SPACE AGE TECHNOLOGY FOR DEVELOPMENT

Agency for International Development
Washington, D.C. 20523

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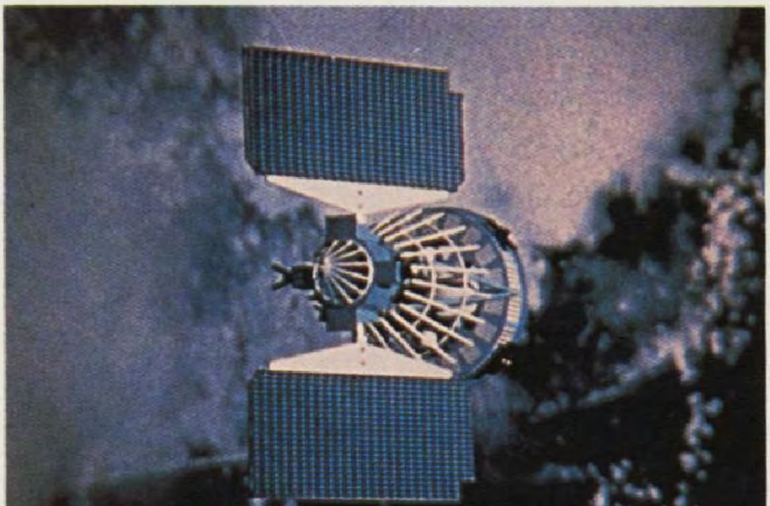

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As we greet our world neighbors on this 200th anniversary of our national independence, our probing of the infinity of space reminds us of the finite quality of this small planet and reinforces the realization that the way in which mankind uses his mental and physical resources will determine the future scale and quality of human life.

Over the past 200 years, the United States has been a developing nation blessed with a productive land and productive people. These have combined to produce the technology to establish strong social and economic growth.

The rate of scientific and technological innovation and discovery in our nation has dramatically accelerated in the nearly two decades since our decision to reach beyond our planet into outer space. Much of the technology thus derived has helped make life better for our citizens and our neighbors. But because much of it is known only to small groups of scientists, the full range of benefits of its applications remains to be realized.

As we have reached outside our own planet, we have become ever more aware of the need to also reach out to our neighbors—in this case, using the same technology. Project AIDSAT is a part of this reaching out, and as such is a major vehicle for raising global awareness of the uses of this technology and its role in meeting national needs and aspirations. By including Project AIDSAT in our Bicentennial celebration, we underscore our commitment as a nation both to the principle of "open skies" and to the widest feasible sharing of the fruits of space-age research.

We especially invite scientists, educators, and technicians from the world over to join us in Project AIDSAT and in the continuing search for new peaceful uses of advanced technologies.

Daniel Parker
Administrator
A.I.D.

Technology for Literacy

"Technology is at the heart of the development process. It enables man to extend his horizons beyond the mere struggle for existence.

"Technology draws the fullest measures from the finite resources of our globe. It harnesses the intelligence of man and the force of nature to meet human needs. . .

"A revolution in development planning could be achieved by the use of satellites to collect vital information on crops, weather, water resources, land use, and mineral exploration.

"The United States has already shared with developing nations information from our earliest resources survey satellites. We are now prepared to undertake much larger programs to apply this technology."

—Henry A. Kissinger
Secretary of State
United States of America

Technology for Health

Introduction

Throughout 1976, as part of the celebration of the 200th anniversary of its founding as a nation, the United States is using space-age communications techniques to acquaint decision makers in developing countries with the potentials of space-age technology. Through its Agency for International Development (AID), the United States has launched Project AIDSAT (AID Space Age Technologies) focused on three fronts:

- **Communications** technology for development
- **Resources** assessment for development
- Technology for **Disaster Prediction and Assistance**

Project AIDSAT represents an invitation by the United States to leaders of developing nations to examine these technologies and to explore their possible usefulness for raising living standards and for advancing other aspects of economic and social development.

The Project AIDSAT format

The President of the United States will introduce the program with a filmed Bicentennial greeting. There will then be three films showing technology applications:

- **"If One Today, Two Tomorrow"** shows the role of communications technologies in development.

• **"Images of Life"** features the uses of the Landsat remote sensing satellite.
• **"Survival"** portrays the rapidly evolving technologies and practices employed in disaster prediction and relief.
The films were specially made for the AIDSAT demonstration.

They are followed by a live program consisting of two segments. The first half is largely determined by the host country featuring local personalities.
The second portion of the live program features a two-way color video discussion between a panel in the host country and one in the United States. This will allow host country viewers to discuss the space-age technology applications with experts in the U.S. This portion of the program features the remarkable capacities of the ATS-6 satellite which allows such communications on portable low-cost equipment.

A.I.D. SAT Communications Link Diagram

Space-Age Projects on Three Continents

Three recent episodes—each on a different continent—illustrate how advanced technology spawned in the space-age touches the lives of people in developing nations:

In India, villagers are clustered around television receivers. For many this is their very first exposure to education outside the home. They are learning how to grow more and better crops on their land . . . how to preserve the harvest with less spoilage . . . how to prepare food for better nutrition . . . how to achieve better personal hygiene and better health . . . how to read and write. The sounds and sights reaching them originate with the nation's best teachers and leading authorities, speaking from centers hundreds of miles away. Transmission takes place via a U.S. communications satellite orbiting thousands of miles up in the sky. For adults and children in this Indian village, a new window has been opened on the rest of the world.

For no apparent reason, the fish in a river in Zaire had been dying. Worried villages had to carry water from wells as much as 30 kilometers away because they could not drink the river water. But with the aid of Landsat images, analysts found that the nature and source of the pollution was a diamond processing plant far upstream. They took action which is restoring the river to its earlier condition. The fish are returning; the villagers again have clean, drinkable water.

In the early dawn an airplane flies high above a region of **Guatemala** which has been stricken by a severe earthquake. Within hours disaster relief officials study high-resolution photographs taken from the plane. With the help of these pictures, disaster specialists can assess the damage, set priorities, plan relief activities and determine the kinds and quantities of emergency supplies required.

Aerial photo to assess damage

In each instance, the desired result could not have been achieved as well or as quickly by any other method than the space-age technology that was employed.

Widespread basic literacy is an essential ingredient of technological, social and economic development. Yet, in Indian villages—as in many other places in the world—not enough qualified teachers are available today nor is it likely that they can become available in this generation or even in the next.

The most promising means of bringing learning to these regions is through "education-at-a-distance" by radio, telephone or television links and, for those who can read, by mail. Where conventional telephone, cable or microwave ground systems are not economically feasible, "education-via-satellite" becomes especially attractive.

In the case of the Guatemala disaster, the use of high resolution aerial photography made it possible for analysts to identify landslides in remote areas which were causing lakes to build up. These could have broken during the rainy season and resulted in further damage. Because of the aerial photos, this threat was eliminated in a timely manner.

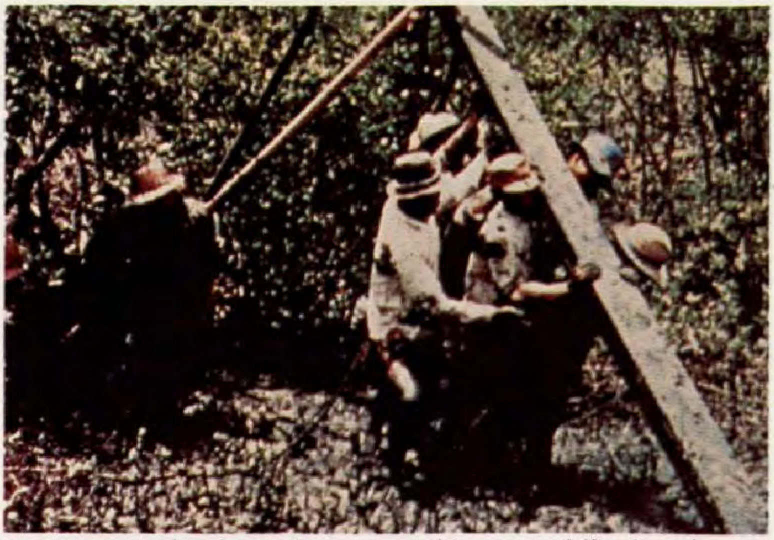
Again in the case of Zaire, speed and efficiency were contributions of the Landsat images which were used to identify the source of serious river pollution.

The choice of any technology depends on local conditions and particular technical requirements. Space-age technology offers an additional new alternative for action. Often this alternative can do the job faster, less expensively and with fewer undesirable side-effects. Sometimes space-age technology is the only feasible way.

Those dealing with technology transfer and engaged in finding appropriate uses for technology have for some time been impressed by the fact that in all countries, the already available tools are not fully used.

This is in part because of the extremely rapid evolution of advanced technologies in the past quarter century. Just "keeping up" with change has become a demanding task.

Moreover, having access to tools is meaningless if they cannot be used. If technology is to have value, large numbers of people must be trained in its use. Experiments must be performed to test which technology is appropriate to each problem. This task is at least as demanding as the research needed to develop the tool. It is a universal task requiring the ingenuity and devotion of people from all nations working together to make the efforts of man and machine more productive.

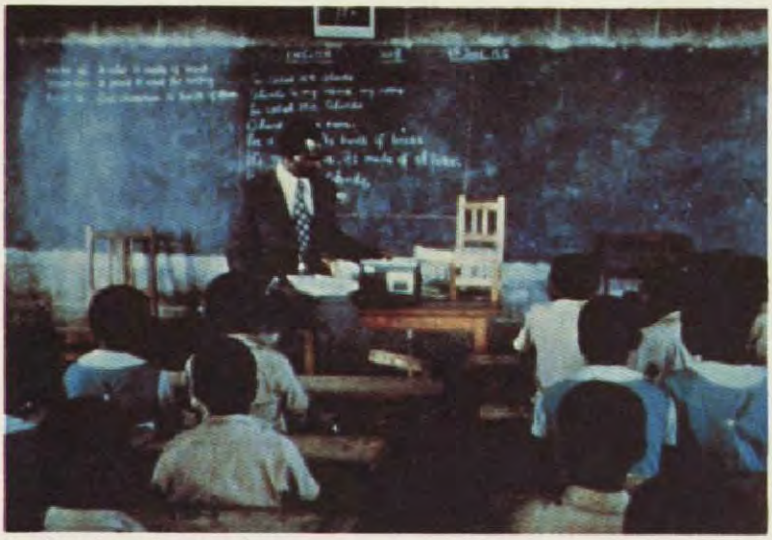

Space-age technology allows us to skip many difficult tasks

Communication via Satellites

North America's communications network, built over the past 100 years, is the investment of four generations. Arduous labor under adverse conditions of climate and terrain brought forth millions of kilometers of wire and cable crisscrossing the continent and the oceans to its east and west.

For other nations it has been equally slow and costly to build land-based communications systems across mountains and valleys, rivers and swamps. The enterprise involves a massive investment in human labor and economic resources.

But now, it is often possible to bypass much of this expensive time-consuming communications structure and look to space-age technology for many kinds of communications. Every year, new, more sophisticated, less expensive satellite communications systems are inaugurated. While the price of nearly everything has been rising, even global inflation has not been able to keep the price of communications from falling. Most telephone calls between continents cost less today than at any earlier time. Satellites transmit conversations, television programs, telegrams and other communications between distant points on the earth with greater reliability and less cost than ever before.



Technology for teaching

Satellites have in recent years been used to transmit educational programs for children and adults. Physicians give medical examinations to patients via television, observing the patient's appearance, viewing the inside of his mouth and throat, noting a grimace of pain—taking advantage of other aspects of non-verbal communication which is so vital in medical diagnosis. Many nations now possess satellite communications stations linking them to a global network. On July 8, 1976, **Indonesia** became the world's fifth nation, joining the **U.S., USSR, Canada** and **Brazil,** with its own domestic communications satellite. It is named Palapa One after a favorite Indonesian fruit. The satellite was custom-made in the U.S., NASA launched it from Cape Canaveral, Florida. It will provide a communications link for the numerous ethnic groups inhabiting the thousands of islands making up the Indonesian archipelago stretching across 5,000 kilometers of ocean. Obviously, television or globe-spanning satellites are not always the best communication technologies. For both education and entertainment—radio, records, or tapes are often the best and least expensive communications tools. In Kenya for instance, radio offers an ideal means of supplementing a teacher's skills for foreign language instruction. In Guatemala, as in the United States, radio is an ideal means to allow a hardworking farmer to keep himself informed.

Information for better crops

Good communications systems are basic to economic and social growth. Space-age technology gives a new dimension to communications which can be of great benefit to developing nations. This rapidly evolving tool along with more conventional technologies, poses a worthy challenge to all peoples to develop uses which are efficient and appropriate. We have only begun to experiment with these tools. As **India** pioneered new forms of education with the ATS-6 satellite, other nations have at their disposal an almost limitless opportunity to select from the available communications uses and to choose that combination of technologies which most effectively fulfills their needs.

The return of the ATS-6 communications satellite to the Western Hemisphere offered a unique opportunity. The satellite "time" was not being fully used. It was therefore possible to stage a series of demonstrations of space-age technologies in association with AID's efforts to substantially expand its efforts to train people from the developing world in their use.

The Genesis of Project AIDSAT

The bridge across outer space used for the transmissions is the ATS-6—Applications Technology Satellite Number 6—which already has established for itself an unprecedented record of service in widely separated parts of the earth.

ATS-6 is in a path in which it completes one orbit every 24 hours, thereby keeping pace with the earth's own rotation. As seen from the earth's surface, ATS-6 appears to stand still in the sky and, thus—in this "geosynchronous orbit"—is available for communications use without interruption.

The United States used the satellite from May 1974 until May 1975 for an "education-at-a-distance" experiment in which lessons were televised into classrooms in secondary schools in communities isolated by mountainous terrain in portions of the western United States where specialized education was not readily available.

The satellite was also used for medical services in Alaska, the northernmost U.S. state, where villages which have no physicians are sometimes cut off from distant cities by severe winter weather conditions. Via satellite television, physicians at city medical centers were able to talk to, see, and even "examine" patients in emergency situations in the villages. Similarly, the satellite was used for medical education and information exchanges among physicians at medical colleges and hospitals.

In May 1975 the satellite propulsion unit was started by radio control from earth, and ATS-6 moved eastward along from its "station" above the Galopago Islands to a new location above Lake Victoria in Kenya. While hovering for a year over that location, ATS-6 was used by the Government of India to televise educational programs into approximately 5,000 villages. This history-making joint experiment has provided many useful lessons for those preparing other communications projects.

During its use by Project AIDSAT, the satellite will be returning to the Western Hemisphere traveling slowly westward along the equator to its new station over the Pacific Ocean.

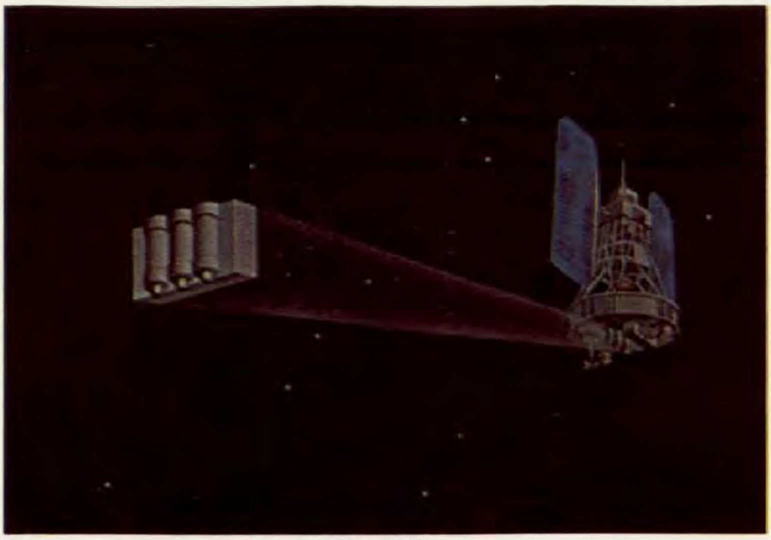
What makes Project AIDSAT technically possible is the sophistication of ATS-6. Earlier communications satellites required very large and complex earth installations—massive antennas costing hundreds of thousands or even millions of dollars—and were far too heavy and bulky for fast transportation and installation at different locations. ATS-6 is far more powerful than the satellites used by many countries for commercial communications. It can receive from and transmit to relatively small, simple, inexpensive earth stations. Thus, teams of technicians can transport on a single aircraft the equipment required to transmit and receive color television programs. This equipment can be quickly set up and taken down again for further movement.

As presently envisioned, by late October 1976 all of the Project AIDSAT participating countries will have been visited and Project AIDSAT will come to an end. The ATS-6 will then resume communications experiments in the Western Hemisphere.

How the AIDSAT Team Works

Two or three days before each planned program in each country, a crew of U.S. technicians arrives aboard a chartered airplane which carries all of the required satellite receiving and transmission equipment. The crew installs one set of transmitting and receiving equipment in the national capital, and additional receiver units in two or three cities or towns in other parts of the host country. Each equipment set contains an antenna and television receivers for obtaining the transmissions from the satellite.

After conclusion of the programs the technicians disassemble and repack the equipment and take it with them to the next host country. Three U.S. crews of technicians—of about a dozen persons each—travel simultaneously so that while one program is in progress two other crews are readying equipment in other countries. Two or three days are allotted to each crew to travel to a country and set up and test the equipment. About one or two days beyond the program day are allotted for disassembling and repacking it, so that a visit to a country takes about a week of a crew's time. During this period, the satellite technicians—and AID experts who will be with the demonstrations as well—are available for more detailed conversations with interested people in the host country.



Resource assessments via LANDSAT

Resource Assessments via Landsat

Technology allows man a new perspective of the world from the unique vantage point of outer space. Two unmanned satellites—with sensors especially designed for observing and reporting on the condition of the earth's surface—transmit their images of our planet from an altitude of 770 kilometers. Each "earth resources" satellite, called Landsat, orbits the earth once every 103 minutes—14 times each day—sending back images of the surface below each of which covers an area 185 kilometers on a side. Every 18th day it begins its complete coverage of the earth anew.

The images obtained by the satellites' "electronic eyes" are received at Landsat ground stations in the United States, Canada, Brazil and Italy. Other countries are also planning to build their own earth receiving stations.

Because these satellites reveal light and color in special ways, they produce images which allow us to see things which normal photography would not show. Because the "pictures" of an area are always of precisely the same area, they allow us to study change. And because they allow us to view large stretches of the earth from afar, we can identify characteristics which are not evident to us even when we stand on them.

Images are available to anyone anywhere for a modest fee covering the cost of Landsat reproduction. Information on how to obtain any images is available from:

EROS Data Center
Sioux Falls, South Dakota 57198, USA

(EROS is the acronym for Earth Resources Observation Systems)

Instituto de Pesquisas
Espaciais (INP)
C.P. 515
Sao Jose dos Campos
Sao Paulo, Brazil

Telespazio Corso d'Italia
42-43
00198
Rome, Italy

The center stores Landsat observations and distributes information about the coverage.
In keeping with the United States "open skies" policy, the center trains technicians from many nations in the use and interpretation of Landsat imagery. Scientists of many nations have conducted experiments which have been instructive to the world community as well as their own countries.

Expensive electronic analyzers are not necessary for most interpretation purposes. To the trained investigator, the pictures reveal information about crops, foliage, geological structures, water conditions and distribution, man-made and natural features of a region, and a host of other aspects of the earth.

• Using Landsat imagery, investigators in Thailand found that the nation's timber reserves were a third less than had been assumed.

• Mapmakers in Bolivia discovered rivers had changed course. Based upon space-gathered observations, they made cost-saving alterations in proposed highway and pipeline construction plans.

• Bolivia also used Landsat observations to remap the country and inventory its natural resources—doing so far more quickly and inexpensively than could have been done by other methods.

• In Zaire, Landsat analysts discovered a freshwater lake not shown on maps. Discoveries of previously unknown fresh water sources through Landsat can materially affect economic planning and development in many regions of the world.

• In Iran, a Landsat investigator established the presence of fresh water under a salt flat. His historic work to verify his Landsat-inspired beliefs is recorded in the AIDSAT film.

• The movement of sand dunes is being monitored by Landsat investigators in Egypt. The information gained is being evaluated for use in planning construction and development which is less vulnerable to inundation by the rolling dunes whose course scientists may now begin to predict.

• Landsat imagery has helped to find remote vegetation hospitable to the tsetse fly, and conditions favorable as breeding grounds for malaria-carrying mosquitoes for attention by pest control crews. Elsewhere comparisons of seasonal or other periodic changes as recorded in successive Landsat observations have made possible the charting of floods and erosion to assist land use planners.


Tools to plan development

Landsat may help increase agricultural production by identifying potentially fertile soils; by indicating favorable growing conditions; and detecting certain plant diseases and insect infestations. This is possible because diseased crops reflect a different electronic "signature" for Landsat's sensors than do healthy crops. Efforts to use Landsat for these purposes are still in the pioneering stages, but offer considerable promise for the future. AID hopes to participate in the design of future Landsat remote sensing satellites and to incorporate in them capabilities which are specifically tailored to assist developing nations in their efforts to assess their resources and improve their lives.
Landsat technology can be a valuable tool for national development. It is one of the space-age tools that help place the opportunity for a better tomorrow within grasp.

Disaster Prediction and Assistance

Natural disasters are among man's universal tragedies. They have wreaked havoc, destroyed communities, and killed and injured people indiscriminately since time immemorial. As man's numbers grow, disasters affect ever more people and require ever more organized and intensive relief efforts. While man cannot eliminate natural disasters, the number of victims and damage to property can be greatly reduced with available technology for preparedness, communications and rescue.

Space-age technology is providing tools and techniques for predicting and assessing disasters and giving assistance after they occur. Through space-age disaster forecasting techniques, it is possible to plan for, rather than merely react to, disasters.

Each year delegates from more than 20 disaster-prone countries assemble in the United States for five weeks of seminars, simulation exercises and conferences to exchange information and acquaint themselves with the most up-to-date means for dealing with disasters.

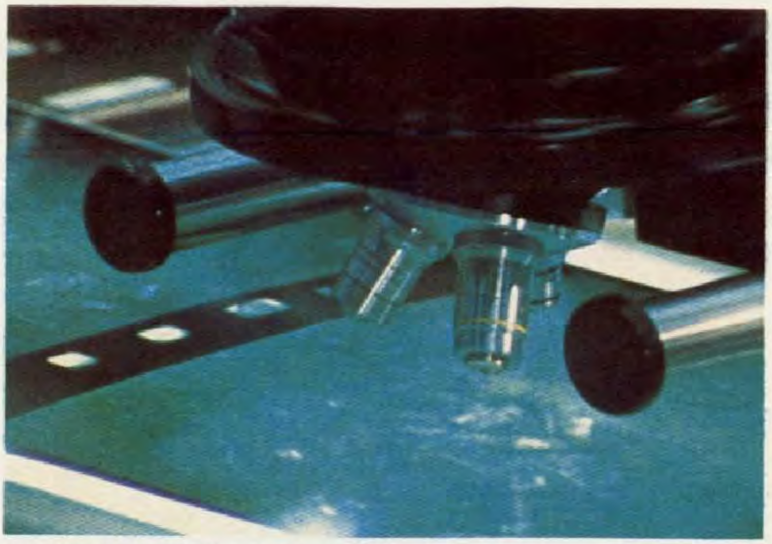
Today we often look above the earth for new help with old problems. Recently, images from Landsat, one of two U.S. earth resources observation satellites, revealed that a fault in the United States that had been believed to be only five kilometers long actually extended for 97 kilometers. Followup aerial photos from an altitude of six kilometers gave geologists additional information.

Instruments now being designed and tested for strategic installation at fault lines will soon monitor fault line **movements** for possible prediction of earthquakes. For example, "Lageos" is the name of a new satellite with high-quality optical prisms which reflect laser light beams back to fixed positions on earth. The **time** required for the roundtrip of the beams is converted to **distance.** If the distance from the laser station to the satellite changes between periodic measurements—even very slightly—scientists know that the earth's crust has moved.

Tools to predict disasters

Weather is still the most frequent cause of national disasters. As a hurricane swirls at sea, a U.S. weather satellite 36,000 kilometers above the earth's surface photographs it at regular intervals and measures its wind speed, temperature and direction of movement, and the condition of the sea and air around it. This information, when processed by computers, can help meteorologists predict a hurricane threat to inhabited regions.

Additional information obtained from aerial photographs and radar probings supplement the satellite's overview. Day and night, the tracking of the storm continues. When the computer print-outs show inhabited regions are threatened, an early warning is sounded and a well-planned program of precautions is set into motion. Food and fresh water are stored. Batteries are readied for use in the event of electric power failures. Hospital patients are moved to safer places. Every available resource is mobilized in a disaster preparedness plan for protecting life and property.



Knowledge to make tools useful

Floods are more readily predicted than storms. Six times each day automatic measuring instruments in the U.S.—located in remote rivers, at sea coasts and on land—take readings of water levels, tidal changes, rainfall and snow accumulations, and transmit them to a satellite passing above. This information often helps weather scientists foresee floods long before they occur.

Devices called "tilt meters" detect ground tilting which often precedes volcanic eruptions whose flow of molten rock destroys lives and property in many parts of the world. Information radioed by tilt meters via satellite to ground stations, can give warning of impending disaster.

Similarly, electronic stations powered by solar energy in remote forest regions measure and transmit every few hours information on humidity, temperature, wind velocity and other factors affecting the spread of forest fires. Such information can be used to alert fire fighting crews and special observation teams in the air and on the ground to check for possible fire outbreaks, or chart the course of existing fires.

No country can afford disasters. Every country can take part in the modern effort to lessen their devastating impact by joining with others in employing the best ways of dealing with them.

Beyond Project AIDSAT

Developing nations have open to them today opportunities and possibilities for accelerated economic and social development that would have seemed visionary only a few years ago.

More researchers are at work today than have ever lived at any one time in world history. They have greater resources at their disposal—more advanced research equipment and more public support—than scientists ever had in all of human experience. The purpose of basic scientific research today is, as it has always been, to learn about nature and the laws of nature. The purpose of applied research and engineering is to turn that knowledge emerging from science to useful technology—instruments, methods and substances supporting human objectives.

Project AIDSAT is calling attention to selected new instruments, methods and substances that promise to help developing nations meet the aspirations of their people.

The dialogues and information exchanges begun via satellite television during the AIDSAT programs between leaders of developing nations and experts in the United States will continue. To strengthen these dialogues and exchanges, the Agency for International Development (AID) is planning a follow-on program for Project AIDSAT. Leaders and technical experts in developing nations are being invited and encouraged to inquire and suggest how space-age technology can help in their nation's development plans and to seek help in selecting, adapting and implementing this technology.

Suggestions, inquiries and comments should be directed to the AID office in the inquirer's country. The address is available from the U.S. Embassy.

Credits:

Agency for International Development:

DANIEL PARKER, *Administrator*
John K. Wilhelm, *AIDSAT Project Director*

James B Chandler	*Communications Consultant*
Stanley D. Handleman	*Consultant*
David M. Sprague	*Communications Consultant*
Merril W. Conitz	*Remote Sensing Applications Consultant*
Christian R. Holmes IV Weston L. Emery	*Disaster Prediction and Relief Consultants*

NASA:

JAMES C. FLETCHER	*Administrator*
Paul J. McCeney	*Technical Communications Program Manager*
F. Dennis Williams	*Program Executive Producer*
Albert A. Whalen	*Goddard Project Manager*
Robert J. Shafer	*Television Producer*
Richard L. Nafzgar	*Technical Coordinator*
F Kenneth Grimm	*Film Production Manager*

FILM CREDITS

Produced for AID by NASA under contract with

HEARST METROTONE

Charles E Shutt	*Executive Producer*
John O. May	*Producer*
Judith A Silverman	*Film Research*

FILMS

IF ONE TODAY—TWO TOMORROW
Written and directed by Walter de Hoog
Editor. Robert Brown

IMAGES OF LIFE
Written and directed by Gene Starbecker
Editor: Richard Laitinen

SURVIVAL
Written and directed by Robert Foster
Editor: Ken Werner

Films are presented in English, Arabic, French and Spanish

76/1441

UNITED STATES OF AMERICA

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

NASA