Project Assistance Completion Report: The AID Rural Satellite Project (#936-5811)

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Actual: $7.3 million plus $2.0 million from LAC Rural Communications Services project, with which it was merged.

I. INTRODUCTION

AID became involved in the use of the then-new technology of satellite communications in the 1960's. At that time, it appeared to some that the impact of this new, far-reaching technology could revolutionize the availability of education and information to the people of the developing world. Satellite broadcasting would be able to reach into schools and communities throughout every nation, providing the education and information so necessary to development. A.I.D.'s exploration and development of satellite potential continued episodically through the conclusion of the A.I.D. Rural Satellite Program in 1989. To facilitate an understanding of the rationale of the RSP, **this report begins with a review of that long history of A.I.D. involvement.**

While AID's role was modest in scope and was intermittent, AID had a considerable influence on the development of national policies and programs, not only in such regions as India and the Caribbean, but also in the U.S. itself.

Throughout, **the focus of AID activities was on ways to introduce systems particularly appropriate for development uses.** AID assistance to particular countries or regions centered on helping to plan and evaluate significant yet affordable applications, providing technical assistance (especially in educational methods and organization needed for distance teaching), and evaluating the experiences for lessons learned in this new field. On the policy side, there was a continued effort to encourage the provision of low-cost, easy to use hardware systems by both vendors and by the providers of satellite services.

One factor to note is that **the initial years**, until the AIDSAT demonstration of 1975, **were largely focussed on the broadcasting of television programs**, into schools or communities. That period coincided with the interest in educational television itself, an area in which AID activities were very influential. **By the late 1970's, the focus had changed to exploring the potential of two-way communications, especially through telephone services to remote areas and through telephone conferencing networks.**

The policy dialogue. This brief description doesn't include detailed discussion of continuing AID participation in relation to State Dep't. and INTELSAT policies. In brief, AID was a lone voice within Government urging the evolution of services to benefit the rural developing world, through high-powered, regional satellites that would lower the costs of establishing communications networks. U.S. policy at the time centered entirely on protecting INTELSAT's monopoly, which focused on linking capitals throughout the world. In the 1980's, U.S. policy toward competition finally shifted. Competitive systems slowly have come into being, and INTELSAT has responded with some "thin-route" services for rural areas. However, the potential of breaking through the communications gap that exists throughout the rural world--more and more practical with new satellite technology--has not been championed powerfully enough to be achieved.

Evolution of the technology. The discussion doesn't address the dramatic changes in satellite technology throughout this period. The television pictures from Iraq during the Gulf War showed how far that technology has come. One of the earliest demonstrations of that kind of capability occurred during the AIDSAT program in 1976. Much of what AID did was posited on the assumption that technologies would become less and less costly--that has largely proved to be the case.

Impact on domestic work. Finally, this narrative doesn't fully discuss corollary domestic activities in stimulating the use of satellite communications for educational and development use. In the late 1970's, AID collaborated closely with the National Telecommunications and Information Administration in its domestic policies and programs relating to social applications of telecommunications. One direct legacy of that work is today's Learning Channel, broadcast on many cable systems throughout the country. It is also worth noting that in the Congressional testimony that spawned the growing "Star Schools" satellite educational television in the U.S., the first citation was to AID's work in the developing world, with Senator Kennedy asking why we could do it overseas but not in our own country.

II. HIGHLIGHTS OF AID'S INVOLVEMENT IN SATELLITE COMMUNICATIONS.

The following is a sketch of some of the highlight activities during this long and varied period.

1. 1967 White House Task Force on Communications Satellites

AID served on this USIA-NASA-Dept. of Education-State-AID task force which was headed by the dynamic Leonard Marks, then Lyndon Johnson's hand-picked head of USIA and drafter of the COMSAT-INTELSAT Act. Gus Ranis, then AA for PPC, was on the Task Force, while Cliff Block served as staff expert. AID proposed that the way to accelerate the use of satellite capability for education was to develop experience as soon as possible, through making use of NASA's experimental satellites, soon to be launched, for educational experiments. Ultimately, the National Security Council issued a finding mandating NASA to do so. Out of that policy flowed most of the social service applications of the next decade.

2. 1968 Interagency Task Force on Communications Policy.

This high profile State-Commerce-FCC-AID effort, headed by Under Secretary of State Eugene Rostow, was designed to develop a new structure for the Federal Government's international communications policy-making, as well as to look at opportunities for important initiatives. AID (Cliff Block) was charged with developing the chapter dealing with developing country possibilities. In doing so, AID was given the resources to design and carry out two large-scale feasibility studies, one for Latin America and the other for India.

The LA study showed the political difficulty in multi-country collaboration in creation and use of educational TV programs (not what the eager consultants concluded, but clear nonetheless.)

The India portion, which utilized Wilbur Schramm and Lyle Nelson of Stanford, developed a nation-wide plan for satellite educational broadcasting. That plan recognized the difficulties of many multiple languages and cultures, yet showed the tremendous advantages of a shared delivery mechanism that could economically bring new educational opportunities to children and teachers throughout that vast nation. The conduct of the study provided important external endorsement (Mrs. Gandhi met with the consultants) for undertaking a national satellite program for social development purposes. It helped the Indian scientific leadership (notably the great Dr. Vikrim Sarabhai) in gaining a strong political commitment to the use of space science for

development--although they probably would have done so anyway. India soon became the first country to sign an agreement with NASA to use its experimental satellites for educational activities, pursuant to the NSC directive noted above.

Later, in 1970-71, the U.S. Office of Education decided to follow suit by asking NASA for use of the same satellites for domestic educational experimentation. The argument for the program was that the developing world was being provided services unavailable to the U.S. itself. The result was a famous and influential series of experiments in Alaska, Appalachia, and the Rocky Mountain states.

3. Programs for Peaceful Communications

In the late 1960s. the House Foreign Affairs Committee held a series of hearings on the impact of satellite communications on foreign policy issues. From an initial concern with the potential of the Soviet Union to broadcast propaganda freely over American borders, the Committee staff shifted to a positive interest in the use of satellite broadcasting for development. That shift was brought about by then-Congressman Don Fraser (now Mayor of Minneapolis) and Committee staffer Jack Sullivan, in collaboration with AID (Cliff Block). The initial committee idea was to set up a separate institute to deal with both satellite and conventional educational broadcasting for the developing world. AID bureaucratic resistance led instead to a special allocation for "Programs for Peaceful Communications," administered by the predecessor of ST/ED. An initial special grant of $1 million gave it a good start; it was devoted largely to a series of studies of potential applications.

After that one-time special funding, a mandate for increased AID activity in communications continued. That mandate helped provide a rationale for the later establishment of the ST/ED Division of Educational Technology and Development Communications, and the establishment of the Clearinghouse on Development Communications (then called the Information Center for Educational Technology.) It took a long while for field interest to become receptive to field programs in communications, with the partial exception of the Latin American Bureau's central staff. ST/ED, however steadily increased its program in this area, through a series of research, pilot project, evaluation, and field planning activities.

This review of satellite activities does not discuss the non-satellite work in educational technology and communications, that constituted the much larger part of AID's Programs for Peaceful Communications (e.g., El Salvador ETV, evaluation of Korea's educational reform, the beginnings of work in educational radio, support to INNOTECH, institutional centers at Stanford and

Florida State, the Basic Village Education project in agriculture, and pioneering work in nutrition, population, and health communications.)

4. The AID International Conference on Satellite Applications to Education.

(1975) The Technical Assistance Bureau's Office of Education sponsored a ground-breaking workshop bringing together LDC leaders from several key countries to meet in Washington and then go on to one of the sites of the domestic series of educational satellite experiments, Heber City, Utah. The participants came from India, Iran, Indonesia, the League of Arab States, several Latin American countries, and the Education Commission for Africa. This meeting was reportedly influential in the planning of a number of those countries, several of whom became pioneers in development uses of satellites.

5. Evaluation of the U.S. educational satellite experiments. (1976-77)

TAB/ED funded an analysis of the U.S. satellite experiments, in Alaska, the Rocky Mountains, and Appalachia and their implications for the developing world. The studies helped show what might be possible and adaptable to the developing world and also showed areas where the state-of-the art needed more work. In retrospect, one of the main benefits of this work was to bring into association with AID some of the outstanding, mostly young, communications research experts interested in social applications of communications. Among them were Heather Hudson, now probably the best-known scholar in the field, and Dennis Foote, who has become an important consultant to AID on many projects. Their mentor, Dr. Edwin Parker of Stanford, also emerged as a key player with AID in developing the Rural Satellite Project.

6. Evaluation of India's Satellite Instructional Television Experiment ("SITE") (1976)

AID gained agreement from the Government of India to carry out the first external assessment of India's SITE experiment, by a team composed of Cliff Block and Stanford consultants John Mayo and Dennis Foote. SITE was being conducted by the Indian Space Research Organization with NASA's collaboration (a result of the U.S. policy delineated earlier.) A widely-cited article in the Journal of Communications was published.

SITE was pivotal in showing the complete practicality of using satellites to reach villages throughout a developing country,

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thus providing a rich new source of information. For a year, this pilot project reached 2400 villages throughout India with daily TV broadcasting of a development and educational nature. Educational broadcasts on science reached the schools, while at night several hours of development programming, regionally and nationally produced in six languages, reached villages throughout India.

The experience of SITE showed that a system using Indian-made "chicken mesh" earth stations could work reliably through monsoons and dust storms; demonstrated that development programming could be very powerful, when producers had the courage to attack unacceptable social values such as inherited debt and widow remarriage; pointed up the complexities of integrating development programming into broader extension and development efforts, and the difficulties of sustaining widespread interest in educational programming alone; suggested the potent long-term impact on the children of India's villages, who unexpectedly became its most devoted viewers; and showed how broadcasting could be used for in-service training of huge numbers (up to 50,000 at a time) of teachers and extension agents.

The technological triumph of SITE spurred India to become the second developing country (after Indonesia) to establish its own domestic satellite communications system, "INSAT". And unlike Indonesia, India has made substantial use of its national satellite capacity for educational programming, almost certainly because of the SITE experience.

7. AIDSAT (1976)

This demonstration program was created by the AID Administrator. TAB/ED then became intensely involved, in carrying it out, in having it's programs convey a significant message, and in generating a follow-on program.

AIDSAT was an extraordinary series of one-day developing-country demonstrations of the capability of satellites to provide two-way television transmission to and from the most remote areas.

As the NASA satellite serving India for SITE (ATS-6) was re-positioned over the U.S. to continue its use by U.S. educators, AID and NASA offered any country in its path the opportunity to participate in a demonstration. Twenty-six countries and a regional conference agreed. A NASA team flew in the equipment for each demonstration, and a TAB/ED staff member or consultant joined them to discuss the development implications of the new technology with national leaders. The demonstration linked each country's capital, a rural site, and a studio at the NASA Goddard Space Flight Center outside of Washington.

After a taped introduction from President Ford, a series of videos on development applications began the program, including an ST/ED-commissioned video, "If One Today, Two Tomorrow". The tile referenced the continued growth of the school-age population and the potential of educational broadcasting to help solve the problem. The other key video was on the remote-sensing use of satellites, developed by the Natural Resources Office of AID. Each country had a live transmission from its remote site (often local cultural groups) and typically a video about the country transmitted from its capital.

The program then turned to a live discussion of development applications with key ministers and sometimes the President of the host country. On the U.S. side, AID had a panel chaired by an astronaut, with an ex-U.S. ambassador to that country and with AID staff experts on communications applications to education, health, and remote sensing.

The Project was thus a spectacular--well-received, but with its real usefulness dependent on the effectiveness of follow-up actions. Late in 1976, the Agency developed a follow-up budget and general plan, assigning the responsibility to ST/ED. That plan provided funding both to S&T and to each of the Regional Bureaus for regional activities in those bureaus. It also provided slots for a development communications officer in each Regional Bureau.

Within six months, the Regional Bureaus had largely abrogated those personnel and budgetary agreements, abetted by the change in Administration in 1977. Out of the follow-up plan, however, did come: Asia Bureau funding for the University of South Pacific Satellite project, using a NASA satellite; a two-year planning study by the University of the West Indies (the most enthusiastic participant in AIDSAT) and, very importantly, a half-time personnel assignment in LAC for a Development Communications specialist (Dr. Richard Martin, who moved over from TAB/ED.)

8. 1977-78 The "SYNCOM IV" Proposal

This episode was the most immediate precursor of the Rural Satellite Project. The President's Science Advisor, Dr. Frank Press, late in 1977 called together an Assistant Secretary-level meeting to indicate President Carter's desire to develop a program to use satellite communications for social development purposes. Alexander Shakow, then AA for PPC, quickly involved DSB/ED in a series of inter-agency planning meetings with the Office of Telecommunications Policy in Commerce and with NASA. The resulting SYNCOM IV proposal was to use an early Space Shuttle launch to put into orbit a partially-donated Hughes Aircraft satellite. It would serve West Africa, the Caribbean, and northern South America while it also served portions of the

U.S. On the U.S. side, the State of California, under Gov. Jerry Brown, would use the capability to serve California interests (ranging from communications for law enforcement in the mountains through a precursor of cellular radio-telephone, and service to ships at sea, to vocational training programs beamed into Mexico to encourage Mexican industrial development).

The attractiveness of the proposal was that the high power of the satellite would permit broadcasting to very small (3-foot diameter) earth stations. The small size would lower costs dramatically and would permit many rural communities and institutions to utilize the capability.

Through meetings with the Agency's senior staff, a commitment of $22 million was made, $9 million of which would buy three transponders for use on the satellite. This would have provided for three television channels, or for thousands of telephone channels (or combination of TV and telephone.) The remaining funds were to go to end-user equipment, planning help, and technical assistance to user institutions.

In January 1978 the proposal fell apart, with Hughes withdrawing. It is still not clear why it did so; the A.I.D. part of the program was already committed. Gov. Brown subsequently told the press that he believed the Carter Administration was unhappy about the prominence the project would give to him, and that the White House had quietly sabotaged the effort.

9. Out of the Ashes of Syncom IV: Development of the AID Rural Satellite Program

Agency support for the idea of Syncom IV was sustained by shifting the program's focus to one that used existing satellite capacity. The idea was to show how much could be done using the international INTELSAT Network and existing domestic satellites such as Indonesia's PALAPA system (at that time the only LDC domestic satellite system).

The major technical loss by this shift was that there was far less satellite power available, which meant that really small earth stations could not be used. Instead of using 3-1/2' diameter earth stations or smaller, the Project was never able to use one less than 6 meters in diameter, many times the area, volume, and weight. The cossts were dramatically increased for each earth station, and the ability to directly reach rural villages with two-way audio communications was eliminated; instead, the system had to use unreliable secondary links connecting the earth stations to the villages.

Programmatically, it also meant that every use required a complicated leasing process with the local Posts and Telegraph

Authority, rather than the use of satellite capacity already owned. It also reduced dramatically the political visibility of the program.

Nevertheless, AID would still be able to carry out its key purpose, which was to work with education and extension agency users to create communications networks facilitating their work. On May 15, 1979 a Project Paper authorizing $22 million was signed.

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III. Review of the AID Rural Satellite Project

The Project's Objectives were to:

1. Demonstrate and test the potential of two-way satellite communications as a new tool for rural development;

2. Develop processes to maximize the cost-effective use of these technologies by LDC institutions; and,

3. Influence the policies of the providers of telecommunications services and equipment, to increase the availability of such services for the rural developing world.

We should point out where this project stood in the history of AID involvement in satellite communications. It was perceived that **no longer was there a need to demonstrate the practicality of bringing television broadcasting into the rural developing world** by satellite. India's SITE project had amply demonstrated that, as had earlier work in schools with terrestrial TV in El Salvador and elsewhere.

The next step was to show how <u>two-way</u> communications could be used, to link rural users with each other, and with centers of expertise. (The only LDC experience to date in this regard was the very limited "Peacesat" audio satellite network in the sparsely populated South Pacific.)

Staffing. A two-person Project Management staff was added to ST/ED's Division of Educational Technology and Development Communications (the Division headed by Cliff Block): Robert Schenkkan (a distinguished retired Professor of Communications at the University of Texas), who had worked with ST/ED as a consultant, and Lawrence Frymire who had recently headed the State of New Jersey's Public Television network.

Contracting. After a long period of preliminary planning work through an 8a contractor and through General Telephone and Electronic's Systems Engineering Division, a contract was awarded competitively to the Academy for Educational Development to carry out the work and to Abt Associates to do a continuing evaluation of the cost-effectiveness of the program. Those contracts began in August, 1980.

The Academy team was headed by Anna Casey Stahmer, an expert in telecommunications applications to social development with special experience with rural populations in Canada, and Dr. Douglas Goldschmidt, a specialist in telecommunications economics and planning. A major subcontract for the engineering side was

let with Teleconsult, Inc., a very experienced engineering consulting firm that had designed Indonesia's system.

NASA had declined AID's offer to have them oversee the technical work, probably because of the switch to the INTELSAT satellite, and the idea of bringing on a technically-sophisticated RSSA from the National Telecommunications and Information Agency (NTIA) did not produce an interested candidate. We therefore put together, and used extensively during the first two years particularly, a technical advisory team of individual experts and specialists volunteered from INTELSAT and COMSAT. We also let a small RSSA-funded contract with the Dep't. of Commerce's Institute for Telecommunications Sciences in Boulder, Colorado for work on small earth-station design. Subsequently, through collaboration with ST/Energy, we used NASA's Lewis Laboratory, in Cleveland, to develop solar energy sources for small earth-station use.

The search for country sites and Mission collaboration.

The intention was to have six-or-seven sites, spread over all major geographic regions, for full-scale pilot activities, plus some short-term demonstrations. A combination of major budget cuts, the cancellation of a planned Mission project in Africa, and a curious decision by the Philippines Ministry of Communications not to participate reduced that to major pilot projects in the Caribbean and Indonesia. In addition, a coordinate LAC project in Peru was later merged into the Rural Satellite Project, yielding three sites.

The two planned projects that did not materialize represented major disappointments. In retrospect, the reasons for their failure to be realized shed light on the issues constraining social applications of communications, reasons that are political, economic, and institutional.

Senegal. A great deal of planning work was done in Senegal, a country very eager to participate and a good model to show the practicality of this kind of activity for Africa. The first plan, to create a small earth station network throughout Senegal for conferencing, information, and facsimile links with scattered development workers, and for resuscitating the rural radio network of Senegal, foundered on the opposition by a staff member of the U.S. Congress. This gentleman blocked approval of A.I.D.'s Congressional Notification on the grounds that the technology was too advanced for Africa. As he so graphically put it, "You know very well that the Africans would just take the wire from those earth stations and use it as necklaces." Unfortunately, we were never able to have him meet the Senegalese <u>woman</u> engineer (Sorbonne-educated) who was to have headed the project--which would have provided an interesting comparison in intellectual sophistication.

As a second effort in Senegal, with the strong encouragement of the Mission Director, we designed a link with the Senegal River Basic development project, a multi-country dam and irrigation project involving Senegal, Mali, and Mauritania as well as several donors, including the World Bank and the French. The RSP was to have added a communications element--astonishingly absent in the original design! After endless waits, AID participation in the overall River Basin Project (whose plan represented 19 volumes and at least two years of work by a sizeable resident team) was rejected by AID/Washington. AID/W had just come to believe that only rain-fed agriculture would lead to sustained development, and so decided after all the planning that AID didn't want that sort of project. The communications component made no sense as a stand-alone effort, so the Senegalese RSP activity was aborted.

The Philippines. An equally long planing process by the RSP in the Philippines, extending for over a year, also came to naught. The Project would have taken one of the less-developed Philippine islands, at that time without any telephone linkages, and set up a small earth-station network. The network would have served commercial long-distance needs through pay stations while providing service to the Ministries of Health and Education--with those Ministries phasing in payment for those services "at cost". Dr. Goldschmidt did an unusually competent cost and revenue analysis, showing the economic viability of the approach. (Later our experience in Peru showed that rural populations were so eager for paid phone service that capacity has to be doubled within a year, so there is little doubt the plan would have worked.) After all the planning, the Ministry decided not to proceed.

The putative reason for the Philippine's decision was that this kind of rural service was economically inviable. In more private discussion, the reason given was that if the project succeeded, political demands for replication in other unserved regions would emerge, and place unwanted political strains on the resources of the telecommunications authorities.

Since then, several Filipinos have suggested the real problem was that Philippine telecommunications was divided into various spheres of interest among Japanese, U.S. and other multi-national suppliers. AID came in outside of that network of relationships, and with no pay-offs to key officials of the Marcos regime. (We and the Mission Director, Tony Schwarzwalder, had been told that the Project could certainly go ahead if it was put under the auspices of Mrs. Marcos' Rural Development Ministry, but the Mission very rightly declined.)

The Philippines plan would have been an important model, demonstrating more purely than we were able to in other sites, that the use of satellite technologies could be both economically

viable and help transform the quality of health and educational services provided to whole regions.

Indonesia--patience pays.

The work in Indonesia was built on a long history of the ST/ED Development Communications Division in helping to establish an educational technology capacity in Indonesia. The effort later was helped immeasurably with the assignment to the Indonesian Mission of Dr. Robert Schmeding, former Director of ST/ED, who was a strong and very patient supporter of this effo .

Indonesia was the first developing nation to have its own satellite system, the PALAPA satellite, launched in 1976. Until the time of the RSP, however, Indonesia had not utilized its system for specific development support objectives; it had used it exclusively for the extension of telephone services and television broadcasting. AID's objective in becoming involved through the RSP was to promote use of this extraordinary capacity in the direct support of sectors such as education, health, and agriculture.

The first task in Indonesia was to plan a developmentally significant activity. After discussion with a number of Ministries and the Planning Commission, the Mission urged that the satellite activity be associated with one of its own that was supporting a regional consortium of universities in the less-developed Eastern archipelago. (Direct services to health clinics were ruled out by the moderately large size and cost of earth stations. Agriculture Ministry interest in supporting extension was great, but extension was not a Mission priority.) The idea of sharing courses through satellite among the dispersed members of the Eastern Islands University Association, as well as strengthening their administrative inter-dependence, was supportive of the Mission's strategy, and illustrated the unique capacity of satellites to link similar institutions arrayed over very large areas.

The next task was to bring together the Ministry of Education and the Ministry of Telecommunications, which controlled the satellite services. That proved to be the most demanding part of the entire Indonesian project, because of mistrust on both sides. The educators were sure they would be over-charged; the telecommunications people were sure they would never be paid. It took over a year of persistent effort to bring both sides (which individually were supportive of the project) to come together for a meeting. (Since the project, they have been cooperating well.) This mutual distrust between users and suppliers, and eventual success in overcoming it, was one of the common experiences of the project in virtually every country where discussions were held.

The ultimate system created fifteen sites for audio-conferencing, located at twelve universities, two sites in Jakarta, and the

Agriculture Institute in Bogor. Dedicated telephone lines were run from the nearest earth station to the university audio-conferencing site, with specialized equipment added to the earth stations to permit audio-conferencing. At each university site, large rooms were set up with microphones, speakers, and convening equipment. The result was a system that permitted student and faculty groups to talk with each other in a conference call, over a 900,000 square mile area.

During the AID field project's operational life of three years (1984-1987), the system was set up and was delivering fifteen courses each semester, produced at different sites but available to students everywhere. At last report, the system was still functioning.

Audio-conferencing permitted faculty and students at each site to interact with each other over what is essentially a conference call. Facsimile permitted some use of immediate print interconnection, although most print materials were developed in advance. An "audio-graphics" system, borrowed from the British Open University, was to have provided an "electronic blackboard" for each professor to present notes; however, the technology, which was new, never functioned reliably enough to be incorporated into daily lessons. (That kind of problem with audio-graphics occurred during the same period with every other system then extant; today, higher reliabilities are attainable.)

At any one time, 3,500 students were enrolled, taking courses developed by the best faculty person in the region--often the only faculty member with a specialty in such areas as Agricultural Statistics, Soil Science, or Human Ecology. In addition, several thousand professionals, including many faculty, participated in special seminars on such topics as "Nutrition and Primary School Performance," "Immunology for Hepatitis B", "Pig Breeding" and "Bureaucracy for National Development." Those audio seminars were rated very highly by participants: 99% asked for additional seminars.

The ABT Associates evaluation was truncated, terminating after only the first, "shake-out" year of operation in Indonesia. Financial resources available to AID for the evaluation had been reduced markedly. Furthermore, strong dissatisfaction with the demeanor of the evaluation team surfaced in the Indonesia Mission, reinforcing dissatisfaction by AID/W with the capabilities of the Contractor team and its performance. The primary problem was that the Abt team adopted a very "distant", academic approach and was resistant to modifications needed to reflect both budgetary realities and the practicalities of data collection in field situations.

Final evaluation data was thus collected by the AED implementation team and incorporated into the final reports. See

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pp. 34-38 of the Program Overview and Distance Education by Satellite: A Case
Study of the Indonesian Distance Education System, supports produced by the Project. Overall, there was strongly positive acceptance, attitudes toward the distance teaching delivered, and perceived effectiveness.

It proved impossible to compare test scores because in the Indonesian system each Professor develops his own tests. 67% of respondents judged they had learned as much or more from the distance courses as from their regular courses; 95% of local tutors felt their students had learned as much (35%) or more (60%).

Very high marks were given to the written materials specially prepared for the courses. Interestingly, 96% of those who attended the special seminars valued the supportive written handouts highly and most were not sure they would attend without such written support.

One of the most interesting findings was that far more interaction occurred in the distance classes than in the very traditional lectures in regular classes. For example, student-teacher discussions averaged over 32 minutes in satellite classes and only four minutes in traditional classes. Students reported a highly favorable reaction to this increased interaction.

A series of cost analyses is summarized in pages 87-106 of the Program Overview report. The cost of preparing and delivering one satellite course to all participating sites (at that time 11), was only 42% of the cost of carrying out traditional face-to-face courses at each site.

In spite of these fairly impressive results--delivering quality instruction to places which would not have it accessible in numerous subjects, developing the knowledge of local tutors in the process, and doing so at less than half the cost of traditional instruction--the project had only lukewarm support within the University system and Ministry of Education. It never engaged a strong local champion after the first Rector of the Eastern Islands Association moved on. Perhaps the technology--audio only after the tele-writer capacity failed to work out--was itself too unexciting. A more likely constraint is the weakness in the desire to collaborate among the various Eastern Island universities. The collaboration of those separate universities through a regional organization was a Jakarta AID Mission advocacy; while rational, it did not serve the desires of individual campuses to themselves expand and become as broad and powerful as possible at their own site.

Nevertheless, the project did initiate an activity that is continuing to serve students and faculty throughout a large region.

University of the West Indies--An Investment in Personal Leadership and Regional Cohesion

The U.W.I. is one of the few regional universities that has continued to prove viable, with strong campuses on Jamaica, Barbados, and Trinidad, and services to students in 11 other small island nations. A high-ranking official of U.W.I., Pro-Vice-Chancellor Gerald Laylor, became very engaged in the idea of distance teaching through the 1976 AIDSAT demonstration. A follow-up longer-term (6-month) demonstration was funded by DSB and a planning study for an operational system by the LAC Bureau. Thus, when the RSP was begun, the U.W.I. was in a good position to take advantage of it.

The basic rationales of the University of the West Indies Distance Teaching Experiment ("UWIDITE") were that distance teaching would permit students in these smaller islands greater participation, that the sharing of courses among the three larger campuses would help to hold together the regional university, and that professionals throughout the Caribbean could be provided kinds of in-service training and consultation otherwise not available.

At first, the plan was to use NASA's experimental satellites and provide small earth stations on each campus. However, with the uncertainty about the remaining life in those satellites and restricted time availablilites, it was decided to build the telecommunications network on the existing Caribbean long-distance telephone system, which makes use of an INTELSAT satellite, microwave, and "troposcatter" links. Leased lines were provided to each campus site, of high audio quality and reliability. The University itself decided to add a video capability to the system, through "slow-scan television", which produces a still picture every 30 seconds or so which is transmitted over telephone lines.

Seven sites were established, on the three main campuses and three small islands, with distance teaching classrooms added to existing small extension offices.

The result has been, almost from the start, a vigorous system that is now considered "the fourth campus" of the University. The system is in operation more than 50 hours a week, providing both university courses and a rich array of professional seminars. The University also uses 15% of its time to assist in the administration of its far-flung campus.

Student and faculty evaluations have shown very similar attitudes to those in Indonesia, although UWI's generally excellent faculty is undecided on the issue of whether students learn as much or more in distance classes as in face-to-face classes.

The addition of a visual capacity proved useful in two respects, even though not used very extensively. Instructionally, it was used most for training in health and medicine, where the ability to use pictures was often viewed as essential. But for all courses, there was an unexpected use. The ability simply for students and faculty to see each other at the beginning of each audio-conference lent as much-appreciated human touch to the system that seemed to have a significant effect on satisfaction with its use.

The provision of services at a distance has had some remarkable effects. The attrition rate of students in the smaller islands dropped dramatically. Within two years, the numbers of passing graduates in a Certificate of Education program required for secondary teaching more than doubled. Special courses for physicians and nurses on reproductive health and later on AIDS reached many hundreds of them, for the first time. The very first in-service courses for teachers of the deaf, a major Caribbean problem, were met with gratitude.

The cost analysis for the UWIDITE system indicated a per student cost for those enrolled on the small campuses 46% as high as sending them to one of the main campuses. For professional meetings the cost savings were even more dramatic, because of the high cost of Caribbean air travel. A day-long meeting of 84 participants cost $1000 over the system; if instead carried out face-to-face it should have cost $11,000.

The continuing success of the West Indies portion of the Rural Satellite Project demonstrates the value of two things: strong and knowledgeable local leadership from a position of authority, provided by Professor Gerald Lalor; second, integration of the distance teaching system into an already robust regional institution. The UWIDITE system has made a significant difference to many in the Caribbean, and apparently will continue to do so.

The Peru Rural Communications Services Project: Introducing Communications to the Countryside

At the time the RSP was initiated, the LAC Bureau, under the technical leadership of Dr. Richard Martin, initiated this related project. It later was folded into the RSP.

Like the other projects, the Peru project set up an audio-conferencing network. However, it was more adventurous in several respects: it used its own small earth stations, operating off the INTELSAT satellite system; secondly, it established commercial telephone services in an area of Peru that, without satellite links, did not have such service because of its remoteness and rugged terrain. The Project was designed to test the proposition

that satellite communications would make possible commercially viable services to rural population centers. If so, it would stimulate economic development by providing telephone communications with the rest of the country, and would permit a new level of service to extension agencies through low-cost audio-conferencing. The cooperating agency was Peru's telecommunications authority, ENTEL, rather than educational institutions.

A detailed independent evaluation was conducted by Florida State University, while implementation was by the Academy for Educational Development. (An earlier implementation contractor, a small 8a firm, was dissolved, and AED took over the task.)

The primary technical connection, by satellite earth station, of five towns and small cities worked well. At the time, the 6-meter diameter earth stations were the smallest used anywhere in the INTELSAT network. The effort to extend services to villages of a few hundred people through secondary transmission links was problematical, with transmissions too unreliable to be considered successful.

The detailed evaluation, by Mayo, et. al of Florida State, contains much useful data and analysis. It clearly demonstrated the value of the telephone service--within months, it was used to capacity and soon was expanded, logging over 11,000 calls each month, and involving 2/3 of the families in the region. Contrary to expectations, calls were primarily not within the region but instead were to Lima, the center of commercial and political authority. A thorough cost analysis showed surprisingly large amounts of revenue being collected, sufficient to pay for 90% of operating costs after two years, and growing rapidly. (Rural telephone sites typically return only about 50% of costs during their first five years.)

The audio-conferencing system provided over 650 audio-conferences over the first two years, involving an astonishing 90% of the health, education, and agricultural professionals in the region. As the system matured, local experts increasingly requested contact with specific experts, often the best to be found in a specialized field, typically in Lima.

The situation in the Project region today is confused, since it is in the center of both revolutionary and drug-growing activity. Some of the earth stations have been moved to other sites, while others continue to operate.

In sum, the Peru Project clearly showed the viability of rural telecommunications services, when small earth station technology is aggressively utilized. As a result of the Project, Peru gave new priority to rural communications, and through its own and external resources has been extending its rural network.

While a national audio-conferencing service was established by ENTEL Peru, its commitment to that social use has been marginal and use is reportedly very limited.

The Solar-Powered Earth Station

Utilizing funds made available through the S&T Office of Energy, the Project collaborated with NASA in developing and putting into place a solar-powered earth station, in a remote area of Indonesia. It was deemed important to try to demonstrate that neither mainline electrical power nor diesel generators (which are difficult to keep fueled when remotely located), were necessary to the expansion of rural communications. The resulting earth station operates on under 500 watts of power, less than a home steam iron. It operates a six-circuit telephone system, plus two channels used for audio-conferencing. Power is supplied by photovoltaics.

During the two years its performance was evaluated, it did not experience a single failure or any down time. Since then, an Indonesian manufacturer has adapted and improved the original design, and Indonesia's telecommunications authority has tendered bids for acquiring similar stations.

Cost Analyses

One of the Project's contributions was the series of cost analyses carried out, that are summarized in each country report, the Program Overview (pp. 87-106), and a separate volume in the series. These analyses permit detailed examination of the cost elements for establishing and operating both audio-conferencing systems and a satellite-based rural telephone service. They also address revenues, issues of cost-sharing, and cost-effectiveness considerations.

Of particular interest may be the cost of creating and equipping an electronic classroom. The basic audio-conferencing equipment for each classroom ranged from $4,500 Peru) to $10,000 (Indonesia). In Indonesia and the Caribbean substantial additional costs were incurred, due to the experimental addition of slow-scan television, electronic blackboards, and/or micro-computers, which raised costs as high as $29,300. Except for the slow-scan TV equipment, these other technologies did not prove useful, although with their greater reliability and lower cost today they very likely would demonstrate their worth.

The INTELSAT earth stations in Peru, together with the needed telephone switching equipment and installation, each cost about $600,000. The lower-capacity experimental Indonesian earth station, operating off the more powerful PALAPA satellite, cost

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only $150,000, installed, in spite of being a single, custom purchase. Informal estimates for a volume purchase of ten stations suggested a possible $75,000 or less installed cost. Today, such costs may be dramatically lower, especially for large volume orders.

Reports

The Project is exceptionally well-documented, in a series of technical reports, papers prepared for presentations at conferences, and a videotape.

The list of Reports is described in Appendix A.

The Inspector General's ("I.G.") Audit

During the final year of the Project, a Program Effectiveness Audit was performed by A.I.D.'s Office of the Inspector General. Because of the size of the project, it had been "volunteered" for such an audit by ST/ED three years before, when its findings might have proved more useful. However, the I.G. Office's schedule dictated the later time of initiation. The audit team, over several months, met extensively with A.I.D. staff and contractors and traveled to the University of West Indies site.

The financial aspects of the audit produced minor areas of difference with the Contractor, A.E.D., amounting to less than 1% of contract expenditures. Those differences were resolved satisfactorily. The auditors also expressed some concern with the bookkeeping procedures of U.W.I.; however, a pre-award audit by a team that had traveled to U.W.I. had approved those procedures, and the A.I.D. Mission in Jamaica had several other grant and contract relationships with U.W.I. The A.I.D. Mission was made aware of those concerns, as they might affect future grants.

The primary Program Effectiveness conclusion of the audit was that

Dissemination Activities

Extensive dissemination was undertaken by ST/ED and the Contractor. Over 1000 copies of the Overall Program Report were distributed to a carefully chosen list of policy makers and planners in communications and in development policy, as well as to many who requested copies as a result of notices placed in various publications. Briefing workshops were carried out within AID and with the Department of State, at the World Bank, and at numerous conferences sponsored by INTELSAT, NASA, the Pacific

Telecommunications Consortium, and academic institutions (Texas, Penn, Harvard, Georgetown.)

A major dissemination trip took the Principal Investigator (at that time Karen Tietjen) and Clifford Block of ST/ED for presentations and discussions with the leadership of the International Telecommunications Union in Geneva, the Director General of West Germany's Posts and Telecommunications Authority, and UNESCO.

In the author's view, these dissemination activities did give the idea of audio-conferencing networks for social service greater policy attention. They did not succeed, I believe, in successfully arguing that networks of small satellite earth stations now make possible the rapid extension of communications to rural areas. The telecommunications planners in Posts and Telegraph ministries, such as those at the BUNDESPOST, are wedded to the gradual expansion of terrestrial systems. They view with alarm and technical distrust the idea of potentially separate satellite systems. While AID was not advocating such separate systems, others such as the Director General of the International Telecommunications Union, were doing so. AID was put into the same camp.

The telecommunications establishment's planning is very resistant to major modifications. There is a huge sunk investment in present systems, and the gradual expansion of that system maximizes profits and minimizes risk. From a business standpoint, that is a sound rationale--one that in most countries will continue to inhibit the introduction of telecommunications to rural areas.

From a development standpoint, the ability to have reliable telecommunications available in rural regions is valuable. Not only does this project support that view, but other studies have shown extraordinarily high rates-of-return for rural telecommunications investments, as high as 42/1 in some countries. The audio-conferencing component of the RSP showed how inexpensively additional training, education, and professional support can be added on, serving every development sector working in rural regions.

From the standpoint of development investment, rural telecommunications represents a remarkable bargain. The Peruvian project illustrated that rural people will pay for basic phone service, providing an immediate and continuing return on investment, unlike most other investments.

The task, then, would seem to be to bring together telecommunications authorities and development planning ministries for serious and committed joint investment planning. If development investment were to provide for the higher

marginal costs of rural vs. urban telecommunications, telecommunications authorities could feel justified in such investments. One convenient vehicle to be considered is for development funds to cover the initial purchase of rural telecommunications equipment such as satellite earth stations (or, if more appropriate for some areas, microwave equipment), with reversion of the equipment to the telecommunications authority in return for operation ; of both telephone and audio-conferencing services.

What has also been learned is that the effective use of services designed for development users, such as audio-conferencing, requires an institutional base. Given the cross-sectoral nature of such communications uses, two potential models present themselves. One option is to build the capacity to utilize audio-conferencing effectively within each of the separate user ministries (e.g., Education, Health, Agriculture, Rural Development), with the technical capacity itself provided as a national service by the telecommunications authority or private providers. A second model is to have the telecommunications authority itself serve both a provider and facilitator function--although in the long run that has not worked out well in Peru. With the cost of equipping an audio-conferencing room as low as $5,000, the first model, incorporating capacity within the user agencies and institutions, is likely to be the more robust approach in many countries.

Summary Comments

This Project was a pioneering effort to develop and demonstrate the capability of modern telecommunications to accelerate both social and economic development. While it began with high-level AID leadership support, that leadership changed. Complicated by a very slow process of establishing cooperating field sites, funding was eventually one-third of that originally planned. Nevertheless, networks to support development purposes were established in key regions throughout the world, and much was learned. An independent IG Audit pointed to the success of the Project and recommended further funding.

The experience of the program sharpened many of the issues surrounding public service use of telecommunications and its use in rural development programs. It came into conflict with vested interests of many sorts: the concerns of telecommunications authorities that they wold be compelled to subsidize unprofitable social services and/or high-cost rural areas; the distrust of user ministries, such as Ministries of Education, in the charges and service quality of the telecommunications authorities; in one country (the Philippines) the concern of local communications bureaucrats that their (probably profitable) relationships with particular overseas telecommunications suppliers might be

threatened by a U.S. project; a similar concern by foreign-dominated companies that the project might mean a U.S. incursion into their market; conflicts between national domestic telecommunications authorities and national satellite communications bodies; and the still-raging struggle between INTELSAT and the providers of competing national or regional satellite systems. That this modest project did do some important work sometimes seems a bit remarkable.

The Project also sharpened other understandings. Economic considerations do rule telecommunications investments--and those are bottom-line cash flow considerations rather than theoretical cost-benefit studies. The integration of diverse telecommunications equipment is a serious issue. Mainline equipment, designed for industrialized-nation use, is high in cost because of the extraordinarily high reliability standards that are demanded (well over 99.9% reliability is the standard), and because it is created for heavy "thick-route" use. But designing to lower standards in order to lower the cost of rural services brings one into an area of uncertainty with regard to system integration and operation.

There also was made clear the paucity of expertise on end-user equipment choices. The education market is so limited that, at the time the Project was ongoing, there was no source of expertise on the best choices for such equipment as conveners, audio-graphics, and other equipment used at each distance education site. Today, with the growth of both distance teaching and audio-conferencing in the U.S, the situation is somewhat better (e.g.,/ Parker Communications and possibly the Public Service Satellite Consortium provide experience-based advice.)

Beyond all these constraints, however, is the fact that both telephone and audio-conferencing services showed their merit in three very different regions. The technologies demonstrated a high degree of reliability. The audio-conferencing work clearly showed the exceptional cost-effectiveness of distance teaching and consultation. The diverse services provided to extension workers, students, professionals, and rural citizens could have been provided in no other way.

In the author's view, the knowledge we now have demonstrates that investments in rural telecommunications can, in very many cases, be exceptionally productive. If those systems are tailored to the communications needs of development institutions in rural areas, through tele-conferencing networks, such investments can be made even more productive, at very low marginal costs. These approaches are worth the very serious consideration of development planners in A.I.D. and throughout the world.

APPENDIX:
AID RURAL SATELLITE PROGRAM PUBLICATIONS

- **An Overview of the AID Rural Satellite Program**, Tietjen, K.
- **The Design and Installation of Rural Telecommunications Networks: Lessons from Three Projects**, Goldschmidt, D., Tietjen, K., and Shaw, W. D.
- **Distance Education via Satellite: A Case Study of the Indonesian Distance Education Satellite System**, Shaw, W. D.
- **An Analysis of the Costs and Revenues of Rural Telecommunications Systems**, Goldschmidt, D.
- **A Handbook for Planning Telecommunications Support Projects**, Tietjen, K.

Also included in the series is a report prepared by Florida State University:

- **An Evaluation of the Peru Rural Communications Services Project**, Mayo, J., Heald, G., Klees, S., and Cruz, M.

The University of the West Indies prepared its own final report:

- **University of the West Indies Distance Teaching Experiment (UWIDITE)**, G.C. Lalor and Christine Marett

Other Rural Satellite Program reports available are:

- **Telecommunications Services for Agriculture and Rural Development: Experiences of the AID Rural Satellite Program**, Stahmer, A.
- **Telecommunications Services for Health Care: Experiences of the AID Rural Satellite Program**, Stahmer, A.
- **Telecommunications for Higher Education**, Tietjen, K.
- **Peru Rural Communications Services Project: Final Field Report**, Medrano, L.
- **The University of the West Indies Distance Teaching Experiment: A Case Study**, Stahmer, A., and Lalor, G.
- **Teaching Via Satellite: An Audioconferencing Guide**, Shaw, W. D.
- **Institutionalization of Three Telecommunications Development Projects**, Calvano, M.

A video on the Rural Satellite Project was developed:

- **The Rural Satellite Program: A Look to the Future**