PD-AAC-966-B1 9310902 (2)

NON-CAPITAL PROJECT PROPOSAL

14p

Interregional Project

AID/Washington, Technical Assistance Bureau, Office of Science and Technology

Project Title: Application of Remote Sensing Technologies

Project No:_____ Original: X

Submission Date: July 1, 1970

Obligation Span: FY 1971 - 1975

FY 1971	$ 20,000
FY 1972	100,000
FY 1973	200,000
Total	$320,000

ID 1020-25 (10-68)

AGENCY FOR INTERNATIONAL DEVELOPMENT (A.I.D.)

Proj. No. 9310902

PROJECT AUTHORIZATION

1. PROJECT NUMBER	3. COUNTRY	4. AID
[illegible] - 902	A.I.D.-Washington TAB	TAB 0095

2. PROJECT TITLE	5. AUTHORIZATION DATE
Application of Remote Sensing Technologies	August 19, 1970
	6. PROP DATED
	July 30, 1970

7. LIFE OF PROJECT

a. Number of Years of Funding: 3

Starting FY 1971; Terminal FY 1973

b. Estimated Duration of Physical Work After Last Year of Funding (in Months): _____

8. FUNDING BY FISCAL YEAR (in U.S. $ or $ equivalent)	DOLLARS		P.L. 480	LOCAL CURRENCY Exchange Rate: $1 =			
				U.S. OWNED		HOST COUNTRY	
	GRANT	LOAN	CCC + FREIGHT	GRANT	LOAN	JOINTLY PROGRAMMED	OTHER
Prior through Actual FY							
Operational FY 1971	20,000						
Budget FY 1972	100,000						
B + 1 FY 1973	200,000						
B + 2 FY							
B + 3 FY							
All Subsequent FY's							
TOTAL	320,000						

9. DESCRIBE SPECIAL FUNDING CONDITIONS OR RECOMMENDATIONS FOR IMPLEMENTATION, AND LIST KINDS AND QUANTITIES OF ANY P.L. 480 COMMODITIES

10. CONDITIONS OF APPROVAL OF PROJECT

BEST AVAILABLE COPY

(Use continuation sheet if necessary)

11. Approved in substance for the life of the project as described in the PROP, subject to the conditions cited in Block 10 above, and the availability of funds. Detailed planning with cooperating country and drafting of implementation documents is authorized.

This authorization is contingent upon timely completion of the self-help and other conditions listed in the PROP or attached thereto.

This authorization will be reviewed at such time as the objectives, scope and nature of the project and/or the magnitudes and scheduling of any inputs or outputs deviate so significantly from the project as originally authorized as to warrant submission of a new or revised PROP.

A.I.D. APPROVAL	CLEARANCES	DATE
Joel Bernstein, AA/TA	M. Belcher, [illegible] (in draft)	[illegible]
	R. Johnson, [illegible]/TECH (in draft)	[illegible]
	A. Jacobs, [illegible] (in draft)	[illegible]
	J. Blume, [illegible]/TECH (in draft)	[illegible]
	B. Bowie, [illegible]/DR	7/25/70
SIGNATURE	L. Hale, [illegible] (in draft)	[illegible]
Bureau for Technical Assistance	K. S. [illegible]	8/18/70
TITLE DATE	A/CONT	

NON-CAPITAL PROJECT PROPOSAL

APPLICATIONS OF REMOTE SENSING TECHNOLOGIES

I. SUMMARY DESCRIPTION OF PROJECT

A. Objectives

This project is intended to develop the framework for action programs that will assist developing countries in building the manpower, facility, and institutional base during the 1970s to (a) make sound investment decisions concerning the use of remote sensing techniques to accelerate economic development, (b) identify those combinations of remote sensing techniques, geographical areas and economic development objectives that offer the greatest promise, (c) acquire, process, and interpret remote sensing data, (d) translate remote sensing data into economically significant information, and (e) use such information as a basis for development programs. Emphasis will be given to evaluating the effectiveness of past remote sensing opportunities from aircraft and to estimate the value of future opportunities from aircraft and satellites in comparison with other approaches in solving the following illustrative types of problems, individually or collectively:

Howard Shoard to "operations" EAP

- Topographic mapping
- Mineral and fuel, location, delineation, and evaluation
- Water resource evaluation including sedimentation, silting, erosion, aquatic weed build up
- Geological structures as they relate to construction and engineering projects
- Degradation of regional ecology as a result of economic development
- Classification of soils
- Inventory of forestry resources and impact of deforestation
- Scrutiny of agriculture and other vegetation patterns, including impact of pests, diseases, weather, and other natural and man-made occurrences
- Assessment of marine resource potential, and coastal processes that affect maritime traffic or coastal urban development
- Planning and altering urban development, transportation, and communication patterns

This project should also (1) provide useful guidelines in increasing the benefit to developing countries of existing cooperative remote sensing programs supported by U.S. agencies such as NASA and DOD and (2) assist in shaping the 1971 US-sponsored international symposium on earth resources satellites announced at the United Nations.

B. Project Components

The project will be reviewed at the end of Phase 1 to determine whether an A.I.D. remote sensing project as described in Phases 2 through 9 appears feasible in the light of the non-technological factors considered in Phase 1. If it is decided on the basis of this review to continue the project, the project will be reviewed again at the end of the first year (Phases 2 - 4) to determine whether, in view of the dynamic nature of the technological developments in this field, Phases 5 through 9 as currently described are still sound.

Phase 1 - Describe how the limiting factors - institutions, human resources, government policies and attitudes - which have influenced the extent of utilization of data developed in IAGS natural resources surveys and other A.I.D. programs, will be mitigated sufficiently to yield reasonable prospects that remote sensing technology would be utilized so as to have significant development impact. Explain how these non-technological factors would be taken into account in each applicable successive phase of the project.

Phase 2 - Review past efforts in selected developing countries to acquire and use information from remote sensors with particular attention to how data acquired from sensing has been integrated into economically oriented activities. Describe the costs involved in these efforts and identify the reasons why such efforts were or were not cost-effective approaches in solving specific development problems.

Phase 3 - Describe the estimated costs and capabilities of sensing technologies likely to be available during the 1970s that appear relevant to the problem areas described in Section IV. Identify the key manpower, facility, and institutional requirements for a developing country to be able to make use of these capabilities. Describe the differences in utilizing these technologies in the U.S. and in developing countries.

Phase 4 - Review the methodologies that have been developed in the United States for relating opportunities for using remote sensing capabilities to solving specific development problems and for demonstrating under what conditions remote sensing is a cost-effective approach to solving such problems. Develop a modified methodology suitable for solving such problems in the developing countries.

Phase 5 - Implementation of Phases 5 and 6 will be contingent upon information obtained in the preceding phases. If the results indicate the desirability of one or more pilot operations, a plan will be developed based upon methodologies formulated in Phase 4. Pilot operations might include the use of advanced sensors in conjunction with a regional survey which had already been scheduled. The objects would be to determine the incremental value of information obtained through the use of advanced sensors; estimate the costs and payoffs from such applications; and evaluate the development programs necessary to translate promising sensor data into economically beneficial results. The cost estimate for a pilot project is based upon the assumptions of a 3000 square mile survey area, data acquisition costs of about $5 per square mile, and data analysis costs of approximately $25 per square mile. These costs are approximately those incurred by the U.S. Geological Survey and the OAS in certain analogous activities. A more precise estimate will be one result of the studies carried out in phases 1-4.

Phase 6 - Evaluate the effectiveness of the methodology as applied in Phase 5 in terms of its general applicability in country-specific and region-specific situations.

Phase 7 - Determine those developing countries and regions where application of remote sensing technology appears to have the potential to provide a significant impetus to economic development.

Phase 8 - Develop the framework for an action program that will assist developing countries in building the manpower, facility, and institutional base to achieve the objectives cited above. Consideration will be given to training programs, national and regional facility and equipment requirements, data standardization requirements, international coordination of national data requirements, development of institutional arrangements to coordinate user requirements with data collection opportunities, and other key elements of an overall economically viable system.

Phase 9 - Develop and implement specialized training programs to prepare specialists from developing countries to use data available from satellite and aircraft programs.

C. Justification.

The potential application of recent advances in sensor technology to solving development problems has been indicated in photographic and other kinds of data about earth resources obtained from satellite program (e.g., Apollo, Gemini), high flying aircraft (e.g., IAGS program), and specific A.I.D. development programs (e.g., Liberia magnetometer survey, Colombia radar survey). Numerous studies and papers concering the potential of earth resources satellites have been prepared and Brazil and Mexico, in cooperation with NASA, have launched programs to assess the future of this satellite technology. However, none of these efforts have been cast in a sufficiently broad system approach directed to relating technological opportunities to economic payoff in developing countries to provide the basis for investment decisions, either by developing countries or by A.I.D.

This project will build on this and other work in the field and will be oriented toward answering the types of questions posed by economic planners and finance officials when considering payoff from investment of scarce resources in a new technology. While the timetable for the development of the technology may be somewhat uncertain, potential capabilities are reasonably well understood and therefore primary attention will be devoted to developing a better understanding of the use of the technology.

D. Life of Project Costs

It is anticipated that the broad reservoir of expertise of several U.S. Government agencies will be utilized in this effort, particularly in shaping and guiding the effort. Complete familiarity with the extensive literature in the field is assumed, thus minimizing the necessity for studies oriented toward the technology of sensing. Finally, the pilot country and pilot region selected for Phase 5 are expected to provide cooperating experts who would contribute local expertise to the effort.

FY 71 - 2-3 consultants (for Phases 1-4); $20,000 for selected meetings, symposia, and other activities of particular interest

FY 72 - 2-3 consultants; $100,000 (for Phases 5-6)

FY 73 - 2-3 consultants; $100,000 (for Phases 7-8); $100,000 (Phase 9)

These costs are in addition to costs incurred in country programs to support training and other related activities.

II. PAST EFFORTS IN REMOTE SENSING

For a number of years there have been limited and sporadic efforts to use remote sensors mounted on aircraft for development purposes in the developing countries. The most extensive effort has been that activity of the IAGS to assist Latin American countries produce topographic maps. The other major activity in this field has been the involvement of the U.S. Geological Survey in A.I.D. and UN programs in many countries in an effort to strengthen the capabilities of these countries in geological mapping. Examples of other remote sensing efforts include soil classification in Korea, mineral surveys in India, and fresh water investigations in the Middle East.

Most attention has been directed to the use of black and white photography. In recent years there have been some attempts to introduce other techniques including magnetometers, radar, and scintillometers and, of course, color and infrared film.

The results of past efforts in resource mapping have been very spotty. Elaborate maps of large areas of Central America have been lying unused for several years. On the other hand, new geological maps of Colombia are providing the basis for accelerated mineral development. Magnetometer surveys of Liberia resulted in a variety of mineral leasing arrangements while overflights of forestry resources in several areas have had little impact. With regard to the institution building aspects of these programs, the results have been similarly inconsistent. Venezuela has a substantial cartographic capability, for example, while the India Geological Survey is very, very weak. 1/

1/ The following references describe in detail the extent of past remote sensing activities in Latin America:
Natural Resource Information for Economic Development, Orris C. Herfindahl, John Hopkins Press, 1969
Annotated Index of Aerial Photographic Coverage and Mapping of Topography and Natural Resources, Organization of American States, 1965

III. THE ADVENT OF THE SATELLITE

The possibility of an earth resources satellite within several years has directed considerable international attention on the potential of remote sensing in leap frogging the classical techniques of resource assessment.

There are many potential advantages in surveying the entire earth or major parts of it by means of sensors on orbiting satellite systems. For sizable areas within the field of view of the sensor, spacecraft coverage is synoptic and thereby eases the problems of creating and interpreting large-scale mosaic photographs. With orbital-based sending, global coverage can be obtained by a single set of calibrated instruments thereby making measurements which are comparable globally. Moreover, advantages result from the precise regularity of spacecraft motion and from the lack of vibration. In sum, the advantages offered by remote sensing from space are recognized as:

- Synoptic pictures from sizable area
- Acquisition of near-real-time information
- Repeated coverage to record changing phenomena
- Reduced data acquisition time
- Uniform measurements
- Wide-area coverage, reducing the problems of assembling broad-scale mosaics
- Coverage of areas beyond practical range for aircraft
- Global survey without large on-site support requirements
- Substantial reduction in costs for large-scale coverage

Many economic, cultural and scientific benefits have been identified, which potentially can accrue from survey of earth's resources from space. In a future operational time frame, beyond the current R&D phase, benefits may accrue ultimately from among the following types of activities:

Agriculture and Forestry
- Increased crop yield
- Rapid detection of tree and plant disease
- Better location of timber, water, and snowline interfaces for better water management
- Faster crop census to predict future yields
- Sharper definition of grass, brush, and timberline interfaces for better range management
- Better definition of vegetation density, tree count, and crop species for production management
- More accurate definition of irrigation requirements

Geography
- Data for better planning of land use
- Faster population density and location assessment

Faster construction of topographic maps
Better definition of transportation system densities
Increased knowledge of plant cover and soils composition
More reliable thematic mapping
Aid in location of future transportation systems
More accurate evaluation of energy and heat balance of cities and determination of how these affect climatology of the city

Geology and Mineral Resources
Better definition of major geologic structures and topographic elements
Timely knowledge of soil compaction, slope stability, and geothermal anomalies
More continuous monitoring of glacier and volcanic activity
Better earthquake prediction, warning, and location
Aid to data on internal magnetism, metallogenic provinces, and gravity gradients
Information which can assist in more rapid location of ore deposits and potential oil bearing structures

Hydrology and Water Resources
More accurate location of ground water discharge
Rapid detection of water pollution
Accurate detection of effluence of major rivers
Better measurement of lake and reservoir levels
Add to data on evapotranspiration
Better assessment of area rainfall and snow levels
Faster prediction of flood warnings
Better assessment of erosion damage due to river and lake flow
More rapid evaluation of sea water intrusions into river channels and delta regions

Oceanography and Marine Resources
More rapid location of better ocean transportation shipping routes
More effective fish production due to more reliable fish location
More accurate charting of sea state and wave profiles
Better location of river current systems and tidal variations
Faster measurements of sea level and sea slope
Better location of ice fields for iceberg warnings and sea ice predictions
Map shoals and coastal regions more accurately and provide revised maps when changes occur
Increased knowledge of cold region thermal structures

In addition, scientific information from earth resources flights will certainly contribute to such related sciences as geophysics, geodesy and

meteorology. The development of recreational areas, better utilization of transportation routes, and faster assessment of the population distribution are also strong potential benefits. Finally, the techniques employed on Earth Resources Satellites may be directly extrapolated to the equipment and techniques needed to survey the planets.

IV. ALTERNATIVE STRATEGIES

A. Strategy 1 - Continue as in the Past

A continuation of the past approach of fragmented, uncoordinated efforts undertaken on an ad hoc basis would probably result in unnecessary waste of scarce investment resources, inadequate attention to the complexities of relating technology to increased economic growth, and indirectly to take full advange of technological opportunities.

B. Strategy 2 - Accelerated In-house Effort

Much of the expertise in this field rests within the U.S. Government and accelerated efforts within AID are in order. However, it is imperative that the development of plans and strategies in this area also involve participation of the foreign users from the outset. Not only will it be necessary to expose them to the new technologies and let them plan themselves how to use it, but such involvements will complement current NASA efforts to quell potential concerns about invasion of sovereign privacy.

C. Strategy 3 - Study by U.S. Contractor

U.S. contractors have conducted many studies of remote sensing technology and these are now available. U.S. contractors do not have the capability to meaningfully involve the broad spectrum of foreign participation anticipated in this study effort which is designed to relate past technical studies to specific development problems.

D. Strategy 4 - Study and Planning Effort Involving Foreign Users

The OAS provides a convenient mechanism for involving direct foreign participation, including participants from developing areas other than Latin America. Also arrangements can be made with the OAS for tapping the expertise of U.S. Government agencies and engaging U.S. experts in the study and planning effort.

V. PROJECT IMPLEMENTATION

Following a December 15, 1969, briefing by NASA on the potential of earth resources survey technology, the AID Interbureau Committee on Science and Technology recommended that (a) AID become actively involved in this

field, (b) a circular airgram be prepared alerting A.I.D. Missions to this emerging technology, including the 1971 conference, and (c) exploration begin of specific steps that A.I.D. could take to assist developing countries in preparing to use this technology. On April 28, 1970, the A.I.D. Interbureau Committee on Science and Technology heard additional briefings by the Geological Survey and generally concurred in moving forward with the project.

On April 29, 1970, the NASA-sponsored interagency Committee on International Aspects of the Earth Resources Survey Program reviewed the project and suggested minor changes which have been made. Through the Department of State, this project is being closely coordinated with the activities on international collaboration in the use of satellites being conducted under NSSM 72.

Assuming FY 71 funds are available for Phases 1-4, steps will be taken in July 1970 to launch the project. Latin America has been tentatively identified as the most promising geographical area in which the pilot country and pilot region should be selected during Phase 5. It is envisaged that through the OAS, specialists from these countries can easily participate in the project from the outset although the core resource group for the project would be specialists from U.S. organizations. The OAS General Secretariat has already identified this type of effort as being of priority interest to the OAS and is prepared to move rapidly to implement the project. Also, the experience of A.I.D. in remote sensing in Latin America, including support of IAGS activities, will be integrated into the project. Since all of the results of the effort are intended to have broad worldwide applicability, steps will be taken to ensure that specialists from other developing areas will also have an opportunity to keep abreast of the project.

The enclosed interagency memorandum describes the efforts being made to strengthen OAS capabilities. This project activity will be linked directly to the OAS activity since the same consultants will serve both OAS and TA/OST.

In view of the innovative nature of this pilot project, and the attendant risks, as well as the emphasis on developing and testing a methodology for worldwide application, central funding is warranted. Close and intensive scrutiny of the project by central staff will be essential in view of the high technological component of the effort, the multi-agency interest in remote sensing, and the worldwide interest in this new technology.

Enclosure

ENCLOSURE

MEMORANDUM

SUBJECT: Proposal for an OAS Capability in Remote Sensing

REF : Mr. Pollack's letter of April 17, 1970

Basic Considerations for an OAS Program

To be meaningful and successful on a long term basis, an OAS remote sensing program in Latin America must make a solid contribution to the development and application of remote sensing technology. OAS involvement should not be artificial or contrived; that is, it should not impose an additional bureaucratic level on the managers, scientists and engineers who would actually be conducting the work, nor should it compete with existing expertise and channels of technical communication. Rather, the OAS effort should be directed towards identifying existing remote sensing expertise in Latin America and rationalizing it to provide an efficient Latin American approach to the use of the technology. With these considerations in mind, the following suggestions are offered.

Organization

It is recommended that the OAS establish a focal point of one or two people with technical competence, supported by the resources of the OAS and advised by an appropriate Standing Committee on Remote Sensing, undertaken the types of activities indicated below. (It is understood that, if the OAS could establish such a focal point, AID might be able to provide it with support by technical experts.) It is further recommended that these proposed activities be discussed with representatives of the OAS and other organizations such as PAHO, the PAIGH, and the Argentine, Brazilian and Mexican remote sensing teams in order to involve them in the planning effort at an early date. Latin American interests in and support for an OAS Earth Resources Program is a sine qua non for the successful development of a program.

a. Coordination and Management

1. As a first order, survey past activities in Latin America to determine the extent to which use is being made of already acquired remote sensing data and the reasons why it is not being used more fully.
2. Survey Latin America to identify groups with existing remote sensing capabilities.
3. With the results of the above surveys in hand, determine how existing capabilities might be more effectively mobilized as a basis for expanding Latin American remote sensing activities and relating there activities to institutional development.

b. Research

1. Evaluate the relative priority of Latin American support of the development of remote sensing institutions and technologies.
2. Stimulate Latin American university and government research and action in utilizing the data already available from previous aircraft programs, the Gemini and Apollo space programs, and the Brazilian, Mexican and U.S. NASA supported aircraft programs.
3. Investigate the feasibility of establishing a facility or facilities to service Latin American requests for spacecraft and aircraft data resulting from remote sensing programs conducted in Latin America.
4. Maintain and circulate a catalog of imagery available from remote sensing programs conducted in Latin America.

c. Information Services

1. Develop and maintain a bibliography of remote sensing material in Spanish and Portuguese and distribute it to interested agencies in Latin America.

2. Translate key remote sensing documents into Spanish and Portuguese, and distribute them in Latin America.

d. Training

1. Sponsor and support briefings by remote sensing experts from Brazil, Mexico and the US for interested countries and agencies in Latin America.

2. Provide scholarships for Latin American students and specialists for training in remote sensing.

3. Devise and support the development of remote sensing training courses for selected Latin American institutions.

4. Sponsor and support the participation of trained Latin American experts from other countries in the Brazilian, Mexican and US remote sensing programs on a basis to be mutually agreed.

e. Facilities and Resources

1. Conduct a review of existing Brazilian, Mexican and US remote sensing test sites for broad interest and applicability throughout the hemisphere.

2. Work with the countries which have established remote sensing programs to see if future test sites can be selected with hemispheric and not just national applications in mind.

3. Investigate the feasibility of multilateral funding for the acquisition of expensive aircraft remote sensing systems, such as a radar and a scanner.

The above actions should be keyed to the development of remote sensing aircraft programs, with spacecraft data to be phased in as and when it becomes available.