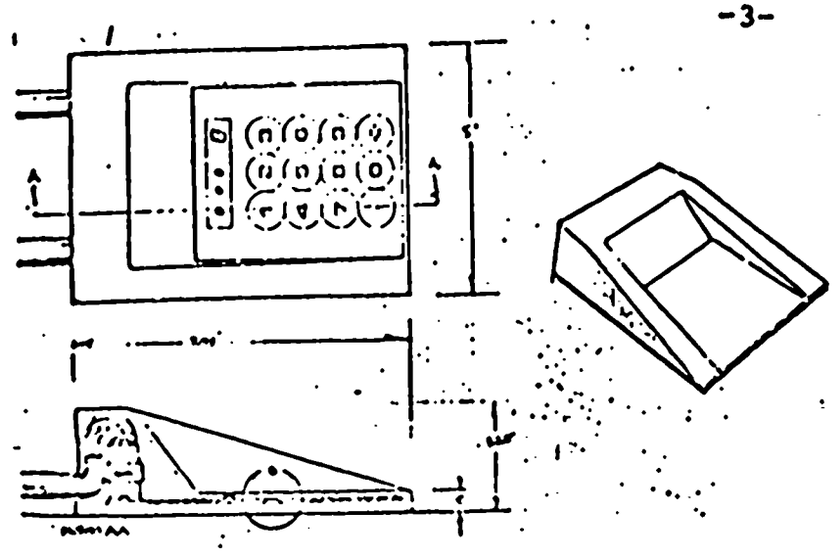


Figure C-2: Proposed design for student digital pad

Figure C-2 is the proposed design for the student pads. The key board is a twelve button touch-tone pad with a digital readout indicator, which will display for the student the answer he selected. There are also three indicator lights: one which indicates the pad is ready for input, one to indicate a correct answer, and one to indicate an incorrect answer.

The software required to operate the mini computer at the intensive site consists of the following:

1. Timing and task scheduler program
2. Satellite asynchronous communications task
3. Software downloader
4. Student pad polling task
5. Student right/wrong response task

The timing and task scheduler program controls all of the other tasks. The satellite asynchronous communications task handles the communication between the satellite, the audio/digital transceiver and the mini computer, as well as operating the voice transmitter controls that allow communication between the site and the Denver Center. The software downloader allows site personnel to request that the complete software package be transmitted over

the satellite link and be loaded in the mini's memory. This loader is stored on a read-only-memory card that is plugged into the mini when it is installed at the site. This down loading capability also allows for remote diagnosis of problems from the Denver Center, thereby considerably reducing the cost of field maintenance and repair. On command from the Denver Center, the student pad polling task examines each pad, collects the answers into a single record, and transmits the record to the central computer, which logs the data onto a disk file. The right/wrong task lights the appropriate indicator light, based on an answer code which was downloaded along with the command that activates the pads.

The addition of the digital capability will require the addition of the following equipment at the Denver Center:

- two magnetic tape drives from storage of data gathered from the student pads.

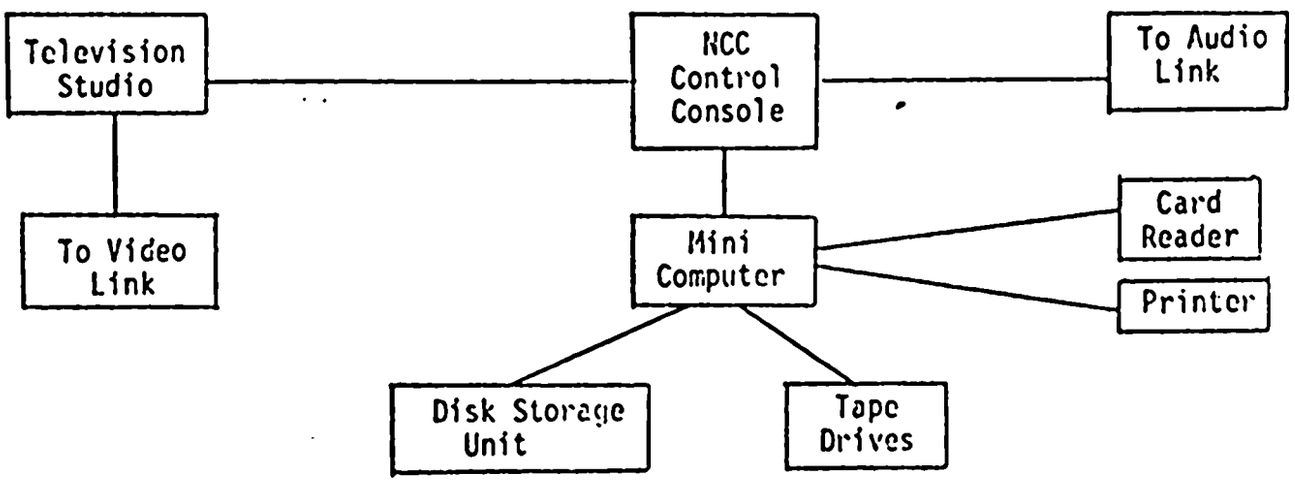


Figure C-3: Basic Denver Center configuration for voice and digital system

The computer programming at the Denver Center for the combined system will be more complex than that of the audio only system. The real time operating system of the computer will run in a multitasking mode and include

the following tasks in addition to those required for the audio system:

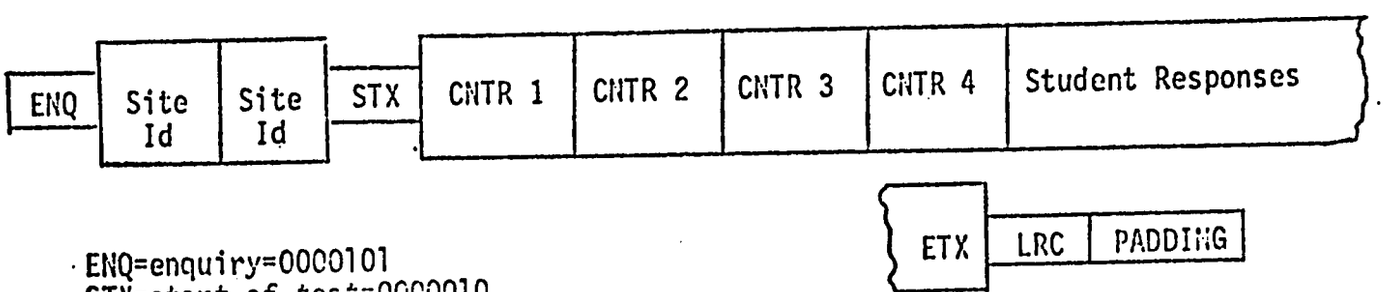
1. Communications scheduler and buffer manager
2. Site polling and line error task
3. Video tape recorder interface
4. Pad data disk logging task
5. Gross statistics overlay task
6. Key point/restart task

The communications scheduler and buffer manager handle the message traffic over the satellite link and the transfer of data between tasks. The site polling and line error task controls the remote sites and requests re-transmission of data, if any transmission errors are detected. The video tape recorder interface detects interrupts generated by the VTR when questions requiring site polling are posed in the video programming. The disk logging task accepts data from the site polling task and writes it to a disk data file for later analysis. The gross statistics task can be used on command to overlay on the video signal the results of the previous question. The keypoint/restart task takes a "picture" at fixed intervals of the system control blocks to allow the system to be restarted after a failure from a rescent state, rather than requiring a complete reloading and restart of all the systems tasks.

All system transmission will be asynchronous at 1200 baud. 1200 baud was chosen to eliminate the need for conditioned lines and to provide a low error rate (about 10-15) over the low quality ATS-1/ATS-3 satellite link. Individual characters will be ASCII standard with seven information bits and one parity error check bit. All system transmission (Denver to sites, sites to Denver) will have the format outlined in Figure C-4. The transmission

scheme, in effect, follows a standard bisync format, however, actual transmission is asynchronous with the following advantages:

1. The error detecting properties of synchronous protocols
2. Full control of the information passing through the satellite channels from a central site afforded by synchronous protocols.
3. The low cost of asynchronous transmission



ENQ=enquiry=0000101
STX=start of test=0000010
CNTRL 1-4 contain questions response and logging information
EXT=end of text=0000010
LRC=longitudinal redundancy check: exclusive oron all characters beginning at CNTRL 1 and including ETX

Figure C-4: System transmission format

The configuration proposed for the STD experiment is 24 sites with a maximum of 48 student pads per site. From figure C-5 the time required for the site mini computer to poll its pads is approximately .02 X 48 = .96 seconds. Due to the orbit of the ATS-F satellite, only 12 sites will have access to the video signal at a time. The time required to poll these 12 sites would be approximately

$$12 \frac{384 + 696}{1200} = 10.80 \text{ seconds}$$

The following operational parameters have been specified for use in developing video programming:

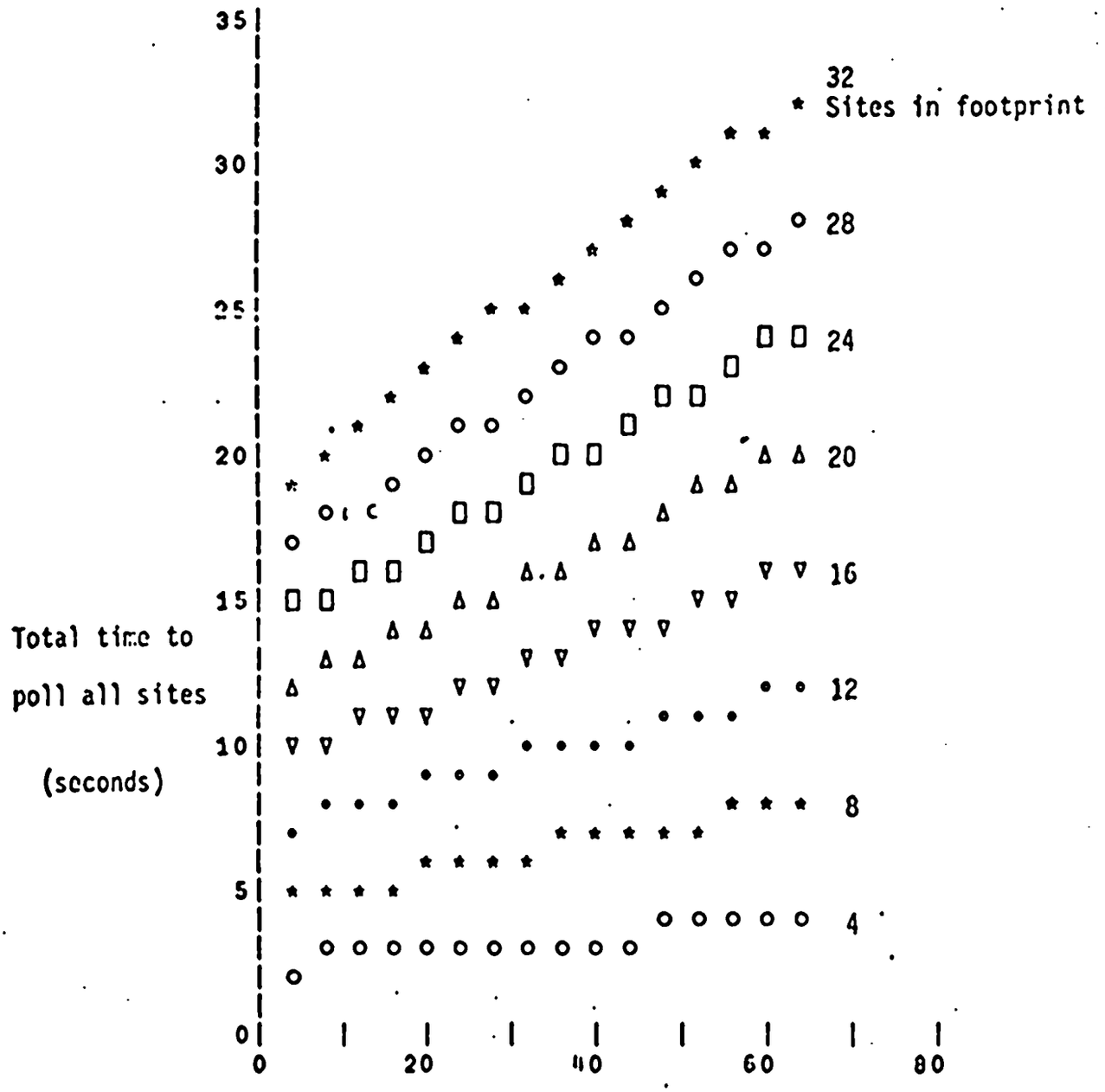
n=number of pads per site
N=number of sites
0.02 seconds=time to poll a pad
8 bits per character
1200 bits per second transmission rate
12 control characters per message
0.500 seconds satellite delay time per message

Time to poll all pads at a site=0.02 x n seconds

Total length of message=8 x n + 8 x 12 bits
=8n + 96 bits

Message transmission time per site=0.500 seconds + (8n + 96)/1200 seconds
=(8n + 696)/1200 seconds

Time to poll N sites=N((8n + 96)/1200)



a) a maximum of 120 questions per hour of programming

b) 5 seconds to 2 minutes delay between posing of questions and activation of pads

c) 12 second minimum period between questions

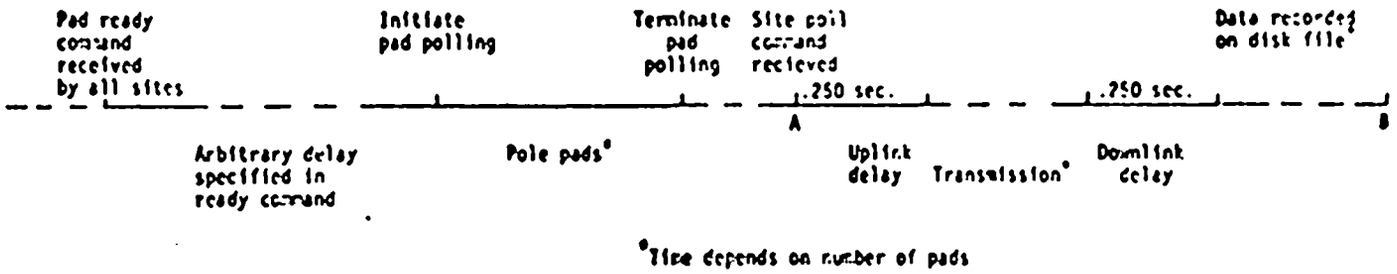


Figure C-6 Timing diagram for system transmission. One of the cycles from A to B is required to transfer one data record from the site computer to the central computer.

APPENDIX "D"

Federation of Rocky Mountain States, Inc.

Suite 300B/2480 W. 26th Ave., Diamond Hill/Denver, Colorado 80211/Phone (303) 458-8000

EDUCATIONAL TECHNOLOGY DEMONSTRATION

MEMORANDUM

TO: Myron Smith

FROM: Toli Fliakos

DATE: July 25, 1973

RE: Broadcast Schedule September 3, 1974 - May 31, 1975

The attached broadcast schedule is based on scheduling needs as perceived by individual sites (37 sites responded to our questionnaire regarding scheduling and other related activities) and reflects the input of all STD components.

In compliance with the data we collected, we cannot broadcast on the following days, which are universal holidays, because schools will not be in session:

Monday, October 28: Veterans' Day
Wednesday, November 27 - Friday, November 29: Thanksgiving break
Monday, December 23 - Friday, January 3: Christmas
Monday, February 17: Washington's/Lincoln's Birthday
Wednesday, March 26 - Friday, March 28: Easter Break

In addition, to arrive at normal corresponding semester cycles, we cannot broadcast, for the 7:30 p.m. - 9:30 p.m. slot only, on the following days:

Tuesday, November 26
Tuesday, March 25

In similar fashion, to arrive at normal, corresponding footprint cycles, we cannot broadcast for the 3:30 - 4:30 p.m. eastern slot only on Monday, September 9, and for the 3:30 - 5:30 p.m. western slot only on Thursday, September 12 and Thursday, May 16.

Four types of broadcasts are defined depending on the nature of the audience. All programming will be dealing with Career Development for the following audiences:

1. Primary audience: in-school adolescents, in grades 7, 8, and 9.
2. "Materials distribution" for use by teachers who need access to specific materials.
3. Secondary audience: parents, teachers, and other community members.
4. School staffs (teachers as well as administrators): in-service career education training.

Specific time requests and broadcast requirements for each of the above are attached.

1. PROGRAMMING FOR IN-SCHOOL PRIMARY AUDIENCE

Since we need, at least, 80 broadcast days per semester, broadcasts are scheduled daily from Monday, September 9 through Friday, May 16, except for those days, listed above, that are recognized as universal holidays.

The September 9 start date and May 16 termination are arrived at to enable a good majority of our sites to be in session before we commence our broadcasting and to allow at least one week after our broadcasting ends for routine activities associated with the closing of the school year.

The 35 minute program length is arrived at on the basis of stated preference by the sites that responded to our survey (19 preferred 30 minutes, 11 preferred more than 30 minutes, 2 preferred less than 30 minutes). All, however, will be glad to accept 35 minutes.

The survey indicates a wide range in preferences of time for programs to begin, although it clearly indicates that morning hours are desirable. To account for schedules of schools in the Pacific Time Zone, we cannot broadcast to the western footprint any earlier than 10:00 a.m. MST. To avoid satellite downtime, in between footprint broadcasts, and since we cannot broadcast to the eastern footprint after the western (we would be uncomfortably close to lunch schedules) transmission to the eastern footprint is scheduled at 9:20 a.m.

2. MATERIALS DISTRIBUTION

One hour/footprint/week is scheduled: Tuesdays (10:40 - 11:40 a.m.) for Rocky Mountain East and Thursdays (10:40 - 11:40 a.m.) for Rocky Mountain West, except on those universal holidays, listed above, when schools will not be in session.

Materials distribution, too, conforms to school year requirements beginning on Tuesday, September 10 through Thursday, May 15.

Both Tuesday and Thursday broadcasts are conveniently scheduled immediately following western footprint transmissions for our primary audience. Since these broadcasts do not involve active student or teacher participation, they are not tied down to specific time requirements.

3. PROGRAMMING FOR SECONDARY AUDIENCE

Two hours/footprint/week are scheduled (Tuesdays, 7:30 - 9:30 p.m. for Rocky Mountain East and Thursdays, 7:30 - 9:30 p.m. for Rocky Mountain West), except on those universal holidays, listed above, when we don't have school facilities, and those extra two days (Tuesday, November 26 and Tuesday, March 25) which are eliminated to provide normal, corresponding semester cycles for both semesters in both footprints.

Most of the sites cannot make their facilities available for adult participation during the day while school is in session. Furthermore, we would be hard pressed to divorce adults from work and other commitments during the day. Hence, start of transmission for secondary, adult audiences is scheduled at 7:30 p.m. which was stated as a preference by a good many of our sites.

Evening programming, too, conforms to the requirements of the school year, beginning on Tuesday, September 10 through Thursday, May 15.

4. PROGRAMMING FOR IN-SERVICE TRAINING

Programming for in-service training also conforms to the requirements of the school year, beginning on Tuesday, September 5 (the Thursday prior to commencement of other programming) through Monday, May 12 (the Monday prior to end of other programming).

One hour is scheduled for Rocky Mountain East on alternate Mondays and Thursdays from 3:30 - 4:30 p.m., except on universal holidays, listed above, and on Monday, September 9 to allow for normal, corresponding footprint cycles.

Two hours are scheduled for Rocky Mountain West on alternate Mondays and Thursdays from 3:30 to 5:30 p.m., except on universal holidays, listed above, and on Thursday, September 12 and Thursday, May 15 to allow for normal, corresponding footprint cycles.

The 3:30 p.m. starting time is contingent upon the closing of schools, most of which, according to the survey close at 3:30 or shortly before that. A repeat at 4:30 p.m. MST is scheduled for Rocky Mountain West to accomodate closing times of schools in Pacific Time Zones.

SUMMARY OF VARIATIONS FROM TYPICAL WEEKLY BROADCAST SCHEDULE

From Monday, September 9, 1973 to Friday, May 16, 1974, we are proposing the attached typical weekly schedule with the following variations:

Add	Tuesday, September 5 - 3:30 to 4:30 p.m. (RME) slot only.
Delete	Monday, October 28 - all broadcasts Wednesday, November 27 - Friday, November 29 - all broadcasts. Monday, December 23 - Friday, January 4 - all broadcasts. Monday, February 17 - all broadcasts. Wednesday, March 26 - Friday, March 28 - all broadcasts.

Delete (Continued)

Tuesday, November 26 - 7:30 to 9:30 p.m. (RME) slot only.
Tuesday, March 25 - 7:30 to 9:30 p.m. (RME) slot only.
Monday, September 9 - 3:30 to 4:30 p.m. (RME) slot only.
Thursday, September 12 - 3:30 to 5:30 p.m. (RMW) slot only.
Thursday, May 16 - 3:30 to 5:30 p.m. (RMW) slot only.

TOTAL BROADCAST HOURS

In-School Primary Audience	189 hours
Materials Distribution	66 hours
P.M. Secondary Audience	128 hours
In-Service Training	93 hours
	476 hours

TF:pp

cc: Gordon Law
Ken Lokey
Greg Pearson
Gene Linder
Dick Campbell

COLLECTION TIME	GATHERED ABOUT	VARIABLES	DATE	PERSONNEL
Before	Hardware	a. Configuration b. Hardware Site Support	May 1, 1974 April 12, 1974	STD Personnel
During	Hardware	a. Configuration	Use Basis	STD Personnel
		b. Stability c. Position d. Frequency of updating antenna e. Environmental conditions f. Receiver location g. Hardware site support h. Signal quality	Daily till Sept. 30, 1974 Then weekly	STD Personnel Site personnel
		i. Reliability	Exception basis	Site Personnel
After	Hardware	None at present		

COLLECTION TIME	GATHERED ABOUT	VARIABLES	DATE	PERSONNEL
Before	Student (open and closed schools)	a. Audience demographic characteristics b. Career knowledge c. Career interests d. Career attitudes	Sept.30, 1974 (1st semester) June 30, 1975 (2nd semester)	State Coordina Site Coordinat and/or teacher
During	Students (open & closed schools)	a. Audience demographic characteristics b. Audience viewing characteristics c. Career Knowledge d. Acceptability of 1) Programming 2) Hardware	Exception basis	AT ROTs & Open Site Coordinator and/or Teacher State Coordinato At Intensives STD Personnel vi digital system
After	Students (open and closed schools)	a. Career knowledge b. Career interests c. Career attitudes d. Opinions of acceptance 1) The concept of satellite based media distribution systems 2) The STD media distribution system 3) The STD 4) the STD delivery modes 5) The concept of career education 6) the career education programs designed for students and transmitted by the STD	Jan. 10, 1975 (1st semester) May 30, 1975 (2nd semester)	State Coordina Site Coordina and/or Teache

COLLECTION TIME	GATHERED ABOUT	VARIABLES	DATE	PERSONNEL
Before	Teachers (open and closed schools) Administrators (open and closed schools)	a. Audience demographic characteristics b. Resource allocations related to career activities c. Roles related to career activities d. Opinions of acceptance 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career educations 6) the teacher training programs	Sept. 30, 1974 (1st semester) Jan. 30, 1975 (2nd semester)	State Coordinator Site Coordinator
During	Teachers (open and closed schools) Administrators (open and closed schools)	a. Audience demographic characteristics b. Audience viewing patterns c. Acceptability of 1) student programming 2) teacher training programming 3) field support 4) public information services 5) hardware d. Critical and significant incidents concerning resource allocations and roles related to career activities	Exception basis Weekly or bi-weekly Exception basis	State Coordinator Site Coordinator
After	Teachers (open and closed schools) Administrators (open and closed schools)	a. Resource allocations related to career activities b. Roles related to career activites c. Opinion of acceptance 1) the concept of satellite based media distirbution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) career education programs for students 7) teacher training programs	Jan 10, 1975 (1st semester) May 30, 1975 (2nd semester)	State Coordinator Site Coordinator

SELECTION TIME	GATHERED ABOUT	VARIABLES	DATE	PERSONNEL
Before	Open audience (entire year)	a. Audience demographic characteristics b. Opinions of acceptance 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the career education programs broadcast on PBS	June 1, 1974	Research staff
During	Open audience (entire year)	a. Audience demographic characteristics b. Audience viewing characteristics c. Reasons for viewing patterns d. Acceptability of: 1) career education programs in PBS 2) public information 3) hardware	Every 2-3 months	Research staff
After	Open audience (entire year)	a. Previous viewing characteristics b. Reason for previous viewing patterns c. Opinion of acceptance: 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the career education programs on PBS	May 30, 1975	Research staff

Before	Secondary audience (closed schools evenings)	a. Audience demographic characteristics b. Opinions of acceptance 1) The concept of a satellite based media distribution system 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the career education programs for adults - evenings 7) the career education programs for students	Sept 30, 1974 (1st semester) Jan 30, 1975 (2nd semester)	Site Coord and/or Tea
During	Secondary audience (closed schools evenings)	a. Audience demographic characteristics b. Audience viewing characteristics c. Reasons for viewing patterns d. Acceptability of: 1) Adult evening programs 2) Field support 3) Public information services 4) Hardware	Exception basis Monthly or less	Site Coordi and/or Teac
After	Secondary audience (closed schools - evenings)	a. Previous viewing characterisitics b. Reason for previous viewing patterns c. Opinion of acceptance 1) the concept of satellite based media distribution 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the career education program for adults - evenings 7) the career education programs for students	Jan 10, 1975 (1st semester) May 30, 1975 (2nd semester)	

Before	Specific audiences (closed sites summer)	a. Audience demographic characteristics b. Opinion of acceptance: 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the specific programs for adults	May, 1974	Site coordinato and/or teacher
During	Specific audience (closed site summer)	a. Audience demographic characteristics b. Audience viewing characteristics c. Reasons for viewing patterns 1) specific adult programs 2) field support 3) public information 4) hardware	Per program	Site coordinator and/or teacher
After	Specific audience (closed sites summer)	a. Previous viewing characteristics b. Reasons for previous viewing patterns c. Opinions of acceptance 1) the concept of satellitebased media distribution system 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the specific programs for adults	Aug. 30, 1974	Site coordinator and/or teacher

COLLECTION TIME	GATHERED ABOUT	VARIABLES	DATE	PERSONNEL
Before	General audience (closed sites summer)	a. Audience demographic characteristics b. Opinions of acceptance 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the general programs for adults	May 30, 1974	Site coordinator and/or teacher
During	General audience (closed sites summer)	a. Audience demographic characteristics b. Audience viewing characteristics c. Reasons for viewing patterns d. Acceptability of 1) general adult programs 2) field support 3) public information services 4) hardware	Exception basis Monthly basis	Site coordinator and/or teacher
After	General audience (closed site summer)	a. Previous viewing characteristics b. Reasons for previous viewing patterns c. Opinions of acceptance 1) the concept of satellite based media distribution systems 2) the STD media distribution system 3) the STD 4) the STD delivery modes 5) the concept of career education 6) the general programs for adults	Aug. 30, 1974	Site coordinator and/or teachers

Critical Incidents	Critical incidents and major decision points	Monthly beginning September 1, 1973 and continuing through June, 1975	STD Management, Personnel Component Director State Coordinators Site Coordinators

THE DEVELOPMENTAL PROCESS

Each element (hardware, programming, field services) of the Satellite Communications System is the product of a design, development and validation process. The elements are subjected to the total process to insure their utility in the total system. However, it is to be noted that the uniqueness of each element requires varying emphases on the steps in the developmental process.

This document will briefly discuss the developmental process as it relates to the hardware, program, and support elements indicating where emphases are being placed. However, the primary focus of the paper is to describe the validation activities. Appended to this document is a listing of the eleven steps to be followed as appropriate in the validation of products and services.

Hardware

In the hardware element documented in a prior proposal, the primary emphasis was placed on design, with equipment acquisition, installation, and debugging considered more routine. Nevertheless, the Broadcast and Engineering Component is implementing a rather extensive validation process.

Beginning on November 1, 1973, ground system simulations of hardware will be conducted. During the period from November 1, 1973 until March 12, 1974, all STD terminals will be installed and continually tested in order to improve operations involving all terminals. Only those terminals which pass inspection during tests performed between March 12 and launch date, April 15, 1974 will enter the operational network 30 days after launch. All terminals which encounter difficulty in the final pre-launch simulation will be required to pass the next round of inspections, which begins approximately 33 days after launch, prior to entering the operational network. The cost and performance of the ETD Ground Systems will be documented and records of all installation and maintenance efforts will be maintained.

During the operational phase of the project, constant daily reports will be collected from both Intensive and ROT sites beginning April 12, 1974, with weekly reports beginning September 1, 1974. These reports will consist of records of signal quality and reliability. Changes in either will serve as an immediate indicator that checkouts for operational difficulties need to be conducted.

Program

The program element will initially require nearly an equal emphasis on the three steps in the developmental process--design, development and validation. However, when validation testing provides evidence that the program materials emanating from development tend to be "on target" and effective less emphasis will be placed on validating future products. (This is a result of financial constraints) The validation process securing user input and feedback, is composed of three steps: exploration, scripting and prototyping. Since programming directed at junior high school audiences will be repeated (two semester format), modifications may be made for the repeat. In addition, daily feedback will serve to provide direction for minor modifications in future programming.

Exploration

In the development of scripts and/or the incorporation of new and novel content and ideas, script writers will have contact at a subjective level with individual members of the intended audience. This face to face contact will provide essential information relative to the adolescent viewpoint.

Scripting

The purpose of the event described as "scripting" is to provide quantitative data upon which to base the revision of scripts and/or vehicles, i.e.,

that element of a presentation which enables the desired content to be communicated. A major portion of those data will consist of perceptions concerning a script's or vehicle's acceptability. These perceptions will be solicited from various members of the professional educational community including teachers, counselors, administrators, and personnel from the eight state departments of education. A completed tv script, written up as an abstract including objectives and descriptions of possible vehicles, will be presented to three or four professional educators at two rural isolated sites in each state, and to appropriate members of each state department of education. During the preliminary stages of the developmental process, almost all scripts will be examined by members of the professional community. However, as trends develop which indicate acceptance and viability of certain vehicles or approaches, investigations concerning these vehicles will terminate. Also, the possiblity exists that during the scripting process a few of the more conceptually difficult vehicles will be presented via story-boards to students for their reactions.

Prototyping

The prototyping efforts, which follow scripting, are designed for providing quantitative data upon which to base the revisions of the video taped programs and/or program segments. The specific data to be acquired are indicators of: 1) student program acceptance and, 2) student achievement relative to performance objectives of each program and/or program segment being tested. This prototyping data will be gathered from junior high school students at one or two rural isolated sites in each state who view programs via video tape cassettes. Not all programs and/or program segments will be prototyped. Approximately 100 percent of the preliminary programs will be tested. However, as the acceptance of specific vehicles, etc. becomes apparent, the prototyping of these particular vehicles will be markedly reduced.

First Semester Validation

The data collected during the first semester of the career development programs will serve the following purposes: 1) the immediate refinement of the live portions of the student's programs; 2) the refinement of other portions of the students' programs for use during the second semester, and 3) the refinement of the biweekly teacher inservice program. The specific data to be collected are measures of: a) student acceptance, b) student achievement relative to specific objectives, c) teacher acceptance of student programs, and d) teacher acceptance of bi-weekly inservice programs. The career development programs for students and the teacher inservice programs will be disseminated via satellite. The knowledge and acceptance data will be collected daily via the digital system at the 25 intensive sites, and weekly or bi-weekly via written acceptance forms at the 32 ROT sites. The presence of the digital response system will provide an effective and efficient means of gathering criterion referenced measures for program evaluation purposes. All data collection activities will occur under the supervision of the state coordinators and will be conducted by the ETD personnel or volunteers at each site.

Second Semester Validation

The data collected during the second semester of the career development programs will serve the purposes of refining: a) the live portions of the student programs, and b) the bi-weekly teacher inservice programs. A third use of the data will be as input for the making of judgments relative to the effectiveness of the developmental process during the utilization of a satellite communications system. The same data will be collected second semester as was collected first semester; and the same constraints and procedures will also be operational.

PROJECT RESEARCH GOALS

1. To describe and analyze the effectiveness of the hardware and hardware support elements of the satellite communications system in the delivery of information to specific audiences.

2. To describe and analyze what elements in the Educational Technology Demonstration were effective in attracting specific audiences.

3. To describe and analyze what elements in the Educational Technology Demonstration were effective in holding specific audiences.

4. To describe and analyze what elements in the Educational Technology Demonstration were effective in attaining the acceptance of specific audiences.

5. To describe and analyze what elements in the Educational Technology Demonstration resulted in changes in students' career related knowledge.

Goal 1. To describe and analyze the effectiveness of the hardware and hardware support elements of the satellite communications system in the delivery of information to specific audiences.

A. Main indicators of hardware and hardware support elements' effectiveness:

1. Signal quality

2. Hardware reliability

   a. Mean time to failure
   b. Mean time to repair

B. Definition of Terms

1. Hardware elements: the equipment used in the transmission and reception of the Educational Technology Demonstration programming and data gathering efforts. (e.g., television sets, antennas, digital pads, satellite, etc.)

2. Hardware support elements: the resources and procedures available to develop, implement and maintain satellite based media delivery system

3. Satellite communications system: the interactive system developed by the Educational Technology Demonstration in which information is transmitted via satellite and received with some effect

4. Delivery: the process by which information is transmitted from one element of the satellite communications system to another element of that system

5. Information: the content of communication among elements of the satellite communications system

6. Specific audience: students and adults who are to receive programming via any of the 64 sites.

C. Specific Questions to Be Answered

1. What is the range of signal quality achieved at each site?
2. What is the variance of signal quality achieved at each site?
3. What is the hardware reliability at each site?
4. What most affect the signal quality and hardware reliability?
5. What skills and knowledge are necessary for site personnel in order to effectively maintain various hardware elements?

Goal 2: To describe and analyze what elements in the Educational Technology Demonstration were effective in attracting specific audiences.

A. Main indicator of attracting: Number of audience members having viewed at least one Educational Technology Demonstration program.

B. Definition of terms:

1. Elements: specific products or procedures
The main element variables to be studied are:

a. Programming

1) Course
2) Scheduling

b. Public Information

1) Level
2) Type

c. Field Support

1) Level
2) Type

d. Hardware

1) Level
2) Kind
3) Performance

2. Specific Audience: Students and adults who are to receive programming via any of the 64 sites. The potential audiences are described in the previous section entitled "Population to Be Studied" The main audience variables to be studied are:

a. Audience characteristics
b. Site characteristics

C. Specific Questions to Be Answered

1. What is the extent to which desired levels of participation were obtained with specific audiences?
2. What is the relationship of site and audience characteristics to participation?
3. What is the effect of programming, public information, field support and hardware on level of participation?
4. What factors are perceived by specific audiences as most influencing their viewing patterns?

Goal 3: To describe and analyze what elements in the Educational Technology Demonstration were effective in holding specific audiences?

A. Main indicators of holding:

1. Number of audience members viewing more than one program

2. Audience viewing patterns

B. Definition of Terms:

1. Elements: specific products of procedures.

The main element variables to be studied are:

a. Programming

1) Subject matter
2) Scheduling

b. Public Information

1) Level
2) Type

c. Field Support

1) Level
2) Type

d. Hardware

1) Level
2) Type

2. Specific audiences: students and adults who are to receive programming via any of the 64 sites. The potential audiences are described in the previous section entitled "Population to Be Studied." The main audience variables to be studied are:

a. Audience characteristics

b. Site characteristics

C. Specific Questions to Be Answered

1. What is the extent to whichdesired levels of participation were obtained with specific audiences?
2. What is the relationship of site and audience characteristics to participation?
3. What is the effect of programming, public information, field support and hardware on level of participation.
4. What factors are perceived by specific audiences as most influencing their viewing patterns?

Goal 4: To describe and analyze what elements in the Educational Technology Demonstration were effective in attaining the acceptance of specific audiences.

A. To describe and analyze what elements in the Educational Technology Demonstration were effective in attaining the acceptance by individuals.

1. Main Indicators of Acceptance

   a. Opinions of acceptance

      1) the concept of satellite based media distribution systems
      2) the Educational Technology Demonstration media system
      3) The ETD
      4) the ETD delivery modes
      5) the concept of career education
      6) the program courses content transmitted by the ETD

   b. Career related attitudes

   c. Career related interests

2. Definition of terms

   a. Elements: specific products or procedures

   b. Acceptance: an interval or overt act indicating approval or agreement

   c. Individuals: students and adults who are to receive programming via any of the 64 sites

3. Questions to Be Answered

   a. What is the extent to which desired levels of acceptance are attained at ROT, intensive, and open sites?
   b. What is the relationship of site and audience characteristics to level of acceptance?
   c. What is the effect of programming, public information, field support, site characteristics, and audience characteristics on level of acceptance?

B. To describe and analyze what elements in the Educational Technology Demonstration were effective in attaining acceptance by institutions or agencies.

1. Main indicators of acceptance:

   a. Opinions of acceptance:

      1) the concept of a satellite based media distribution system
      2) the ETD media distribution system
      3) the ETD
      4) the ETD delivery modes
      5) the concept of career education
      6) the program courses content transmitted by the ETD

b. Resource allocations

c. Role changes

2. Definition of terms:

a. Elements: specific products or procedures

b. Acceptance: an interval or overt act indicating approval or agreement

c. Institutions or agencies: organizations whose activities directly effect the functioning of the sites

3. Questions to Be Answered:

a. What career development related structural and functional changes have occurred in junior high schools participating in the STD?
b. What career development related structural and functional changes occuring in participating junior high schools can be attributed to the STD?
c. Which variables were most influential in bringing about structural and functional change in participating junior high schools?
d. What is the relative level of acceptance of various school staff, administrative personnel, board members, and community members toward the STD?

Goal 5: To describe and analyze what elements in the Educational Technology Demonstration resulted in changes in students' career related knowledge?

A. Main Indicators of Knowledge:

1. Identification of

a. the decision making steps for making career decisions
b. the type of career related information needed in each decision making step
c. the responsibilities of making career related decisions
d. information about careers including career names, activities, etc.

B. Definition of terms

1. Elements: specific products or procedures

The main element variables to be studied are:

a. Programming

1) course
2) scheduling

b. Public information

1) level
2) type

c. Field support

1) level
2) type

d. Hardware

1) level
2) kind
3) performance

2. Students: those adolescents who receive career development programming within a classroom setting via any of the 67 sites. The main audience variables to be studied are:

a. Audience characteristics
b. General career related knowledge

3. Career related knowledge: information concerning the procedures for and effects of individual decision making relative to future occupational endeavor

C. Questions to Be Answered

1. What kinds of content learning show the greatest change?

2. What is the probability that given types of students will ahcieve a stated criteria?

3. What is the average expected change in student learning with respect to a criterion?

4. How do the high involved and low involved differ in learning, attitudes and interest?

Population to Be Studied

The Educational Technology Demonstration is developing a variety of programs for a variety of intended audiences. Essentially, the potential audiences can be differentiated on four bases:

1) Kind of program received

2) Kind of receiving site

3) Level of field support received

4) Audience characteristics

These bases of differentiation are briefly described below.

1. Type of Program Received

The ETD is developing programming in six areas.

a) Career development programs designed for junior high school students. These are 16 week series, to be broadcast 5 days a week. The series will be broadcast once in the fall, and repeated again in the spring semester.

b) Evening programs consisting of a combination of career information and entertainment designed for general community audiences. These are 16 week series, to be broadcast one evening a week. The series will be broadcast once in the fall, and repeated again in the spring.

c) Teacher in-training programs, designed for teachers of career development classes. These are 16 week series, to be broadcast 2 afternoons a week. The series will be broadcast once in thefall and repeated again in the spring.

d) Summer pre-service training programs for teachers. This is a 2½ day series to be broadcast August 20-23 in the summer of 1974.

e) Summer programs for specific audiences. This consists of an eight week series beginning in June, 1974 and ending in August. These programs will be designed for community planners, etc.

f) Summer programs for general audiences. These are general interest programs to be broadcast for 9 weeks in the evenings during the summer of 1974.

2. Type of Receiving Site

EMD programs can be received at four different types of sites.

a) Intensive terminal sites: These sites consist of 24 selected schools. They have the capability of interactive communications with the Denver Center, and receive EMD programming directly via satellite.

b) Receive Only Terminal Sites: These sites consist of 32 selected schools. They have only the capability of directly receiving the EMD programs via satellite.

c) Open Schools: These schools contain classrooms which have elected to receive EMD programming via PBS or cable.

d) Open Audience: They consist of private homes or other private receiving terminals which receive EMD programming via PBS or cable.

3. Level of Field Support

The EMD intends to provide program support in the form of site personnel, educational materials, public information, etc. The level of support will be varied among the sites. Intensive Terminal sites will receive either Type 1 (full-time site personnel), Type 2 (half-time site personnel), or Type 3 (site personnel 2 hours a day). Receive only terminal sites may receive Type 2, Type 3, or Type 4 which is volunteer support. Open sites and open audiences will receive either low support or no support.

4. Audience Characteristics

The potential audience can also be differentiated on the basis of their personal characteristics. For purposes of the EMD programming and research, the potential audience can be categorized into four main groups:

1. Junior high school students

2. Junior high school staff in junior high schools (teachers, counselors, and administrators)

3. Specific audiences: interested professionals, such as social workers, probation officers, personnel managers, community workers, youth club personnel, etc., unemployed adults, etc.

4. General Audience: Mostly adult viewers who elect to participate from personal interest

COMMUNITY SUMMARY SHEET

(To Be Completed by the STD State Team)

Please supply the following information for each community that is visited. See instruction sheet for detailed instruction and an example.

Community _____ County _____ State _____

Considering your observations and the information available to you, please rate this community as a candidate for STD participation.

High									Low
1	2	3	4	5	6	7	8	9	10

Narrative:

INSTALLATION SUMMARY SHEET

(To Be Completed by STD State Team)

Please supply the following information for each potential installation that is visited. See instruction sheet for detailed instructions and an example.

Community _____ County _____ State _____

Name and Street Address of Installation:

_____

_____

Installation is Being Considered for:

Career Development ____

Early Childhood ____

Both ____

This is _____ of _____ potential installations in this community.

Considering your observations and information available to you, please rate this installation as a candidate for STD participation.

High									Low
1	2	3	4	5	6	7	8	9	10

Narrative:

I. Community Profile

A. Identification

Please fill in the following information.

1. In what state is this community located?

_____ (name of state)

2. In what county is this community located?

_____ (name of county)

3. What is the name of the community?

_____ (name of community)

4. What is the population of this community?

_____ (indicate number)

B. Demographic Characteristics Available From 1970 U.S. Census of Population

If answer on 4 is 2,500 or larger, skip to Question 6.

5. Please indicate if this data for the county in which this community is located would likely be representative of the community in each of the following categories.

a. Age distribution ____ Representative ____ Non Representative

If non representative, indicate reasons:

b. Occupations of employed persons ____ Representative ____ Non Representative

If non representative, indicate reasons:

c. Percent of households with one or more phones ____ Representative ____ Non Representative

If non representative, indicate reasons:

d. Percent of occupied housing units owning one or more phones ____ Representative ____ Non Representative

If non representative, indicate reasons:

e. Percent of occupied housing units owning one or more tv sets ____ Representative ____ Non Representative

If non representative, indicate reasons:

C. Media

6. Number of TV stations received by cable: _____ (indicate number)

7. Number of TV stations received, but not by cable: _____ (indicate number)

8. Number of radio stations received: _____ (indicate number)

9. a. Are any Public Broadcasting Service (PBS) stations received by cable (CATV)?

____ Yes ____ No

b. If "Yes" in a, List call letters of PBS stations received by cable:

1) ____ 2) ____ 3) ____ 4) ____

(*Write call letters of each station*)

10. a. Are any Public Broadcasting Service(PBS) stations received, but not by cable (S.T.V.)?

____ Yes ____ No

b. If "Yes" in a, List call letters of PBS stations received, but not by cable:

1) ____ 2) ____ 3) ____ 4) ____

(*Write call letters of each station*)

11. If community is served by cable, please indicate:

a. Percent of houses accessible to cable line _____

b. Percent of houses currently subscribing to cable _____

c. Cost of subscribing to cable _____

12. a. Number of English language/general audience newspapers published locally on a daily/weekly/monthly/quarterly basis.

Daily Basis	Weekly/Monthly/Quarterly Basis
(indicate number)	(indicate number)

"Specific audience" refers to newspapers whose primary audience is a member of one of the following ethnic/cultural groups: Negro or Black American, Spanish surnamed American, Anglo American, Native American Indian. Definitions of these categories are derived in part from the U.S. Commission on Civil Rights' definition and are included in Appendix A.

13. a. Number of English language/specific audience newspapers published locally on a daily/weekly/monthly/quarterly basis. (*Indicate Number*)

Daily Number	Weekly/Monthly/Quarterly Number	* Ethnic/Cultural Group of Primary Audience
___	___	Negro or Black American
___	___	Spanish Surnamed American
___	___	Anglo American
___	___	Native American Indian

*See Appendix A for Definitions

14. a. Number of non-English language newspapers published locally on a daily/weekly/monthly/quarterly basis. (*Indicate Number*)

Daily Number	Weekly/Monthly/Quarterly Number	* Ethnic/Cultural Group of Primary Audience
___	___	Negro or Black American
___	___	Spanish Surnamed American
___	___	Anglo American
___	___	Native American Indian

*See Appendix A for Definitions

15. Number of locations of various sizes within two hours automobile travel:

(*Fill in the number of communities of each size which can be reached within the times noted*)

Average Automobile Travel Time

Community Size	Best Six Months		Worst Six Months	
	Under 1 Hour	Between 1 & 2 Hours	Under 1 Hour	Between 1 & 2 Hours
500-2,500				
2,501-25,000				
25,001-100,000				
100,000 and above				

16. Approximate automobile travel time to various facilities and services:

Service	Number Within ½ Hour	Number Between ½ Hour and Hour
a. General practice physicians	___	___
b. Pediatricians	___	___
c. Public hospital	___	___
d. Private hospital	___	___
e. Nursery School	___	___
f. Day Care Center	___	___
g. Public school		
Grades 1 - ___	___	___
Grades ___ - ___	___	___
Grades ___ - ___	___	___
h. Institution of higher education	___	___
i. Trade (vocational) school	___	___
j. Local store	___	___
k. Major shopping center	___	___

17. Please list potential Early Childhood and Career Development installations. [*Indicate installation address and suitable category*]

Installation Address	Suitable for (check one) Career Development	Early Childhood	Both
___	___	___	___
___	___	___	___
___	___	___	___
___	___	___	___

18. Note the approximate distance between each Early Childhood and Career Development installation.

Example:

Career Development	Early Childhood
Dennis Junior High (1)	*Community Center (3)*
Adams High School (2)	*Smith Day Care Center (4)*
(1) to (3) - 500 ft.	*(2) to (3) - 3 miles*
(1) to (4) - 4 miles	*(2) to (4) - 1 mile*

Write Here:

II. Nominated Installation Detail Sheet

A. General Description

1. This is Installation _____ (number) of _____ (number) nominated installations in this community.

Example: *If 12 locations were nominated as potential early childhood and/or career development installations, and this was the sixth location nominated, it would be designated as 6 of 12.*

2. a. Address of nominated site installation:

_____ (number) _____ (street) _____ (city/state) _____ (zip code)

b. Is the primary use of this building a public school?

____ Yes ____ No

c. If "Yes" in a - write the full name of the school.

_____

d. If "No" in a - what is the primary use of the building? (check one)

____ a. Day care center
____ b. Family day care center
____ c. Home
____ d. Nursery School
____ e. Kindergarten/public school
____ f. Foster parents
____ g. Church hall
____ h. Social hall - private
____ i. Social hall - public
____ j. Business
____ k. Other

e. If "K" on c - please specify primary use of the building:

_____

3. a. If selected, does this installation want to participate? (check one)

____ Yes ____ No ____ Cannot answer at this time

b. Comments on above answer:

4. Is this installation to be

a. Either a dual installation or a career education installation?

____ Yes ____ No

If yes, go to Section B.

b. An early childhood installation not conducted in a home?

____ Yes ____ No

If yes, go to Section C.

c. An early childhood installation conducted in a home?

____ Yes ____ No

[illegible]

1. a. Given that the ETD will be broadcasted at times not to be determined between 8 a.m. and 3 p.m. on weekdays with length of each program to be no longer than 30 minutes, if selected does this installation guarantee that programs can be scheduled into the the school classroom schedule?

____ Yes ____ No ____ Cannot answer at this t

b. Comments on above answer:

2. a. If selected, what is the number of students that can be guaranteed to be available for participating in the ETD?

_____ (number of students)

b. Of total guaranteed in a, what number is the likely grade and sex distribution?

Grade	Number Male	Number Female

c. Of the total guaranteed in a, what is the likely ethnic/cultural distribution?*

Ethnic/Cultural Group	Number	Languages other than English
Anglo	____	_____
Black or Negro Americans	____	_____
Spanish Surnamed American	____	_____
Native American Indian	____	_____

* See Appendix A for definition

3. If selected, what is the number of teachers and/or other staff that can be guaranteed to be available to supervise and interact with students? ____ (indicate number)

4. Will credit be given for courses taken under the ETD Project?

____ Yes ____ No ____ Cannot Answer at this time

5. Does the school receive any PBS programs?

____ Yes ____ No

If yes, which ones?

6. Where would Career programs be viewed?

Room	Kind of Unusual distractions which may be present

7. a. Are there any Career Development programs currently operating in this school?

____ Yes ____ No

b. If [illegible] the [illegible] structure [illegible] primary type [illegible] number of students served, [illegible] to study, etc.

8. a. Do you anticipate any Career Development programs to be operational within the next three years?

____ Yes ____ No

b. If Yes, please describe the likely nature of the program, types of students to be served, materials to be used, etc.

9. a. Do you have a Career Development summer program?

____ Yes ____ No

b. If Yes, Please describe the nature of program, type and number of students served, materials used, etc.

If this installation is a Career Development installation only, go to section E.

If this installation is an Early Childhood installation conducted in a home, go to section D.

If this installation is either dual installation or an Early Childhood installation not in a home, continue to Section C.

C. Dual Installation or Early Childhood Installation Not in Home

Is this a Dual Installation or an Early Childhood Installation Not in Home? (Please check)

____ Dual installation ____ Early Childhood Not in Home

1. If selected, what types of rooms would be available for use for viewing Early Childhood programs?

Room	Number of Rooms
Rooms holding over 200 persons	_____
Rooms holding between 50-199 persons	_____
Rooms holding between 30-49 persons	_____
Rooms holding between 10-29 persons	_____
Rooms holding under 10 persons	_____

2. If selected, can available space be divided into various areas?

____ Yes ____ No

3. a. If selected, number of caregivers of children 0-6 who would potentially be able to attend Early Childhood programs at this installation.

Ethnic/Cultural Group*	Number Who Could Attend: Morning	Afternoon	Evening
Anglo	____	____	____
Black or Negro American	____	____	____
Spanish Surnamed American	____	____	____
Native American Indian	____	____	____

* See Appendix A for Definitions

b. Is there reason to believe that the characteristics of participants would differ greatly from the census data available for the rest of the community?

____ Yes ____ No

c. If yes on b, please comment.

If this is not an Early Childhood Installation conducted at home, go to Section E.

D. Early Childhood Installation at Home

1. Number of children 0-6 served by this facility:

Ethnic/Cultural Group*	Number
Anglo	____
Black or Negro American	____
Spanish Surnamed American	____
Native American Indian	____

* See Appendix A for Definition

2. Number of staff

Ethnic/Cultural Group*	Number Full Time Male	Number Full Time Female	Number Part Time Male	Number Part Time Female
Anglo	____	____	____	____
Black or Negro American	____	____	____	____
Spanish Surnamed American	____	____	____	____
Native American Indian	____	____	____	____

* See Appendix A for Definition

3. Average years of childcare experience (with other than own children):

_____ (number of years)

4. Number of staff who have taken accredited college level courses in child care training.

_____ (number)

5. Is this childcare program supported by outside funds?

____ Yes ____ No

6. Likelihood of program continuing in 1974-75?

No likelihood — High likelihood

0 1 2 3 4 5

2. If selected, does this installation feel it can guarantee participation?

____ Yes ____ No ____ Cannot Answer at This Time

3. Number of caregivers who will be able to participate in 1974-75.

_____ (number)

4. What are the main problems which may affect caregivers participating (i.e., transportation, church meetings, family obligations, etc. - please explain). *Use additional sheets if necessary.*

E. Broadcast and Engineering/ Utilization

1. Equipment available for ETV use:

	Number Currently Available	1974/75 Estimates
a. Black and white televisions	____	____
b. Color televisions	____	____

2. a. Can color tv be received?

Yes ____ No ____

b. If Yes on a, rate the quality of reception. (Check one)

Excellent ____ Good ____ Poor ____

3. a. Does this installation receive cable (CATV)?

Yes ____ No ____

b. If No on a, indicate reason. (check one)

1) ____ Not available
2) ____ Available but too expensive
3) ____ Available but not wanted
4) ____ Other

c. If "4" in b, write reason.

4. Brand of televisions and model numbers used in building.

Brand	Model Number
_____	_____
_____	_____
_____	_____

5. Brand of video tape recorder and model numbers used in building.

Brand	Model Number
_____	_____
_____	_____
_____	_____

6. a. Is there telephone service?

____ Yes ____ No

(If no skip to question 7.a.)

b. If Yes on a, indicate type of service.

1) Party Line ____
2) Private Line ____

c. Is telephone service provided by the Bell Telephone System?

____ Yes ____ No

(If Yes on c skip to question 6f)

d. Name of telephone company: _____

e. Number of households served by telephone company:

_____ (number)

f. Does telephone company accept incoming WATS line?

____ Yes ____ No

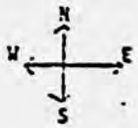
g. Does telephone company accept outgoing WATS line?

____ Yes ____ No

h. Does telephone company equipment allow for data transmission?

____ Yes ____ No

7. a. Draw a simple diagram of the building.



b. Show your choice of antenna location.

c. Are there any obstructions which might effect reception?

____ Yes ____ No

d. If Yes on c, please specify.

8. Assuming antenna may have to be hand adjusted, would a ground or roof installation be preferable? (check one)

____ Ground ____ Roof ____ Either

9. a. Does the building have convenient electric power? (check one)

____ Yes ____ No

b. If Yes on a, is it (check one)

____ AC ____ DC ____ Both

c. If Yes on a, is it (check one)

____ 110 volts ____ 220 volts ____ both

10. a. If No on 9.a., does the building have a power generator?

____ Yes ____ No

(If No on a, skip to question 11)

b. Is power (check one)

____ AC ____ DC

c. Is there a DC convertor? (check one)

____ Yes ____ No

d. Please fill-in:

____ Voltage volts ____ Wattage watts

e. Hours for which generator power is available:

_____

(indicate hours)

11. Indicate those times during which this installation could be regularly available for ETV purposes:

	Monday	Tuesday	Wednesday	Thursday	Friday
7:00					
7:30					
8:00					
8:30					
9:00					
9:30					
10:00					
10:30					
11:00					
11:30					
12:00					
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8:30					
9:00					

Comments:

ETD BRIEF BIOGRAPHICAL SKETCHES OF KEY PERSONNEL

Management Staff

Project Director: Dr. Gordon A. Law

For one and a half years prior to being appointed STD Project Director, Dr. Law was director of the STD's Broadcast and Engineering Component. He is on leave as Professor and Chairman of the Department of Communications, University of Idaho, and General Manager of the university station, KUID-FM-TV.

He was awarded a B.A. from Denver University, an M.S. from Syracuse University, and an Ed.D. from Washington State University.

His twenty years of media experience included reporting for newspapers and managing radio and television stations.

Associate Project Director: Dr. Ken R. Lokey

Dr. Lokey holds a bachelor's degree in electrical engineering from Texas Tech University, a master's degree in business administration from Texas Tech, a master's degree in systems engineering from Southern Methodist University, and a doctorate in business administration from Texas Tech.

He has been an instructor in management at Texas Tech; founder and president of Matrix Computing Inc., a data processing service bureau; project manager for the information sciences subdivision of McDonnell Douglas Corporation; and a systems analyst for Ling-Temco-Vaught in the design and programming of the automatic destruct system for anti-missile missiles.

Public Information Director: Greg Pearson

Mr. Pearson is on leave as Associate Professor of Communications, Metropolitan State College, Denver, Colorado. He was a war correspondent in Korea and later in Vietnam, and has worked for several newspapers, in radio, television, and in public relations. His work has been published in newspapers, magazines, and books all over the world.

He holds a bachelor's degree from the University of San Diego, a master's degree from the Graduate School of Journalism, Columbia University, and has done doctoral work at the University of Colorado, with special studies in mass communications and political science.

Executive Assistant: Richard D. Campbell

Mr. Campbell, before joining the STD, was a management auditor for the U. S. General Accounting Office. He also served as a management engineer for the G.A.O.

He was awarded a bachelor's degree in industrial management from Miami University, Florida, and a master's in business administration from the University of Denver.

Utilization/Field Services Component

Director: Dr. Louis A. Bransford

Dr. Bransford, who holds degrees from Northern Colorado University and the College of Santa Fe, New Mexico, has been an instructor and administrator in public schools and universities. Before joining the STD, he was an associate professor in guidance and special education at the University of New Mexico.

As a consultant he has assisted the President's Committee on Mental Retardation; the Bureau of Education for the Handicapped, U. S. Department of Health, Education, and Welfare; and the office of the assistant secretary for community and field services, Department of Health, Education, and Welfare.

Associate Director: Dr. Tom Maglaras

Dr. Maglaras was graduated from Fort Hays (Kansas) State College with a bachelor's degree, and received advance degrees from the University of Colorado.

He has taught at the junior and senior high school levels, and has served as a school principal. He was associate executive secretary of the secondary school commission of the North Central Association of Colleges and Secondary Schools, and before joining the STD was director of the teacher placement bureau and an associate professor of educational administration at the University of Wyoming.

Field Service Coordinator: Frank A. Anderson

Mr. Anderson has worked as a military instructor, a high school science teacher, director of a Ford Foundation rural school improvement project, executive assistant to the Colorado Commissioner of Higher Education, director of corporate educational services of the Encyclopedia Britannica Educational Corporation, director of research and development of Encyclopedia Britannica Films, and as director of the division of research development and demonstration of the Colorado Department of Education.

Mr. Anderson has served as a consultant to thirty-one states and numerous national and regional organizations in rural school matters and educational communications. He holds degrees from Stanford University and the University of Northern Colorado.

Broadcast and Engineering Component

Director: Dail Ogden

Mr. Ogden has extensive experience in engineering, installation, and operations of broadcast systems, cable systems, microwave-relay systems, and translator systems. He has been a consultant

Broadcast and Engineering (cont.)

to the governor of Utah and director of engineering at station KUED in Salt Lake City. He has done consulting work for the University of Wyoming, the University of Illinois, Telecommunications, Inc., the Communications Investment Corp., and several other agencies in the public and private sector. He was the author of the state of Utah's Telecommunications Plan in 1970.

Associate Director: Myron P. Smith

Prior to joining the STD, Mr. Smith served as production director of the Computer Image Corp. in Hollywood, California. Previously he was an associate professor of mass communications at the University of Denver. The author of more than 500 radio, television, and motion-picture scripts, he holds a bachelor's degree from Stanford University and a master's degree from the University of Denver.

Assistant Director, R & D: Dr. James M. Janky

Dr. Janky holds degrees from the University of Detroit and Stanford University. He has been a consultant to the Office of Telecommunications Policy, U. S. Department of Health, Education, and Welfare; a member of the board of directors of the Alma Corporation; and a general partner in TJ Associates, a consulting and manufacturing firm.

For the past six years he has been engaged in the development of mass-producible receivers at 2.5 and 12 GHz for use in direct-broadcast, satellite-communication systems.

Assistant Director, Planning: Dr. James G. Potter

Dr. Potter has been responsible for the gross systems engineering of the HEW/NASA HET ground systems. Prior to joining the STD staff, he served a two-month period as acting director of the Office of Telecommunications Policy, U. S. Department of Health, Education, and Welfare.

He has worked in developing computer models for performing the preliminary systems analysis of satellite teleconferencing systems. He holds a bachelor's degree in physics from the University of Michigan; and master of science degree as well as a Ph.D. in electrical engineering from Stanford University.

Program Component

Director: Gene Linder

Mr. Linder was in commercial television for twenty years, nineteen of them in management. He has overseen the creation of three television stations, including the design of facilities, installation of equipment, and the selection, training, and scheduling of all personnel. For ten years he was production

Program Component (cont.)

manager at Station KOA-TV in Denver, responsible for all production talent, the art department, and film activities. He has produced and directed an average of twenty productions annually over a five-state region.

Assistant Director: Apostolos Dimitrios Fliakos

Mr. Fliakos holds a bachelor's degree from Yale University. He has worked extensively on the production of educational audio-visual materials for use on National Educational Television. He has been production manager and executive producer of an educational film production and distribution company. A number of films he has been involved with have been honored with awards such as the "Cine Golden Eagle" and the "Emily."

Content Coordinator: Dr. Alfred E. McWilliams, Jr.

Before joining the STD, Dr. McWilliams was assistant dean of administration, School of Special Education and Rehabilitation, University of Northern Colorado. Previously he was director of the UPWARD BOUND program for that university. He holds three degrees from that university and has been a teacher, counselor, and a vice-principal in public school systems.

Executive Producer: Richard E. Borstadt

Mr. Borstadt has been making films since he was thirteen years old, has worked in stage and radio, and has been in television for eleven years. He has produced and/or directed well over 1,000 hours of instructional and public television programming. Among these were special projects in public affairs and cultural areas for agencies such as the National Endowment for the Arts, U. S. Public Health Service, U. S. Department of Employment Security, Sears-Roebuck Foundation, and Corporation for Public Broadcasting.

Operations Manager: Keith Darby

Mr. Darby gained much of his television experience from his years in the production management department of the British Broadcasting Corporation, where he was involved in a wide range of productions including the first trans-Atlantic satellite transmissions. Immediately prior to joining the ETD, he was production administrator at WTTW, the Chicago PBS affiliate, and was producer of the nationally telecast program "Book Beat."

Originally trained in theatre, he earned speech proficiency certificates from the London Academy of Music and Dramatic Art, and was graduated from the Central School of Speech Training and Dramatic Art.

Research Staff

Director: Dr. Austin Connolly

Dr. Connolly holds degrees from the University of Northern Colorado and has been a teacher at the elementary, junior high school, senior high school, and university levels. Prior to joining the SID, he was on the staff at the University of Missouri, where he was responsible for three projects dealing with evaluation, mediated instruction, and competency-based curriculum development.

Research Associate: Ron Hart

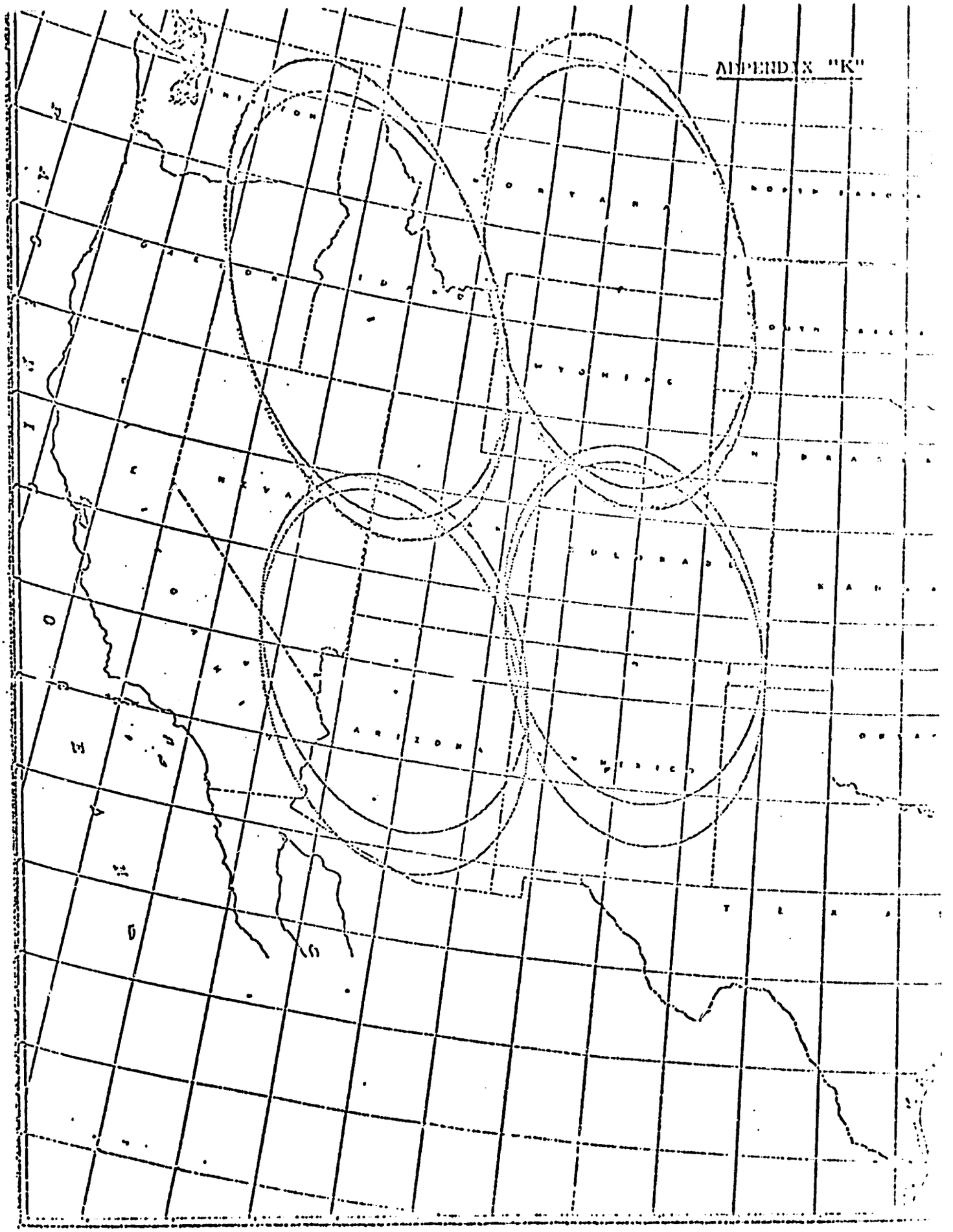
Mr. Hart is concluding his doctoral program at the University of California at Los Angeles. His experiences range from rural community development in South America for the Peace Corps to research efforts for the Center for the Study Evaluation and the School of Public Health at U.C.L.A.

Research Associate: Dr. Joyce Dale

Dr. Dale holds degrees from the University of North Carolina, East Carolina University, and the University of Georgia. Her background is in the application of measurement and evaluation methodology to curriculum development.

Coordinator, R & D: Dr. William Zelman

Dr. Zelman received his bachelor's degree from San Francisco State College and advanced degrees from the University of Washington. He is experienced in a number of social action research endeavors in areas dealing with mental health, special education, pre-school education, and environmental protection.



Satellite "Footprint" Map

CONCLUSION: Part I Synopsis

All the foregoing case studies have posed the late 1973 situations of the respective ATS-F experiments. While each more or less represents one discrete chapter on specific satellite communication potentials, we may yet attempt to synopsize what may be salient points or directions noteworthy for less developed countries.

Let us consider just the general, fundamental impetus for using satellites; they can reach large areas of variable population size in what many experts believe may be a cost-effective arrangement; they may bypass the need for extensive terrestrial communications equipment; there is beyond this a prestige associated with the use of so advanced a technology and the expectations of technological spill-over in its development. In deciding on any broadcast distribution made, three sorts of systems are usually recognized. One is the terrestrial microwave system, and the other two are satellite-based, one a rebroadcast configuration and the other a direct broadcast type. Choice of a system for some particular region or nation is necessarily a complex process. "...a satellite system and a terrestrial system are difficult to compare because the performance of the two systems and the deployment techniques are fundamentally different. The choice of system is then largely dependent on the problem which is to be solved and on policy decisions made by the LDC (less developed country) governments."[1]

In the case of the Rocky Mountain demonstration the choice of a satellite system for educational distribution takes into consideration cost-benefits and the appropriateness of the geographic region. The establishment of the Federation of Rocky Mountain States (FRMS) as a parent organization to tackle problems common to member states is the first indication that the geographic area presents unique problems. The Rocky Mountain region is a large area of low density population and varied topography as well as climate. This in itself lends credibility to satellite opportunities. Even so, the case study reports that communication and transportation are good excepting Indian reservations. Furthermore, there is an overall high level of television and radio penetration in addition to telephone service. The intent of the FRMS ATS-F experiment therefore is not to provide badly needed services but rather to test the satellite distribution mode for cost and user acceptance.

> There is a rising cost pressure on public services, particularly education, and this is a major reason the ETD (educational technology demonstration) is being funded. The cost of education is rising at a time when taxpayers appear unwilling to pay much more for it. If the quality of education in the United States is to be increased, or even maintained, more cost-effective means of delivering this service must be developed.[2] Technology is one potential avenue of relief.

The case study emphasizes the words utility, proficiency, feasibility and cost in defining the education technology demonstration.[3] Moreover, because the ATS-F satellite is experimental, with satellite time provided by NASA, and because the Rocky Mountain is not the only U.S. ATS-F project the FRMS operated in a decision framework possibly less stringent than that applicable to less developed countries.

The exigencies facing the Indian situation are quite different. As the case study demonstrates, the current social, political and economic context of the country is important. India is a country of large area with high density population. National development, which includes expanding the agricultural and industrial base, controlling population, increasing educational opportunity and achievement, and national unity, is the priority. In a country of fifteen official languages and 800 dialects, little electricity, a dearth of roads, hospitals and schools, and a 70 percent illiteracy rate; the exigencies facing a satellite communications experiment are multifold. It is more or less accepted that television can contribute to this goal. Already plans are operative to expand television's urban base to about nine cities or 17 percent of the population by 1975. The question with respect to satellites is one of a distribution mode for television.

The favored system provides direct satellite reception in sparsely populated areas with rebroadcasting to more densely populated regions. The discussion by the Indian Department of Atomic Energy (DAE) on satellite possibilities is relevant:

> DAE emphasized that the use of a satellite is the only way of covering certain parts of the country in the time frame 1974-79 and that in this time frame, there is no alternative to the use of a satellite; that the use of a satellite makes it possible to be non-discriminatory between villages and the cities; that the programming requirements of villages are different than those of cities; and that with a multipurpose satellite the whole national TV system could, in effect, be put up free of cost ... DAE also argued that a satellite system would enable the country to enter a new and sophisticated field of technology at an early date and that it would enable India to leapfrog over intermediate technologies in an effort to start catching up with more advanced countries...[4]

It is appropriate to mention that some studies conclude that the cost of a terrestrial and satellite distribution system for India are not very different or actually weighted in favor of the terrestrial system.[5] In this respect the case study's own questions on satellite system decision points become important.[6] These more subjective qualifications go beyond cost-effectiveness evaluations.

Satellite System Considerations

1) achieving national unity
2) bring creative talent into programming
3) application of critical evaluation
4) contribution to national security
5) importance of implementation speed
6) compatibility with management structure

Thus the SITE program's acknowledged value lies somewhere in between the technical success it can demonstrate and the information it will provide to Indian planning authorities on cost-effectiveness of satellite television distribution, with these other considerations looming nearby. The future operational system plans are vested to a large extent in the prototype configuration ATS-F will provide.

Brazil is another less developed area of the world which could make use of a satellite delivery system. As the case study by Laurence Wolff points out, the reasons behind exploring this technology are apparent: Brazil encompasses a great expanse of continent; it has high illiteracy and drop-out rates; geographic diversity hinders a balanced technologic advance -- the south is much more developed; the north and central west are sparsely settled, less developed regions (64% of the land with only 9% of the population); there exists an urban/rural dichotomy in education. The cause of national development has mobilized Brazil

to restructure its educational system. "It attempts to make education available to a large segment of the population, while tailoring curricula to meet the demands of the labor market. Using limited resources and covering a wide geographic area, the reform will take some years to penetrate every region." Thus, education is a prime target in Brazil's future plans.

Modern technology is felt by Brazilian authorities to be a key to improving the educational system. Satellite delivery in particular offers opportunity to implement an area-consistent primary education. Satellite education could provide teacher training, and uniform curricula; it could solve problems of understaffing, region inaccessability, and lack of materials. The Brazilian Minister of Planning has commented:

> The Government is convinced that...in order to revolutionize education, it will not suffice to solve the problem of resources and reform the existing structures. It will be necessary to take a giant step forward and adopt a new technology...which, utilizing advanced communication media--Image, Sound, and Motion...can take education, still within the 1970 decade, to all of the potential school population of the country, besides ensuring a permanent adult education service. 7

Hence, technologically-based instructional materials has been an area of interest in Brazil.

There are of course other reasons why a satellite system would be of interest to Brazil. As the Latin American giant,

in size and economy, Brazil could benefit from a leap into the relatively new realms of electronic equipment and satellite expertise: its industries could move into new areas; it would be a leader in advanced technology among Latin American nations; it would garner prestige with its own satellite system; a new cadre of technology professionals would have to accompany the initiation of a system. During 1967-68, the Brazilian Institute of Space Research (INPE) did a study on satellite feasibility and concluded that a satellite information distribution system would aid the purposes of national development.

The factors affecting implementation of the experiments, above and beyond the initial decision context, are certainly of groundwork importance. Such elements as funding, site choice, experimental design, the delivery format and the delivered program content, evaluation plans, management, hardware and software and so forth must be examined. Insofar as less developed countries are concerned, the paths that India, Brazil and the FRMS follow suggest

numerous planning constraints and opportunities.[7]

One of the most comprehensive statements the FRMS study makes appears early in the report:

> It does seem important, though, to state that goals and objectives for projects using new technologies are not easily formulated. Nor is the management of large, complex, and untried systems easy to analyze. The planning, management, and maintenance of a project of the scope of the Rocky Mountain experiment require not only money, but also manpower. Furthermore, the manpower must be highly skilled, and the team must be able to learn and appreciate vocabularies of different disciplines, so that it can deal with the forces that can result from education, communication, and technology.[8]

This is probably true of any user satellite experiment anywhere at this time and certainly apropos to the following discussion.

The particulars of the Rocky Mountain project point out many illustrative facts. First, the demonstration is a regional project combining the efforts of both Federal and State government, business, private and public agencies. As the area shares a common language (for the most part), culture, and legal system there is a practical base for satellite-delivered services. Moreover, a satellite system is not very practical for

small areas; the target region must be large, as in the Rocky Mountains or India, for simple cost-effectiveness. Representative of a large area and diverse interests the Federation was able to get funding from the Federal government. The case study points out that fund raising can be a very tenuous phase of an experiment; its effects on the planning process and naturally the scope of an experiment are direct. Also the form of that funding - whether it is incremental or a flat total sum - can be important.

Planning is always a delicate mechanism touching upon needs assessment, fiscal realities, legislative mechanisms, priorities, technological problems and limitations, and State and Federal input.[9] The Federation used empirical data to determine what educational needs should be addressed, and used site surveys to identify possible target areas. Many groups were incorporated into the planning process although the original goal of involving the direct beneficiaries of the technology was inhibited. The significance of this limited direct user input should bear close scrutiny. Several planning accomplishments were necessary:

1) creation of a board integrating elements of broadcasting, business and government

2) creation of a state coordination mechanism
3) planning a public relations stance
4) assembling regional/site data
5) surveying equipment needs and existing facilities for transmission and production

It was recognized that some factors made the planning phase easier such as the advantages of area accessibility for equipment set-up and maintenance, the availability of power sources, and the familiarity of the populace with the television (though not ITV) medium.

The design of the system itself took into consideration educational needs, potential evaluation mechanisms which could be built into it, language dissimilarities, and site advantages. For example, some feedback capacity has been determined quite beneficial in educational situations. Therefore a real-time audio capacity for numerous sites has been developed, along with a digital system to supplement the limited audio channels and provide feedback not only to the student but also to the central planning and software sources. The use of both school site earth terminals and supplementary public broadcasting systems demonstrates one way in which existing facilities can be worked into a satellite experiment; this sort of equipment

optimization mechanism is very practical. By virtue of reaching not only the student audience but also a more total adult base population segment, the career development material may support a well-integrated awareness of the pertinent concepts. Choice of the specific sites was left to educational authorities; it is apparent that there has been an attempt to equalize each State's participation in the project at least in site quantity. Although the idea is not well-developed in the case study, the use of a "control" school already possessing an excellent program in the given subject area may render valuable experimental contrasts with satellite-delivered programs. Choice of sites was also influenced by the size of the satellite footprint - hence the decision to include two more states in the experiment in order to make fullest use of ATS-F.

Another element in planning the project was the question of language as not all intended audiences are native speakers of English. Although English was chosen as the broadcasting language, the case study points out that "if the project were more of a social delivery system and less of a technology demonstration, the language question would probably have to be rethought."[10] The boundaries and implications of these two types of systems,

social delivery versus technology are unclear. The selection of the course field was based on 1) the recognized need to decrease numbers of students who leave school without any career knowledge, 2) the desire to treat a subject relevant to students and 3) the satisfaction of an indicated interest on the part of the students and teaching personnel. Thus career development was chosen; its emphasis is conceptual —self-assessment, job needs analysis, and so forth —rather than vocational.

In the software realm the Federation's use of the "course-team" approach will document an interesting practice and workable alternative to a more fragmented or 'divorced' habitual programming routine. One inquiry which could provide guidance to developing countries concerns the transition from course content goals to the broadcast product itself. The Indian study is more enlightening on this point than the Federation's. Even so, we need more information on programming methods and considerations as well as specific technology.

Both case studies note liaison efforts: field people who can work between the system and its recipients. The Rocky Mountain group's support plan will add to the efficiency of the project while also linking it more closely to the community.

The evaluation plan for this project is still being formulated. Nonetheless, it cannot be overemphasized that a properly designed system should give the evaluation priority not only as the structured goal of any experimental design, but also for the sake of passing on concise and valid versions of knowledge gained to other parties. The current evaluation axes include cost analyses, user acceptance indices, hardware component factors and so forth. The nexus of field service units should give formative input on many aspects of the program.

The implementation of the SITE project is every bit as complicated as that of the Rocky Mountain demonstration India, a large country with varied terrain, has the audience and the resources to warrant its own satellite project. However, use of a satellite, particularly the direct broadcast type, is problematic by virtue of the regionalized requirements of broadcasting to people of diverse language, culture, education, and the like. The direct satellite system is in some ways the most inflexible as it "... has little or no regional origination capability, is the least attractive in its ability to accommodate language, ethnic, and agronomic diversity."[11] Nevertheless if the Indian

commitment to television expansion for national development is to be satisfied through a satellite, it must sacrifice some elements for others. Thus while the SITE demonstration is to afford rather heavy one-way coverage to rural regions - 2,400 direct reception sets in 2,400 villages clustered in areas of about 400 each with rebroadcast to about 3,000 conventional sets——its direct feedback limitations, language problems, and localism disadvantages must be evaluated as tradeoffs or factors somewhat ameliorable with careful planning. As pointed out before, the more general or even implied goals inherent in working with the satellite system, in demonstrating its value in mass communications for national development may offset recognized disadvantages. It is obviously important for any country contemplating satellite use to painstakingly consider system advantages and tradeoffs.

The choice of target sites in the Indian experiment is uniquely designed to complement the current and habitual urban television acquisition/distribution pattern. Direct broadcast receivers will go to lowest density population areas representative of a low though varied development level. Rebroadcast receive areas are closer to urban

centers. As on the Rocky Mountain project, this experiment encompasses regional state jurisdiction; these jurisdictions primarily affect the educational program aspect rather than overall basic coordination and planning which are more federally oriented. Besides the basic low development criteria, authorities have considered site choice parameters such as accessibility, availability of power sources, existence of a suitable location for a TV receiver, the ability to continue television services to the area after the experiment terminates so as not to abort rising expectations resulting from the introduction of the project, and the existence of common agro-economic-socio conditions.

Programming has wisely been scheduled for audience convenience with 1.5 hours during the day for students and teachers and 2.5 hours during the evening for instruction and entertainment for a more varied group of viewers. One method of adapting linguistically to certain regions will employ broadcasting different audio channels for a single common picture. Therefore this effort is to provide "... an opportunity to develop effective techniques for audience attraction and organization and to solve problems involved in the development and presentation of bi- and uni- lingual TV program messages for practical instruction."[12] The organizational

elements contributing to the programming include several Ministries concerned with the program goals of population control, agricultural development and national unity. Unlike the situation facing the Rocky Mountain group, television programs will be new and curious phenomena for the target audiences and the application of instruction television a relatively new venture for India. In an effort to preserve cultural values as well as to develop truly relevant programming the SITE experiment will rely on indigenous talent resources and an "Indian approach" to innovation. Cultural imperialism through importation of foreign resources or influences will be avoided. Hopefully the result will be a judicious balance between cultural norms and new technological information and adaptation.

SITE is performing audience profiles, assessing viewing needs, and will pre-test its programming like the Rocky Mountain project. The social science personnel aiding such surveys will be able to give worthwhile formative evaluation input. Undoubtedly the Indian experiences with 'Krishi Darshan' broadcasts, the agricultural television series, will help in formulating new programs. Production techniques will explore video tape and Super 8mm and possibly some other methods. Four production

facilities will be used by a variety of groups which have expressed interest in the project - besides the overseer agency, the Audio Visual Instructional Division (AVID).

In providing the ground segments for the satellite system, the software, and an acceptable experiment evaluation plan (as agreed upon with the United States), India will gain technological skill and planning expertise. Management of SITE under the Indian Space Research Organization (ISRO) operates in three branches: 1) a chairperson for planning, implementation and inter-agency coordination policy; 2) Project Managers (which are groups) in Earth Stations, Electronics and TV Hardware and Software; 3) a systems engineering group. As the case study points out each area has readily identifiable priorities.[13] As in the Rocky Mountain plan, SITE will incorporate programming and utilization units to help relate the ITV experience to everyday situations and to provide feedback to the central programming and evaluation mechanisms. These units will apparently work with the supplemental film inserts which are to help make the TV screen pictures more relevant. These liaison units may prove critical - along with maintenance - to the systems continued operation and sustained relevance.

The current pointed gap in summative evaluation plans is a matter for some concern. Again, if the experiment is to provide data on the basis of which important decisions are to be made, the process for a final synthesis of conclusions should be well-established in the early stages. Planned use of an independent evaluation team could be useful in terms of objectivity and freshness of perspective. On the other hand, the advantage of having project personnel doing summative evaluation tasks (as is also planned) lies in their knowledges of causes, effects, and perhaps their ability to apply resultant information more knowledgeably.

The implementation plans of the Brazilian experiment will note the value of starting out with a localized experimental delivery system before moving to a national configuration. The first phase of Project SACI involves reception of voice, slow scan, and teledocumentation from Stanford and broadcasting of Brazilian cultural programs to Stanford. The second phase will involve a small-scale demonstration of educational transmissions to the State of Rio Grande Do Norte (a north eastern area). This will provide occasion for localized system development in terms of equipment, personnel, procedures and so forth.

The ATS-F satellite may be used for this experiment although initially a ground signal distribution mode will be employed. The third phase of satellite plans calls for Brazil's own dedicated satellite providing educational and other communication services. Currently a hybrid system is under consideration, one that offers direct reception in isolated areas and community reception for rebroadcast into more densely populated areas.

Very similar motivations for satellite delivery systems are evident for India and Brazil. Both nations can be characterized as large, possessing varied topography, and victims of extremes in weather; both are intent upon improving their educational systems; both desire the technological/professional/leadership factors satellite development would foster. One major difference between the two is the language factor. Whereas in India many languages are spoken - adding to regional segmentation - in Brazil, Portuguese is the predominant language. Both countries are working with one-way types of systems. The satellite activities in Brazil and India are thus strictly national efforts; no regional cooperation plan has been broached to our knowledge.

In the Project SACI test, the Rio Grande Do Norte site was selected because its conditions and problems are representative for many regions of Brazil: "INPE believed that if the educational problems could be overcome there, they could be overcome anywhere in Brazil." The experiment will

provide education to both primary school students and teachers, testing the following hypotheses:

-Educational technology will augment student achievement.

-An educational technology system will reach more students with greater efficiency.

-Training teachers via satellite communications is more cost-effective than traditional training.

The experiment will attempt to develop programming capabilities, test the educational efficiency of the system, train and upgrade teachers, develop school curriculum, and analyze cost/benefits and cost/effectiveness results. Clearly the objectives apply to immediate operational concerns.

Implementation of the test begins with back-up work-training personnel and arranging and showing programming. VHF and medium-wave transmissions to schools from five locations will begin the program. Later, satellite transmission will relay the designated material. The first 'simulated' transmission system (terrestrial base) may provide formative information for the system modification before satellite use. The idea is a useful one. Surveys have provided base information on user needs, experience/knowledge levels, school characteristics, and community leadership attitudes so that system software might be relevant to users. Conventional radio, programmed radio, television and slow scan materials will be devised and tested.

Brazil chose a national programming center to produce broadcast programs. About 600 schools representing urban and rural populations, economic centers, bureaucratic centers and other variable situations important to experimental design will participate in the satellite delivery test. This choice of sites reflects Brazil's operational commitment. The inclusion of many sorts of audiences and the development of a national programming center are first steps for both the small scale demonstration and the later large, operational system.

One of the principle problems which the Rio Grande Do Norte experiment will address concerns the relationships of the project to the administrative structures of the educational system and to the regional interests of separate areas. Hopefully the small pilot demonstration will keynote such problems and solutions. National, stae, and local involvement is integrated into many aspects of the test; this too may facilitate regional relationships to the national program. Other implementation considerations include the problems of developing a cadre of skill professionals to operate the system, incorporating a wider range of audience and programming into the system once it is operational, deciding how to work regional diversity and interests into programming functions, and the overall cost-effectiveness determinations.

CONCLUSION: Part II - System Considerations

User experiments are a relatively new innovation in satellite programs. Only in the past decade have sponsor institutions in the United States been allowed to perform their own demonstrations or tests on a government-provided vehicle. The Applications Technology Satellite (ATS) has been the most active instrument in this respect, the "F" spacecraft last of the series. While many sorts of user experiment developments precede the ATS-F plans, no one demonstration even approached the scale and the planning now going into the FRMS and Indian tests. A brief list of some of these earlier accomplishments follows.

Inter-university connection (resource sharing)

CAI for dispersed populations

Teleconferencing studies and medical communications links: electrowriter, slow scan TV, satellite base station, X-ray transmission

Experiment in low-cost terminals

Alaska experiment in educational broadcasting and medical information teleconferencing

Law Enforcement Assistance Administration (LEAA): identification of persons through fingerprint transmission

World Weather Watch; international data dissemination service

NOWCASTING weather broadcasting

Project Seekstorm: a near real time hurricane data transmission experiment.

Such experiments have served to hint at still largely unrealized satellite potentials. However, they have not truly generated a broad-based user community, any group of individuals with the expertise to plan a long-range satellite delivery system. Previous experiments have been rather insular, often unrelated to regional communications development plans. The later demonstrations on the ATS-F and the Communications Technology Satellite (CTS) will somewhat ameliorate this fact. The FRMS case study modestly states this about ATS-F:[14]

> The underlying communications technology, while well established, has never been applied in the manner contemplated for this overall project; never before have so many satellite earth stations, more than 100, been implemented across a 23-state region (including Alaska and Appalachia); the project represents an ambitious attempt to create a user-based information system.

It is such experiments which will leave the technology in the hands of those who <u>must</u> develop it; that is, once the basic feasibility or technical demonstrations yield their

results, all the on-going work of planning, scheduling, managing, designing and programming will still exist. The larger experiments (on ATS-F and CTS) will develop these needed skills to some extent -- indeed the previous case studies try to record this process of acquiring skills for the benefit of yet other groups. These same projects will bring more diversity to the body of testing knowledge, especially with three or more countries using satellite time. Unlike their predecessors, such experiments are to bring their investigators into contact with broader constraints involving satellites, constraints made all the more significant as the experimental context of satellite use makes the transition to the operational context. The burden of meeting and solving problems, of indicating worthwhile directions is upon these experiences.

Yet we cannot expect a definitive set of questions and answers from the ATS-F and CTS projects. Satellite experiment results cannot simply be transposed to other unique situations. Thus, especially for developing countries, we must consider an explication in general terms of (1) what satellites can offer and (2) what potential and realistic actions a developing country should consider in exploring satellite systems.

Already completed and planned user experiments document the utility of satellites in transmitting to large regions; a system can usually be cost-effective when that region is sparsely populated, characterized by rugged terrain, and an inheritor of poor terrestrial communications and transportation. Satellites can perform a number of functions in the general application areas of broadcasting, teleconferencing, interconnected networks, slow scan TV, facsimile transmission, electronic blackboard, data retrieval and transmission.[15] A satellite can deliver television and audio capacities, ETV, computer links, and so forth; it offers wide-area consultation -- between experts or a hospital and a remote paramedic -- disaster warning, educational courseware, remote diagnostic services -- the list is long and varied. A developing country would have to consider what sort of delivery system most appropriately meets its needs as well as its own resources. One constraint appears immediately: like any communications system, satellites entail a heavy investment. A second major constraint also emerges quickly: there is little public information on satellites. This complicates planning. Nonetheless, the groundwork understanding of satellites is not impossible to obtain; numerous

institutions in North America and Europe are able to provide it. Determining which satellite uses can be beneficial, and determining which needs are to be addressed by the system can be more difficult.

It is this latter task which requires analysis of numerous factors. The goal of "national development" means many things to many countries. A standard set of answers presents the following thoughts: population control, agricultural productivity, more national unity, child and adult education, better health care. Out of the compendium of satellite-delivered services, those most suited for a designated task should be identified. There is an alternative conceptual method which dictates choice of a satellite service followed by the determination of where it can be useful; however, the previous problem - first, solution - second approach preserves "the ends determines the means" maxim while the other tends to capitalize on the excitement accompanying a new technology. The intensive planning requisite to a good system should probably discourage the latter. To return to the collateral needs assessment and system choice, we can point out a number of integral factors. On the delivery or software side, a user may want to consider the advantages of different capabilities:

-- should there be a feedback capacity in an educational/instructional situation?

-- can radio have the same effect as television?

-- how important is local origination?

-- how may future communications innovations or refinements affect a current system plan?

-- how will the audience react to a given technology?

-- what type or amount of program material and resources are available and can be implemented?

-- what percent of nationwide broadcasting is desirable?

-- what problems may arise due to cultural and linguistic differences?

-- what software is best for a given activity?

Some of these questions may be answered through software pre-tests, site surveys and careful study. The user aspects of a system cannot be overemphasized as in the long run they will determine whether or not communications are effective. Social feasibility should have at least as much bearing on a system design as technical feasibility. Moreover, once a system is operating, it must be analyzed for effectiveness; how closely does the actual audience result of satellite broadcasting approximate identified goals?

On the technical side, a developing nation may want to consider the following:

1. availability of electrical power
2. previous experience of personnel in handling electrical and electronic equipment
3. effects of the physical environment (e.g. dust, damp)
4. the potential frequency of use of the devices
5. the acclimatization level of the audience
6. technical expertise available
7. the capacities of existing communications (and transportation) facilities
8. possibilities for maintaining an efficient maintenance system
9. standardization and compatibility of needed equipment
10. the level of commitment for manpower and resources which is available
11. the available budget
12. how changes in the technology may affect the planned system

Such elements are indicative of the very rigorous decision-making and planning which should go into a system design. Yet, the difference between these factors and the previous list of user considerations is perhaps that these latter points can

be quantified, shifted around, and objectively evaluated. The user factors, by nature subjective, open to dispute and trial and error, may be then more unwieldy and intricate. If the technical considerations are the least complex, most easily recognized and debated, this reason alone may suggest why many satellite studies begin with cost-effectiveness and equipment capacities rather than user assessments: they are easier. In any event, the above list is a simplified, self-explanatory set of valid design factors.

A developing nation interested in satellites would have to examine at least the above concepts and undoubtedly others to decide on any satellite implementation scheme. There is still another level on which decisions operate. As mentioned earlier, even more central strategies exist. Consider the Indian case study's discussion of the following questions: [16]

-- Which plan would most promote national unity while allowing for regional differences?

-- Which plan shows promise of bringing the most creative talents to bear on the problem of programming?

-- Which plan would allow for the type of detailed and on-going critical evaluation which would lead to constructive evolution of the system?

-- To what extent does each of the plans contribute to national security -- through technology creation and/or through creating dependence on foreign powers?

-- How important is it to reach villages soon?

-- Which plan is most compatible with a management structure capable of assessing and implementing national objectives?

These are very direct, weighty questions of prominent relevance to developing countries. Consider the case of regional differences: either within one country or among many there will be cultural, social and political differences in target areas. Under one satellite system with a limited number of channels, how can each interest be accommodated? Can nations cooperate to share the costs of common programming? To what extent can and should the national unity goal diminish regional concerns in programming? Technological spin-offs -- accompanying use of indigenous materials and labor power, the development of industries to produce needed components -- can enhance a system's advantages even as it could sustain and augment national pride. Potential dependence on foreign powers for equipment, advice, training and money should be analyzed in depth.

There can also be difficulties in dealing with rising expectations which come about as a result of experimental systems. That is, the newly introduced satellite services may be so successful as to create not only a firmly dedicated

target audience but also an extensive group of support personnel, equipment, and fringe commitments. The experimental content should always be emphasized; this is not to imply that a future operational development should be ignored.

There is, furthermore, clearly little desirability in embarking upon the major enterprise of planning a satellite system if the effort is to be unmanageable. In fact there are very good arguments for selecting first systems or experimental systems which are relatively contained and controllable, possessing a readily understood plan relating technology configuration to goals; systems should also be capable of modification and expansion, supported by an increasing level, over time, of the given nation's own expertise.

Many nations will have to think in terms of regionalization to use satellites so that the costs of time on the spacecraft, program production, and equipment costs are rendered affordable. Sharing satellite time and equipment may create political pressures; however small nations who believe they can efficiently use satellites will probably have little option on this count. Hence the importance of existing organizations and cooperative efforts among countries is heightened. Such precedent institutions or liaisons may be able to smooth international cooperation needed for satellite implementation.

The sharing of programming is also possible by using one picture with different languages on the audio as needed. This would be very cost-effective; however, regional variations or nationalistic sentiments may militate against such an operation. Furthermore, careful scheduling is required of any joint or regional operation not only to reach the designated audience at the right time of the day but also to make the most valuable and, if appropriate, the most judicious use of satellite time. Regionalization may also take into consideration the opportunities for joint delivery systems. They could be a very useful resource conservation mechanism for educational or medical expertise among other activities.

Various possibilities exist for obtaining access to satellites. They are briefly described below:[17]

1. To use a commercial circuit -- buying time on the satellite, and on the ground equipment: this is directly comparable with the use made of satellites by broadcasting authorities for live, long distance, broadcasts.

2. To use only the space segment of a commercial satellite circuit: in theory at least a nation could provide its own ground equipment and simply buy time on the satellite itself. There may be financial advantages in this course of action over the previous one.

3. If a multipurpose satellite was in orbit, it might be possible for national interests to provide -- and pay for-- a transponder on it, and thus share the other satellite costs with other interests.

4. To have a satellite wholly dedicated to national use.

5. To carry out experimental transmission, using narrow bandwidth suitable for audio or data transmissions only, on experimental satellites.

6. To carry out experimental transmissions on governmental satellites. Transmissions could be video or audio signals.

Even if demonstration time were not freely or cheaply available, developing nations could test a large portion of the pertinent technology and of course software without the satellite entity.

Developing countries can start planning now for satellite telecommunications in the future. Even though it may appear that the use constraints are too numerous, or that satellite technology would not be beneficial in the near future, it must be kept in mind that satellites are a reality. Their applications will be extended in developed countries; their costs will go down; both governmental and private entities will develop satellites and depend on them someday. Hence it goes without saying that unless developing countries are at least aware of the technology, acquainted with system contingencies, the gap between developed and less developed nations will widen even more. This is not to presume that a nation's own needs be altered to "fit" into a satellite system; indeed we caution against just precisely that and emphasize the deliberateness with which any State should proceed in the matter. Still, just as surely as history witnessed the advancement of the tractor over hand-plowing, the replacement of the horse by the automobile, so too will

electronic/satellite communications systems outmode current utilization patterns. What can developing nations do? First, it is possible to acquire a firm level of expertise with the technology. This means sending students to schools where they can learn about new developments and innovations now so that future use can be anticipated. Secondly, portions of advanced satellite systems can be tested without a satellite. Production and programming abilities can be improved; software delivery can be examined and tried. Existing communications facilities can be studied and perhaps planned with future satellite configurations in mind. If experimental opportunities present themselves, it should be kept in mind that experiments do not have to be successful: they have a beginning and an end with a proof or conclusion in between. As learning experiences they can be invaluable and deserve encouragement. Satellite experiments are no exception. Finally, developing countries may want to consider the barriers to innovation within their own social, political, economic systems. That is, strategies for innovation are needed by all countries when scientific invention moves as rapidly as it does today. Considered application of new technologies--and all the planning and weighing it entails--should be a priority for all countries. Thus those forces holding up the learning, innovating, applying processes should be studied. Hopefully some of these suggestions may aid the inevitable rendezvous of developing nations and satellite communications.

NOTES

1. Robert Butman, George Rathjens, Colin J. Warren, "Technical-Economic Considerations in Public Service Broadcast Communications for Developing Countries," A report prepared by the Massachusetts Institute of Technology for the Academy of Educational Development, 1973, II-3. (Hereafter cited as the M.I.T. Study)

2. Bert Cowlan, "An Educational Television Satellite Experiment, Federation of Rocky Mountain States, (Hereafter cited as F.R.M.S. Study), 1973, p. 5.

3. FRMS Study, p. 50.

4. Jai P. Singh and Dean T. Jamison, "The Satellite Instructional Television Experiment in India: A Case Study," (Hereafter cited as SITE Study) July, 1973, p. 11.

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6. SITE Study, p. 16.

7. See especially SITE Study, p. 18, 22, 23.

8. FRMS Study, p. 2.

9. Ibid., pp. 8-9.

10. FRMS Study, p. 26.

11. MIT Study, II-7.

12. SITE Study, p. 25.

13. Ibid., pp. 27-28.

14. FRMS Study, p. 14.

15. H.D. Perraton, "Satellites for Education? The Next Steps," A report for UNESCO based on the International Meeting of Experts in Nice, May 4-8, 1971, p.5.

16. SITE Study, p. 16.

17. Adapted from H.D. Perraton, op. cit., pp.9-10

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