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ASIA REGIONAL

ASIAN REMOTE SENSING TRAINING CENTER

(Bangkok, Thailand)

Project No. 498-0253

July 1979

PROJECT PAPER

ASIAN REMOTE SENSING TRAINING CENTER

TABLE OF CONTENTS

		PAGE NO.
Face Sheet Data		1
PART I:	Summary and Recommendations	2
	A. Recommendations	2
	B. Purpose	2
	C. Summary Description	2
	D. Summary Findings	2
	E. Project Issues	3
PART II:	Project Background and Detailed Description	4
	A. Background	4
	B. Detailed Description	6
PART III:	Project Analyses	11
	A. Technical Analysis	11
	B. Financial Analysis and Plan	13
	C. Social Analysis and Role of Women	16
	D. Economic Analysis	17
	E. Beneficiaries	18
	F. Environmental Concerns	19
PART IV:	Implementation Planning	20
	A. Administrative Arrangements	20
	B. Implementation Plan	21
	C. Evaluation Arrangements	24
	D. Negotiating Status and Conditions Precedent	25
ANNEXES:		
	A. PID Approval Cable	
	B. Logical Framework	
	C. Detailed Technical Analysis	
	D. Map of Ground Station Coverage	
	E. Remote Sensing Applications	
	F. Detailed Financial Tables	
	G. Implementation Plan	
	H. AIT Agreement (Request)	
	I. Remote Sensing Training	
	J. Statutory Check List	
	K. Draft Authorization	

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT PAPER FACESHEET

1. TRANSACTION CODE: A (A = ADD, C = CHANGE, D = DELETE)

PP

2. DOCUMENT CODE: 3

3. COUNTRY/ENTITY: Asia Region

4. DOCUMENT REVISION NUMBER:

5. PROJECT NUMBER (7 digits): 498-0253

6. BUREAU/OFFICE: A. SYMBOL: ASIA; B. CODE: 04

7. PROJECT TITLE (Maximum 40 characters): Asian Remote Sensing Training Center

8. ESTIMATED FY OF PROJECT COMPLETION: 85

9. ESTIMATED DATE OF OBLIGATION: A. INITIAL FY 79; B. QUARTER 4 (Enter 1, 2, 3, or 4); C. FINAL FY 81

10. ESTIMATED COSTS ($000 OR EQUIVALENT $1 –)

A. FUNDING SOURCE	FIRST FY B. FX	FIRST FY C. L/C	FIRST FY D. TOTAL	LIFE OF PROJECT E. FX	LIFE OF PROJECT F. L/C	LIFE OF PROJECT G. TOTAL
AID APPROPRIATED TOTAL	3,210		3,210	5,040	560	5,600
(GRANT)	(3,210)	( )	(3,210)	(5,040)	(560)	(5,600)
(LOAN)	( )	( )	( )	( )	( )	( )
OTHER U.S. 1.						
OTHER U.S. 2.						
HOST COUNTRY	1,335		1,335	1,335	500	1,835
OTHER DONOR(S)				2,500	2,660	5,160
TOTALS	4,545		4,545	8,875	3,720	12,595

11. PROPOSED BUDGET APPROPRIATED FUNDS ($000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE C. GRANT	PRIMARY TECH. CODE D. LOAN	E. 1ST FY 79 F. GRANT	E. 1ST FY 79 G. LOAN	H. 2ND FY 80 I. GRANT	H. 2ND FY 80 J. LOAN	K. 3RD FY 81 L. GRANT	K. 3RD FY 81 M. LOAN
(1) ST	611(s)	874		3,210		500		1,890	
(2)									
(3)									
(4)									
TOTALS				3,210		500		1,890	

A. APPROPRIATION	N. 4TH FY ___ O. GRANT	N. 4TH FY ___ P. LOAN	Q. 5TH FY ___ R. GRANT	Q. 5TH FY ___ S. LOAN	LIFE OF PROJECT T. GRANT	LIFE OF PROJECT U. LOAN
(1)					5,600	
(2)						
(3)						
(4)						
TOTALS					5,600	

12. IN-DEPTH EVALUATION SCHEDULED: MM 04 YY 82

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN THE PID FACESHEET DATA BLOCKS 12, 13, 14, OR 15 OR IN PRP FACESHEET DATA, BLOCK 12? IF YES, ATTACH CHANGED PID FACESHEET

[ ] 1 = NO, 2 = YES

14. ORIGINATING OFFICE CLEARANCE

SIGNATURE: Dennis J Brennan

TITLE: Dennis J. Brennan, Director ASIA/PD

DATE SIGNED: MM 08 DD 07 YY 79

15. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION: MM 08 DD 07 YY 79

AID 1330-4 (3-76)

PART I: Summary and Recommendations

A. Recommendations

1. It is recommended that A.I.D. authorize a Grant of $3.21 million in FY 79 to cover partial costs of an Asian Regional Project to establish the Asian Remote Sensing Training Center (Center/ARSTC) as an educational facility of the Asian Institute of Technology (AIT) at Bangkok, Thailand, complete with laboratory, computer, and data storage facilities.

2. Approval is requested for follow-on funding for a life-of-project total of $5.6 million. Disbursement of funds for Phase II will be contingent on the results of an external review conducted near the end of year three.

B. Purpose

To establish an Asian Remote Sensing Training Center with capability to: (1) provide training to ESCAP technicians, (2) demonstrate the usefulness of remote sensing in development planning, as well as resource management, and (3) assist in planning, as requested by Asian user agencies, with a view toward the Center's becoming an integral part of the Asian Institute of Technology.

C. Summary Description

This is a two-phased six-year training and demonstration project to develop with ESCAP's cooperation the Asian Remote Sensing Training Center for ESCAP member countries in the Asia region. The project will provide: (a) data bank and outreach facilities to give Asian decision-makers the most sophisticated and current data available to regulate their resource and land-use procedures, and (b) a facility to train Asian technicians who will be capable of developing resource and environmental utilization plans based on sound, current, regional data obtained from U.S. space vehicles. The ultimate beneficiaries of effective national land-use planning will be the masses of rural Asians now suffering from hunger and floods, as well as inefficient use of natural resources.

D. Summary Findings

The technical and financial analyses done for this PP indicate that the design of the project is technically sound and the cost estimates are reasonable and reasonably firm. Other analyses indicate that significant benefits should ultimately accrue to the rural poor of the Asian regional countries, and that no significant environmental damage is foreseen as a result of this project.

E. Project Issues

(1) The AIT computer, an IBM 370/145 originally considered ample for the computation required by enhancement and classification of satellite imagery, has no spare capacity beyond present academic and research requirements of AIT that are likely to grow by at least 10% per year during the life-of-project. The IBM 370 is on loan to AIT from IBM until December 31, 1979. IBM has agreed to provide an IBM 3031 computer valued at approximately $5 million to AIT which will provide ample capacity to accommodate the current AIT needs, the Center requirements, and the near future growth load of both activities. The IBM commitment which includes an additional $1.475 million grant for operational and maintenance costs of the computer satisifes the requirement for adequate computer capacity which was an issue during the project planning stages.

(2) This PP has been developed for FY 79 funding because early commencement is both practical and advisable in order to take advantage of the current project development momentum and high degree of interest shown by the Economic and Social Commission for Asia and the Pacific (ESCAP) and AIT .

PART II: Project Background and Detailed Description

A. Background

1. The Problem

Every year in Asia, floods and other weather vagaries cost the region untold numbers of lives and millions of dollars in property damages. Although weather disasters will probably always plague the peoples of Asia, their impact can be diminished by prediction of their scope and location. Flood forecasting, erosion abatement, land-use optimization and similar projects based on timely weather and resource data would benefit populations through reduction of loss of life and property, increase in real income, and to a lesser extent, by the employment they provide.

Throughout Asia inadequate maps, crop and forest statistics, hydrological data, and weather forecasting are the result of an incomplete data base and the lack of personnel trained to utilize information now made available on a repetitive basis by LANDSAT space vehicles, which review each point on earth at least once every eighteen days. In addition, modern computer science has made nearly indefinite storage and high-speed retrieval of vast amounts of data from the satellite observation stations possible to facilitate use of the data as a basis for national planning in a number of fields.

In this regard, a recent study by the National Academy of Sciences (BOSTID Report, 1977) urged the transfer of satellite technology to the developing countries, where it is most needed. The report cites numerous specific development applications in agricultural production, forest, water, and rangeland management, mineral resources exploration and inventory, cartography, land-use, and regional planning, as well as environmental protection, exploitation of marine resources, coastal engineering, and disaster assessment. The extent of the problem is evident when one realizes that more than half of the developing world has not yet been mapped at scales larger than 1:1,000,000, and that many of the existing maps are all but obsolete.

It is clear that the lack of adequate, up-to-date weather and resource information in the Asian region affects the impact of weather disasters. Likewise, it is not supportive of a wide spectrum of development projects aimed at improving the lives of the poor.

2. Action to Date

In July 1972, NASA launched LANDSAT 1, the first Earth Resources Technology Satellite (ERTS), to gather and publish widely information on the earth's natural resources. Now there are three U.S. LANDSATS orbiting the earth and two are broadcasting data down to a number of receiving stations, and LANDSAT D is scheduled for launch in 1981. (LANDSAT I ceased communications in July 1978). More receiving stations will be constructed, including one recently authorized by the Royal Thai Government (RTG) for $4 million worth of Thai funds. Since that first launch in 1972, the data accumulated have been utilized to discover more than $1 billion worth of petroleum and hundreds of millions of dollars worth of mineral resources.

When used in conjunction with computer analyses such as digital enhancement, pattern recognition, and classification techniques, the satellite data have enabled scientists to inventory crops and forests, estimate timber and crop yields, develop useful base maps of isolated areas, locate supplies of surface water, and monitor air and water pollution. It is these applications of satellite imagery that have stimulated positive action on the part of many governments in Asia that wish to use this new tool in national development planning.

After making repeated offers to be the host for a satellite receiving station for ESCAP and ASEAN countries, Thailand has now decided to build her own, and through AIT to host the Regional Training Center.

A precursor to the present project was initially prepared and submitted for PID approval as an FY 78 project and was therefore reviewed by APAC on August 4, 1977. However, prior to seeking PID approval, it was decided to canvas the Missions to establish whether the activities as stated would be responsive to national needs in the region. Its responsiveness was subsequently determined, and an amended PID was prepared and approved in July 1978.

In August and September 1978, a five-person Project Design Team visited Thailand, India, Pakistan, Bangladesh, Sri Lanka, Malaysia, Singapore, Indonesia, and the Philippines to explain the nature and scope of the project to appropriate government officials and assess the type and degree of interest in the Center concept. The team was led by Dr. Charles K. Paul of DS/OST, who was accompanied by Josiah Royce, General Engineering Advisor, AID/Washington; Joseph Morgan, Office of International Geology, USGS; Dr. Stanley A. Morain, Technology Application Center, University of New Mexico; and Dr. Heng L. Thung, Geodata Systems International, of Ithaca, New York. The team found varying but generally keen interest throughout the area, both in applying satellite data to development problems, and in having sophisticated data processing and interpretation instruction available in Asia.

3. Strategy for Project Phasing

The PID for this project anticipated an AID grant input of $4.0 million over five years. It subsequently was determined, however, that an additional one year and $1.6 million would be needed to develop fully the Center into a viable institution. In order to accomplish this objective, the project has been divided into two phases which permits a two-staged strategy.

During Phase I (FY 1979-81), the project will be targeted on establishing an institutional base for the Asian Remote Sensing Training Center. Physical facilities will be established, all equipment will be installed, a library will be set up, staff will be in place. In addition, relations with appropriate international institutions will be established, services of U.S. advisors will be secured by contract, curricula will be developed and tested, and several short-term training courses will be completed. U.S. assistance will total $4.056 million during Phase I.

During the final year of Phase I, an external evaluation of the project will be conducted to determine whether the project is achieving its objectives. If the evaluation team recommends proceeding to Phase II of the project, it may also recommend modifications to the project design as appropriate at that time.

Phase II is expected to begin in FY 1982 and end in FY 1985. A.I.D. assistance will total $1.544 million during this phase. Project strategy will evolve during Phase II from one aimed at establishing facilities, curricula, and staff to one emphasizing accelerated training, research and demonstrations of the Center's capabilities. Phase II may include establishment of a Master's Degree Program. ESCAP will assist in promoting the use of the Center's facilities by arranging fellowships in selected fields to be funded by UNDP and other donor countries.

Such a strategy should firmly establish the Center's credentials with the region's governments and concerned institutions, and enable it to attract the necessary support to maximize the future beneficial impact of remote sensing expertise. It is to be hoped that by the end of Phase II, the Center will be an integral part of AIT's program.

B. Detailed Project Description

This project will provide the Asian Institute of Technology (AIT) in Bangkok, Thailand, with technical assistance and commodities in order to establish an Asian Remote Sensing Training Center available to the countries of the region for training their technicians and assisting them in obtaining remote sensing information and technology transfers. Under the project, a LANDSAT computer processing facility will be installed at AIT and a library with data archives will be established. Seminars will be held, and more than 200 technicians from participating ESCAP member countries such as Indonesia, Thailand, Malaysia, Sri Lanka, Nepal, Bangladesh, India, and the

Philippines will be trained.* A logical framework is attached as Annex B, and a detailed description of the project's goal, purpose, outputs and inputs follows immediately below.

1. Goals

The higher-level goal to which this project contributes is the improvement of the management of natural resources in the Asia region. Flood forecasting, desertification studies, erosion abatement, land-use optimization and similar projects based on satellite data will benefit populations through reduction of loss of life and property, increase in real income, and to a lesser extent, by the employment they provide. Agriculture will benefit from crop forecasting, and inventories, and flood control made possible by utilizing LANDSAT data.

One measure of the extent to which the project is contributing to this goal will be the use actually made of data available through remote sensing technology. Evident use in actual development plans of data obtained by remote sensing technology will indicate that the project is reaching its goal.

2. Purpose

The six year project purpose is to develop an internationally recognized Asian Remote Sensing Training Center that will have an ongoing program fully supported by the region's countries and institutions, and an output that is satisfactorily utilized throughout the region. This purpose will be met through an accelerated training and demonstration program that will be implemented primarily during the last three years of the project. The success of Phase II will be dependent on the proper completion of Phase I activities, which involve the installation and testing of necessary equipment, staffing, and technical assistance activities. Readiness for Phase II will be determined by an in-depth evaluation conducted during the third year of the project.

Phase I of the Project will last three years and will be targeted on developing the capacity of the Center to provide training through short-term courses to user-agency personnel and to provide other services that will assist agencies concerned with the utilization of satellite imagery and computer technology to solve development problems. The Center's major functional components, which will be developed during Phase I, include data acquisition, storage, retrieval and distribution, as well as training, problem solving, research, and outreach.

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*A nationality positive list for AID-funded scholarships for short-term training will be included in the Grant Letter of Agreement; however, Center activities will be available to all full and associate member countries of ESCAP.

Indicators that the Phase I purpose has been met include establishment of training and research activities, acquisition and processing of LANDSAT computer compatible tapes (CCTs), generation of land-use and other maps, and the initiation of short-term training, library, data storage and retrieval activities in fully staffed and equipped facilities.

Project completion (End-of-Project Status) will be indicated by ongoing participation of the Center in recognized international seminars, adequate financial and technical support for the Center on a continuing basis, steady demand for satellite imagery and Center expertise from regional countries, and the reliance upon Center graduates in responsible positions by their Governments.

3. Inputs/Outputs

a. Technical Assistance

Promptly after execution of a Grant Letter of Agreement, AID/Washington, at the request of USAID/Thailand, will undertake to arrange appropriate consulting services, either via PASA from the USGS or NASA, or by contract with qualified individuals or firms, in order to finalize detailed specifications for the equipment to be purchased for ARSTC and NRC.* It is envisaged that two different individuals will be required for two months each, totalling four person months of technical assistance at a cost of about $40,000. Required specialists are:

(1) Computer Specialist: This individual will require in-depth knowledge of all hardware and software alternatives compatible with a computer of capacity comparable to that of AIT's, and will prepare detailed specifications for all equipment for processing and correcting Computer Compatible Tapes (CCTs) from satellite data and utilizing all likely outputs from a Ground Receiving Station to prepare research and data outputs in a useful configuration. The equipment list (Annex F) is a guide, but alternatives and substitutions, where appropriate, will receive consideration. The final list should include estimated procurement lead-time when known, and a list of spare parts to be stocked by the Center.

(2) Remote-Sensing and Ground-Truth Specialist: This individual will require complete and thorough current knowledge of optical and ancillary laboratory equipment for photographic and optical processing and utilization of satellite data, and all applicable field equipment for

*All equipment to be supplied to the National Research Council (NRC) for use in connection with this project will be supplied under the Remote Sensing Technology for Development Project (493-0314).

processing ground truth. He/she will prepare detailed specifications for all equipment needed, using the list attached to this Project Paper as a guide, but making recommendations for alternatives/substitutions where necessary or economical. The final list and specifications given to A.I.D. should include estimates of required procurement lead-time and necessary spare parts.

Also, promptly after satisfaction of conditions precedent, AID will undertake the contract for the services of a U.S. academic or other institution having internationally recognized expertise in the reduction, processing, enhancement, and utilization of satellite data, as described in this Project Paper, and the rapid, effective transfer of its related technologies to students in an international environment. The institution will be expected to provide the services of a Project Leader, Geologist/Hydrologist, Land-Use Specialist, Cartographer, and Systems Analyst for the work periods specified in this Project Paper and having the qualifications attached hereto. It is anticipated that services under the contract will continue for varying periods, up to six years. In addition, it is estimated that the contractor will be required to arrange for up to ten person-months of specialized expert consulting services during the six-year period of the project, for solving special problems and giving special advice and lectures.

b. Data

The first step in preparation for the Center is to order appropriate historical scenes in CCT and imagery form from the EROS Data Center and commence building up a library and data bank. Prompt action on this will be required since delivery time has been quoted at from six months to a year according to what end-product is required and the location of the user. A library of professional papers, aerial photographs, and relevant text books will be established at AIT. These data will be digested, enhanced, and utilized for instruction, problem solving, and the data products most needed by the countries in the Region will be distributed by the outreach facility. Aerial photography and maps of Thailand will be made available by the National Research Council, RTG as part of their ground-truth function. The Data Bank of the Center will be integrated with the AIT Library, which is already active. Library personnel will be provided by AIT.

c. Training

Most Asian countries do not yet possess sufficient depth of technical personnel to insure optimum use of satellite data. Because the level of training required varies widely from country to country, the Center plans to begin by teaching only one-term (3 to 4 months duration) special courses during the first year to maximize flexibility to respond to individual requirements. Both optical and computer-based problem solving will be demonstrated with hands-on instruction. Students will be encouraged to bring imagery and local problems from their own countries to the Center for solution during the training. Test areas in Thailand, and air photo coverage and imagery of them, will be arranged by the National Research Council technicians.

In later years, as the need develops, ESCAP is expected to make increasing use of the Center as its program in the field of remote sensing develops.

d. Problem Solving and Research

As mentioned above, problem solving will be taught and encouraged in all phases of the training. The U.S. and Asian instructors will assist in carrying out remote-sensing research to establish this subsidiary of AIT as a center of excellence, and to insure Asian acceptance of the utility of the discipline in national development planning. A research problem involving the Brahmaputra River and its tributaries has already been suggested by Bangladesh and, when the word gets out through ESCAP and the Center outreach facilities, more such problems can be anticipated. AIT officials have indicated that they do not wish to see the Center become purely a service organization, but this does not close the door to contractual research on special problems as is now being done at AIT's Computer Center.

e. Outreach

Particularly in its formative period, it is vital that knowledge of the Center, its capabilities, curriculum, facilities, and costs be disseminated to the appropriate Asian institutions. The U.S. Project Leader, and later the Asian Director of ARSTC, will have to be dynamic and innovative in their communication with Asian Governments, institutions, and interested individuals, to make known their capabilities and receive feed back on the varying requirements of the client countries. A newsletter will be circulated, and ESCAP and the Center will collaborate on symposia and other meetings to increase Asian awareness of the Center and its capabilities.

f. Equipment

To accomplish its technical mission, the Center will require equipment that will be purchased by A.I.D. and transferred to AIT.

PART III: PROJECT ANALYSES

A. Technical Analysis

A detailed discussion of the principal factors bearing on the technical feasibility of the project is contained in Annex C.

Generally, determination of the technical feasibility of this project is based on the following factors:

(1) The proven ability of the Asian Institute of Technology to house and conduct multinational technical studies in the Asian environment, coupled with the cooperative spirit evinced by the National Research Council of Thailand in agreeing to provide aerial photos, reproduction of photographic materials, and ground-truth assistance.

(2) The cooperation and assistance of ESCAP in providing a forum for discussion of Asian remote-sensing needs by means of symposia and its Intergovernmental Committee on Natural Resources. ESCAP's support of the outreach facilities of the Center will consist of circularizing its member countries and arranging fellowships for selected students at AIT. This support will be a major factor in maintaining the international and non-political posture of the Center which is necessary to assure area-wide acceptance.

(3) The continuing and growing need of the member nations of ESCAP for their own expertise in making available, interpreting, and utilizing remote-sensing data in the formulation of their development programs.

(4) The decision of the RTG to fund a Ground Receiving Station with $4 million of its own funds demonstrates the importance Thailand attaches to satellite data and will contribute to the problem-solving capability of ARSTC by making available current data on a timely basis as stipulated in the Memorandum of Understanding signed with NASA, and

(5) The academic and research requirements of AIT are growing and the combination of these trends necessitates the replacement of the present IBM 370/145 by a computer having increased capacity if AIT and ARSTC are to coexist successfully. The commitment by IBM to replace the present computer which is discussed elsewhere is a major consideration in this project.

For the actual transfer of satellite technology at AIT, an internationally known U.S. institution will be engaged to provide a Project Leader, Land-Use Specialist, Geologist/Hydrologist, Cartographer and a Systems Analyst, each an expert in his field, to assist Asian counterparts at AIT in teaching their specialties to Asians.

The project envisages a transfer of technology to the Asia region on six different levels:

(A) Direct transfer of skills through short-term training

(B) Transfer of new techniques through reports, seminars, symposia, etc.

(C) Transfer and interchange of students, full-time instructors, and part-time lecturers throughout the area.

(D) Outreach activities resulting in the transfer of information via communication, newsletter, document dissemination, etc.

(E) Transfer of knowledge through continuing education of university professors and government officials, and

(F) Transfer of benefits to Asian populations through implementation of programs applying the technology.

At the close of the six year project, it is anticipated that the Asian Remote Sensing Training Center will be an integral and productive part of the Asian Institute of Technology ably supported and advised by NRC and ESCAP. It will have trained 200 to 300 technicians to form the nucleus of an Asian community of remote-sensing specialists. This community of experts, in turn, will train contributors of remote-sensing expertise to national development planning in the ESCAP area in the years to come. They will have available the imagery and other products of the Thai ground station and the up-to-date technical and research facilities of the Center to assist them in solving development problems.

B. Financial Analysis and Plan

Tables 1 and 2 summarize the cost estimates and financial plan for the project. Detailed cost breakdowns are contained in Annex F. As has been discussed elsewhere in this Project Paper, a grant of $5.6 million will finance A.I.D.'s inputs into the project. This will be spread over several years commencing with a $3.21 million tranche in FY 79. Other participants in the project, including the Royal Thai Government (RTG), International Business Machines (IBM), Asian Institute of Technology (AIT), and other donors under the auspices of ESCAP will provide funds and resources equivalent to about $7.0 million. The total $5.6 million A.I.D. contribution for both phases equals about 44% of all support for the Center.

1. Funding Arrangements

A.I.D. will finance the total costs of technical assistance. These costs will be financed directly by AID either through a PASA arrangement with a U.S. Government Agency or direct letter of commitment procedure with a private institution.

A.I.D. will also finance the purchase and installation of equipment needed for the Center listed in Annex D.

It is estimated that $400,000 will be required for maintaining computer peripherals and software during the life of the project. A.I.D. will finance this requirement from the grant.

2. RTG Contribution

The RTG has earmarked 80 million baht (about $4 million) in its FY 1979 budget for the construction of a ground receiving station in the Bangkok area. One-third of the cost of the station (about $1.3 million) is attributed to this project as an RTG contribution since the Center will be a major user of the station. In addition, the RTG will finance all operational costs of the station and will provide data to ARSTC without cost -- a contribution of $500,000.

3. Other donors

IBM will be a key donor to the project through the loan to AIT of a 3031 computer valued at $5.0 million and a grant of $1.475 million. Of this total contribution, $2.5 million (approximate value attributable to this project) is shown as an AIT contribution on the summary tables. ESCAP is also expected to seek funding for fellowships for regional trainees to help offset AIT's costs during the first years of the Center's operations.

A.I.D. COMMITTMENT SCHEDULE

(US $1000)

	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	TOTAL
I. U.S. Consultants (Long-Term)		1127	10	763	10	10	5	1925
II. U.S. Technical Assistance (Short-Term)		40	20	40	40	40		180
III. Scholarships			100	150	150	75	25	500
IV. Commodities & Maintenance		1725	94	200	100	100	80	2299
V. Evaluation & Photo Liaison			12	32	12	12	32	100
VI. Contingency		200	200	96	50	50		596
TOTAL		3092	436	1281	362	287	142	5600

SUMMARY COST ESTIMATE AND FINANCIAL PLAN

(US $000)

PROJECT COMPONENT	AID		RTG		AIT		ESCAP		TOTAL	
	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Ground Station (FX)			1335						1335	
Commodities (FX) & Computer Maintenance	2019	280			1750	750			3769	1030
Technical Assistance (FX) (Long/Short Term)	1247	858							1247	858
Local Operational Costs (Local Costs) & Scholarships	274	286	200	300	1080	1080	200	300	1754	1966
Evaluation (FX)	20	20							20	20
Contingency (10%) (FX)	496	100							496	100
TOTAL (Rounded)	4056	1544	1535	300	2830	1830	200	300	8621	3974
GRAND TOTAL	5600		1835		4660		500		12595	

C. Social Analysis and Role of Women

It is the increased institutional capability resulting from the training that will have significant beneficial effects throughout the region. Improved water management in Bangladesh, for example, will bring tangible results to this stricken country which will be very positive. Better weather forecasting can also reduce tragic losses now often experienced in this country. Forecasting of floods, which are often devastating in the area, may save lives and property if data from weather satellites can be interpreted and disseminated in a timely fashion. Satellite imagery and its interpretation will play an important role in these developments.

The direct social impact in terms of unemployment in Asian societies of training 200 to 300 technical and managerial personnel in the application of remote-sensing technology is expected to be negligible. The greater efficiency of this tool will not result in significant numbers of foresters, hydrologists, geologists, cartographers, or surveyors becoming unemployed as a result of its introduction. Rather, the new techniques and materials will just slightly reduce the vast backlog of development work. For instance, Indonesia has a long-range program for resettlement of some of its population from densely populated islands to nearby relatively uninhabited ones. Satellite imagery may contribute substantially to the choice of feasible areas for development.

In India and elsewhere, the encroachment of the desert upon farmland has caused economic and social distress. Greater awareness of the progress and extent of desertification resulting from satellite imagery could foster social, economic, and agricultural programs to reverse the present trends. In general, better land and water resource management will be accelerated by utilization of properly interpreted satellite data.

Role of Women

The RTG National Research Council (NRC), which will conduct the ground-truth portion of the project, employs about 200 people on a full-time basis, more than 70% of whom are women. The Deputy Secretary-General for Science of NRC is a woman and five of the six Division Chiefs are women.

Thirty percent of AIT's academic positions are currently held by women; the AIT student body is also roughly 30% female. AIT is endeavoring to recruit more women on its staff and among its students and will welcome female staff members both among the instructors at the Center and as its students.

For its part, A.I.D. will endeavor to recruit at least one woman instructor among the members of the U.S. team. Information on the Center circulated by ESCAP and the outreach facilities of AIT will stress the welcomed participation of women as both students and instructors in the project.

Finally, women will account for at least 50% of the ultimate beneficiaries of improved national and regional resource planning throughout the Asia region.

D. ECONOMIC ANALYSIS

Remote sensing with satellite technology is such a recent phenomenon that the entire spectrum of benefits is not yet known. Natural disaster forecasting, environmental-degradation monitoring, and land-use optimization are only a few of the many applications now in use and yet to be discovered. Since the magnitude of benefits is not quantifiable but presumed substantial, every effort has been made to design the most cost-effective project by minimizing input costs.

Traditionally, land surveys have had to be done by personnel actually traversing the survey area, however remote and inaccessable. Aerial photography has easily supplanted onerous field surveys and still remains the chief alternative to remote sensing by satellite. However, aerial photography, including interpretation, is estimated to cost about 30 times more than surveys of comparable areas done by satellite. For many purposes, satellite imagery, while not as detailed as aerial photography, provides sufficient detail and information for large regions. Where sufficient detail is not available from satellite imagery, it can be accompanied by limited aerial or ground surveying.

In the present project, twenty countries in South and Southeast Asia, with about 5% of the world's land area and 18% of the world's population, will be imaged every 18 days. The Center will provide the capability for all twenty countries to obtain an overview of their national territories for about one thirtieth of the conventional cost. (Prior experience has shown aerial survey costs plus interpretation to range from about $12 to $30 per square mile). Satellite sensing combined with aerial photography provides an excellent mix of large area and localized observation, and at a cost far below that of aerial photography when used alone. For example, under the present project, 100,000 square miles can be examined by satellite remote sensing for about $102,000. A more detailed examination of 20,000 square miles by aerial photography would cost an additional $680,000. The total cost of the combined satellite and aerial surveys is $782,000 compared to $3,400,000 if the entire 100,000 square miles were aerial photographed.

While the full range of potential development benefits from remote sensing is not known, benefits are undoubtedly greater than the anticipated project costs. Indeed, the timely forecast of just one major natural disaster would probably in itself justify the project. From the foregoing discussion, it is clear that remote sensing by satellite is by far the most cost-effective method of obtaining these benefits.

E. Beneficiaries

Examples shown below are drawn from Thailand's experience in utilizing and experimenting with the use of remotely sensed data in resource management. Additional examples of regional use of this technology can be found in Annex C. In assessing benefits to be derived from the project, one must accept the premise that improvements to environmental planning benefit all, both rich and poor, and that tracing the linkage all the way to a poor farmer in the field is unnecessary. This would be the case in both land classification and forest management.

By utilizing satellite imagery, the Department of Forestry observed that substantial deforestation occurred between 1961, when aerial photography and ground checks showed that 55% of the country was forested, and 1973, when satellite imagery showed that 38.6% was forested. The cost of the 1973 inventory was comparatively small and satellite data visually demonstrated the critical trend of deforestation due to illegal cutting, shifting cultivation practices, and concession logging. This knowledge stimulated the RTG to move to a more intensive forest management system in order to properly control timber extraction and to initiate replanting of certain exposed forest lands, as well as to explore other renewable energy sources.

Another use of satellite imagery was in the production of land-use maps of large sections of Thailand. These maps are used in planning development activities throughout the nation, and changes in land use are important indicators of food production, population movements, soil-depleting erosion, and many other resource and environmental trends. National planners armed with current information are moving more rapidly and more accurately to take advantage of changes that are positive and plan corrective action when changes are regressive.

Another example of productive use of NRC's imagery is in irrigation planning for river basins. Recently, an entire water course network in a major river basin was mapped accurately during a two-day period. This new map will be used in designing an irrigation system to increase crop production in the area.

Still another use of imagery is in crop forecasting. By use of imagery and statistical sampling through ground survey, crop areas and yields can be measured with acceptable accuracy to predict surpluses and shortfalls in advance. This provides planning time for marketing excesses, or importing food in areas of shortfall. Famine affects the poor more significantly than the rich, and corrective measures, made possible by accurate forecasts from remote sensing, would certainly benefit the poor directly.

Satellite imagery and its interpretative outputs are tools, that when used in connection with other technology, can produce data for better resource-development planning. Taken by itself, remote sensing doesn't result in change any more than any other planning tool. Used in the design and implementation of projects; however, it can greatly increase the chances of success, and it has a solid role to play in that process, especially in the less developed countries where data are so difficult to obtain.

F. Environmental Concerns

The project, largely a training effort, will not in and of itself have any effect on the environment. It will, however, lead to improved resource management and, therefore, will have a positive environmental impact. Other sections of this paper discuss projects utilizing remote-sensing technology that have benefitted the environment throughout the Asian area. Due to the desire within the area and, in fact, worldwide, for proper management of renewable energy resources, including forest reserves, this training is timely and the applications of remote-sensing technology can and almost assuredly will have a positive impact on the environment.

The environmental concerns were fully explored during the project-planning stages and a negative threshold decision was approved.

PART IV: IMPLEMENTATION PLANNING

A. Admininstrative Arrangements

The Asian Institute of Technology (AIT) in Bangladesh, Thailand, has been selected to house the Asian Remote Sensing Training Center, hire and administer its Asian staff, and insure its continuity after the termination of this project, because of its central location and the availability of its Computer Center. The Institute, founded in 1959, became fully independent in 1967 under a charter granted by the Royal Thai Government (RTG). AIT has a 400 acre campus located 42 km north of Bangkok which is provided by the RTG. The Institute physical facilities were financed by the governments of Australia, the Republic of China, Japan, New Zealand, Thailand, the United Kingdom, and the United States, as well as the Lee Foundation of Singapore. Besides dormitories for 600, cafeterias, sports facilities, and a medical center, AIT maintains a Conference Center providing a 600-seat auditorium, simultaneous translation facilities, dining rooms, and hotel rooms for 120 guests.

The Institute's Board of Trustees consists of 40 members from 21 countries, and its present enrollment from 20 countries across Asia, amounts to more than 400. Its alumni, as of August 1977, amounted to 1377, including some from outside Asia, taught by a faculty of more than 100. Instruction presently offered spans a broad technical spectrum and varies from short special training periods to long-term scholastic studies leading to a Ph.D degree.

A.I.D. has been assured that existing living and administrative facilities at AIT are ample to house and support the Remote Sensing Training Center students who will amount to not more than forty at any one time during the six-year life-of-project. Further, its Computer Center and Library system will adequately house the data bank. This data bank will provide the information base from which the extensive outreach procedures of the center can be conducted to keep the activities of the regional and various national Remote Sensing Centers before decision makers in the governments of the area.

The project, although part of AIT, will be under the overall direction of and supported logistically by a U.S. academic or private institution having internationally recognized expertise in the reduction, processing, and utilization of satellite data, and the rapid effective transfer of its related technologies to students. This institution will conduct its portion of the project under an A.I.D. direct contract. It is possible that a U.S. government employee will be seconded, under PASA arrangements, as one of the U.S. instructors at the Center. In any case, all long-term instructors will be seconded to AIT and instructors will be integrated into the AIT Staff and accorded appropriate professional rank. The Project Leader will be the Acting Director of the Center until the end of the first academic year, when the Asian Director will take over responsibility for the Center and the Project Leader will act as his Assistant.

Added support for the project will come from the local United Nations organization headquartered in Bangkok, the Economic and Social Commission for Asia and the Pacific (ESCAP), which has agreed to act as a non-political clearing house and focal point for the exchange of views and information concerning the utilization of satellite data for development in the region. ESCAP has also undertaken to organize ad hoc intergovernmental meetings to provide the Asia Remote Sensing Training Center with feedback from the regional countries including, inter alia, their recommendations for improvements in the curriculum and operation of the Center itself. In addition, it is anticipated that the United Nations will provide a number of fellowships at the Center for promising Asian students. (ESCAP has, in the past, hosted symposia, such as the Inter-governmental Meeting on Remote Sensing and Satellite Surveying held at Bangkok from 7 to 13 June 1977, and plans to continue its support for technology transfer in this field even more actively in the future.)

B. Implementation Plan

An Implementation Plan is contained in Annex G. A discussion of some of the more critical elements of the implementation plan follows:

(1) Promptly after signing of a two-party grant letter of agreement, AID will undertake to arrange appropriate consulting services, possibly via PASA from the USGS or NASA, or by contract with qualified individuals or firms, to finalize detailed specifications for the equipment to be purchased for ARSTC and NRC (equipment for the latter will be financed under another project, Remote Sensing Technology for Development).

(2) The five U.S. members of the Center instructional team will be contracted and proceed to Bangkok, Thailand to become members of the staff of the Asian Institute of Technology ninety days before the beginning of the appropriate term at AIT. They will coordinate with the Asian instructors hired by AIT, check out the equipment, and prepare the final curriculum in active cooperation with NRC and AIT officials prior to the opening of the teaching term.

(3) During this period, AID will, based on the specifications prepared by the consultants mentioned in (1) above, award a contract to

(4) For one year (3 full terms) following the opening of ARSTC's remote sensing program, only single-term special training courses of a problem-solving nature will be taught at AIT. NRC will conduct the ground truth portion of these courses and provide necessary aerial photographs and imagery reproduction to assist AIT, utilizing the AID-financed equipment provided in other A.I.D. projects. NRC will be assisted in its liaison with AIT for the duration of the project by an English-speaking photo-liaison officer financed by AIT under the A.I.D. grant.

(5) Beginning at the completion of the Center's first academic year, the U.S. and Asian instructors of Center, in consultation with ESCAP officials, will prepare curricula for long-term training in remote sensing if justified. (This advance planning is necessitated by an AIT requirement to submit degree courses (as differentiated from specialized training) to the Academic Senate for approval.)

(6) During each academic year, but particularly in the first year of training courses, it is planned that the Project Leader will make several trips to Asian countries, coordinated where possible with ESCAP and other symposia on remote sensing. The purpose of these trips will be to sensitize appropriate government officials in the area to the advantages of remote sensing in development planning as well as familiarize them with the activities and capabilities of the Center and interview potential students and instructors for the Center. The trips will also provide the Leader with an opportunity to assess the needs and facilities in the area. Similarly, some of the instructors may travel in the area to present papers at meetings and also, on occasion, to assist with research problems at the request of governments and institutions in the area. (Decisions on approving research participation should be made so as to maximize work done at the Center and minimize absences.)

(7) Early in the project, the Project Leader and both Asian and American instructors will establish and maintain cordial relations with the Mekong Secretariat, WHO, the World Bank, FAO, and other user and donor organizations, particularly those based in Bangkok. In the meantime, Center outreach staff, assisted by AIT library personnel, will publicize the activities of the Center, provide up-to-date information from NASA and U.S.G.S. on remote sensing applications, and collect information on other satellite-related problems and accomplishments in the region. The staff will also attend to working relationships with cooperating organizations, particularly ESCAP and NRC.

(8) At the end of the second year of training (more precisely the end of the fifth academic term of training under the project), the Geologist/Hydrologist and the Land-Use Specialist positions will be terminated, and duties of these individuals will be assumed entirely by their Asian counterparts at the Center. At the end of the fourth academic year (the twelfth academic term), the Cartographer and the Systems Analyst will also return to the U.S., shifting their duties to counterparts by now well-established at AIT.

(9) During the final year of the project, only the U.S. Project Leader will remain to oversee implementation of the project. Primary emphasis will be on a smooth transition to an all-Asian instruction and management system, including courses responsive to the needs of ARSTC's client countries. The objective will be to make sure that every effort is made to develop the Center into an integral part of the Asian Institute of Technology to ensure a continuing supply of graduates who are actively applying their remote sensing skills to Asian development problems throughout the region.

C. EVALUATION ARRANGEMENTS

This project with its regional focus will require close monitoring in order not to lose track of widely dispersed graduates. The following evaluation activities are planned:

(1) At the end of the first and second years of Phase I, USAID/Thailand will conduct evaluations to determine intermediate progress toward attainment of project purpurpose and to provide early warning of implementation problems. These evaluations will be carried out with the participation of AIT and the Royal Thai Government.

(2) The first indepth evaluation will be scheduled approximately six months before the end of Phase I. The evaluation will examine the degree to which the efficient management of inputs has produced the planned outputs of data and trained personnel, as well as an intra-regional transfer of information. The outputs will then be reviewed to determine how far they have gone toward the achievement of the purpose of Phase I of the project: the establishment of an Asian Remote Sensing Training Center with capacity to undertake activities outlined in the logical framework. At this point in the project, concepts and targets will be reviewed and redesigned as necessary in preparation for Phase II. This evaluation will require outside expertise, either from Thai or U.S. sources.

(3) During Phase II, the same procedures will be followed, with USAID/Thailand evaluations after each of the first two years and an indepth end-of-project review at the end of the final year. Assessment of attainment of project purpose will be derived from life-of-project experience with the utilization of satellite data in resource management as well as development planning.

Evaluation Costs: Adequate (4 p.m.) personnel external to the project to participate in evaluations during 3rd and 6th years are budgeted within the project at a total cost of $40,000.

D. Negotiating Status and Conditions Precedent

The design of this project has been worked out in close cooperation with AIT, NRC and ESCAP, organizations which will have the major implementing responsibilities under the project. All have contributed ideas to the project design, including reviewing the PP in draft and concurring with its substance. Official documentation confirming the interest of the key organizations is already on record in the form of a diplomatic note from the RTG Ministry of Foreign Affairs, and correspondence with AIT, NRC and ESCAP (Annex H). Further and more detailed commitments will be secured in the course of negotiating the project. A two-party grant letter of agreement will be signed by AIT and USAID/Thailand. (A nationality positive list for AID-financed scholarships will be annexed to the letter of agreement.)

As conditions precedent to disbursement for other than equipment procurement advisory specification writing services, A.I.D. will be provided:

1. Evidence that AIT has made arrangements to secure and maintain adequate mainframe computer capacity to service project requirements.

2. Evidence of firm commitments and agreements between AIT and NRC, detailing the services each is to provide the other, including quantification (e.g. number of images to be computer enhanced by AIT, number of copies of photo reproduction to be processed by NRC etc.), timing, and costs to be charged, if any.

As stated elsewhere, governments in the region which will be served by the Center have been surveyed and generally indicated support for the Center concept and their intention to make use of its facilities and programs. No specific written commitments will be sought from individual countries, but A.I.D., AIT and ESCAP will continue to provide information to them and to solicit their participation. An important step in this process was the meeting on remote sensing activities in the ESCAP region held in Bangkok during November 28 to December 2, 1978.

ASIA REGIONAL

ASIA REMOTE SENSING TRAINING CENTER (BANGKOK, THAILAND)

ANNEXES

JULY 1979

ANNEXES

A. PID Approval Cable

B. Logical Framework

C. Detailed Technical Analysis

D. Map of Ground Station Coverage

E. Remote Sensing Applications

F. Detailed Financial Tables

G. Implementation Plan

H. AIT Agreement (Request for Assistance)

I. Remote Sensing Training Program (Short Course)

J. Statutory Checklist

K. Draft Authorization

ANNEX A

UNCLASSIFIED

Department of State

OUTGOING TELEGRAM

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TAGS:

SUBJECT: ASIA REGIONAL REMOTE SENSING TRAINING CENTER
(493-0253)

REF: BANGKOK 30649

1. PROJECT COMMITTEE (PC) REVIEWED DRAFT PP OCTOBER 23. PLANNING APAC REVIEW NOVEMBER 21 OF ISSUES BELOW. MISSION COMMENT INVITED PRIOR TO APAC REVIEW.
2. INCREASED PROJECT LENGTH AND COST (COMPARED TO ESTIMATES AT PID STAGE) INDICATE DESIRABILITY OF OBTAINING AA/ASIA VIEWS BEFORE FINAL PROJECT DESIGN. PC ALSO FELT THAT PROJECT SHOULD BE PRESENTED FOR APPROVAL OF BOTH PHASE I AND PHASE II AS MAJOR BENEFIT FLOW DEPENDENT ON CARRYING OUT BOTH.

3. FORMAL ACADEMIC (DEGREE OR DIPLOMA) STRUCTURE IS ALSO A CHANGE FROM PID APPROACH. SOME PC MEMBERS QUESTION WHETHER THIS CONSISTENT WITH CURRENT AID EDUCATION EMPHASIS. PERHAPS FINAL PP CAN ANALYZE WHETHER FORMAL ACADEMIC STRUCTURE NECESSARY TO PROJECT OBJECTIVES.

4. PC QUESTIONED AID FINANCING OF DOLS ONE MILLION OF SCHOLARSHIPS. PC CONCERNED THAT HOST COUNTRIES OR USAIDS FINANCE AT LEAST PART OF SCHOLARSHIPS IN ADDITION TO FINANCING TRAVEL COSTS AS INDICATION OF INTEREST IN AND COMMITMENT TO PROPOSED PROJECT. PC RAISED POSSIBILITY THAT IF SOME AID SUPPORT FOR SCHOLARSHIPS PROVES NECESSARY, FINANCING MIGHT BE PHASED DOWN OVER LIFE OF PROJECT SO THAT BY END OF PROJECT FULL SCHOLARSHIP COSTS ARE MET BY HOST COUNTRIES.

5. DRAFT PP ALSO ENVISAGES A PERMANENT AND SELF-SUSTAINING ACADEMIC PROGRAM AT END-OF-PROJECT. PID HAD THE TRAINING ACTIVITY TERMINATING AFTER MEETING PARTICIPATING COUNTRIES NEEDS FOR A PERIOD OF YEARS. FINAL PP MIGHT SPELL OUT ANTICIPATED SOURCES OF SUPPORT FOR A PERMANENT PROGRAM.

6. DURING PC DISCUSSION, POSSIBILITY RAISED THAT, IF AIT CONTEMPLATING A REGULAR ACADEMIC PROGRAM IN NATURAL RESOURCE MANAGEMENT, THIS PROJECT MIGHT BECOME A SPECIFIC SUPPORT GRANT COVERING ROUGHLY THE COSTS OF REMOTE SENSING TRAINING TO MEET PARTICIPATING COUNTRIES NEEDS FOR THE PERIOD CONTEMPLATED WHILE AIT DEVELOPS REST OF ACADEMIC PROGRAM FROM OTHER SOURCES. THIS, OF COURSE, IS ONLY A SUGGESTION WHICH MISSION MAY CONSIDER SUITABLE OR NOT.

7. PC HAS ASKED DESIGN TEAM MEMBERS IN AID/W FOR MORE CONCRETE ILLUSTRATIVE EXAMPLES OF PRACTICABLE PROBLEMS IN ASIA REGION WHICH COULD BE DEALT WITH AS A RESULT OF PROJECT ACTIVITIES. BELIEVE MORE DETAIL NEEDED TO ESTABLISH PROJECT BENEFITS. WILL ADVISE MISSION OF RESULTS.

8. BRIEF SEPTEL COVERED ISSUE OF COMPUTER REQUIREMENTS. TO ELABORATE, PC ASKED DESIGN TEAM TO INITIATE ASSESSMENT OF PROJECTED COMPUTER REQUIREMENTS TO BE IMPOSED BY THIS PROJECT AS WELL AS GROWTH OF OTHER DEMANDS ON AIT COMPUTER CAPACITY AND TO RECOMMEND ALTERNATIVES IN COMPUTER FACILITIES TO MEET THESE DEMANDS. DESIGN TEAM ANTICIPATES SUCH ASSESSMENT WILL REQUIRE SHORT CONSULTANCY IN THAILAND AND WILL CABLE SCOPE OF SERVICES AND SUGGESTED CONSULTANT FOR USAID/T CONSIDERATION/APPROVAL ASAP.

9. PC AGREES WITH REFTEL POSITION OF MISSION THAT APPROVAL PROCESS SHOULD NOT BE RUSHED UNDULY, AND WILL ADJUST TIMING OF PROJECT PREPARATIONS TO FIT MISSION REQUIREMENTS. REVIEW BY APAC WAS PROPOSED (PRIOR RECEIPT REFTEL) TO PROVIDE ENOUGH GUIDANCE ON PROJECT LIMITS TO ASSURE FINAL DESIGN EFFORT CAN CONCENTRATE ON AREAS OF GENUINE CONCERN TO AUTHORIZING OFFICER. WILL POSTPONE THIS REVIEW IF MISSION CONSIDERS IT PREMATURE. VANCE

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PROJECT DESIGN SUMMARY

LOGICAL FRAMEWORK

Project Title and Number: Asia Remote Sensing Training Center - 498-0253

Life of Project:
From FY 1979 to Fy 1985
Total U.S. Funding - $5.6 million
Date Prepared - 7/30/79

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Program or Sector Goal: The broader objective to which this project contributes: To improve agricultural forestry and other natural resource planning and management, as well as forecasting natural disasters, throughout the Asia region in order to enhance the region's economic and social development.	Measures of Goal Acheivement: 1. Existance of development plans based on remote sensing throughout participating ESCAP countries. 2. Individuals who have graduated from ARSTC program are actively contributing to development planning, as well as resource management and planning.	1. Examination of development plans of participating ESCAP countries. 2. Interviews with ARSTC graduates in participating ESCAP countries.	Assumptions for Acheiving Goal Targets: 1. Remote sensing will prove to be useful and a cost effective means of obtaining data and information needed for resource and development planning. 2. LANDSAT series of satellites (or others with like capabilities) will continue to orbit earth at least until 1990. 3. Ground receiving stations are constructed in Asia area as orbiting memory capacity wanes.

ANNEX B

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title and Number: Asian Remote Sensing Training Center, 498-0253

Life of Project:
From FY 1979 to FY 1985
Total U.S. Funding - $5.6 million
Date Prepared: 7/30/79

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
PROJECT PURPOSE Phase I - To establish an Asia Remote Sensing Training Center with capabilcity to : (1) provide training to ESCAP technicians, (2) demonstrate the usefulness of remote sensing in development planning as well as resource management and weather forecasting, and (3) assist in planning as requested by Asian user agencies. Phase II: Center functions as an integral part of AIT with an internationally recognized program which is being utilized by ESCAP members.	CONDITIONS THAT WILL INDICATE PURPOSE HAS BEEN ACHEIVED: END OF PROJECT STATUS 1. Center Staff regularly invited to and attend international seminars. 2. Graduates are in responsible positions in resource management/development agencies of respective ESCAP countries. 3. Center continues to train students, conduct research, and process and analyze imagery.	1. Evaluations 2. AID and other agency records. 3. Field visits to appropriate agencies of ESCAP countries; interviews with graduates to determine if are working in fields which utilize remote sensing expertise.	ASSUMPTIONS FOR ACHEIVING PURPOSE: 1. Timely AID/RTG/ESCAP approval of annual operating budgets; adequate staff and policy support. 2. AIT Board of Directors commits itself to permanent status of center. 3. NASA and US continue to make technology and imagery available. 4. Remote sensing yeilds important data from a resource management/development planning perspective.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title and Number-- Asian Remote Sensing Training Center, 498-0253

Life of Project:
From FY 1979 to FY 1985
Total U.S. Funding - $5.6 million
Date Prepared - 7/30/79

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Asusumptions
OUTPUTS: 1. Trained Technicians, planners and decision makers. 2. Increased natural resource and weather data/information.	MAGNITUDE OF OUTPUTS 1. 200 or more technicians trained (short term). 2. Two or more semiaars per year conducted at Center and/or regional countries. 3. LANDSAT computer processing facility established and more than 200 scenes processed each year (NRC). 4. Library established with image and CCT data archives; 1000 plus sq. ft. image storage capacity.	1. AIT records and reports. 2. Annual evaluations. 3. Indepth evaluations at end of years 3 and 6.	ASSUMPTIONS FOR ACHEIVING OUTPUTS 1. Planned computer capacity is sufficient. 2. AID remains committed to Center and takes steps to make it an integral part of the Institute.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title and Number - Asian Remote Sensing Training Center - 498-0253

Life of Project:
From FY 1979 to FY 1985
Total U.S. Funding - $5.6 million
Date Prepared - 7/30/79

Narrative Summary	Objectively Verifiable Indicators			Means of Verification	Important Assumptions
INPUTS	IMPLEMENTATION TARGET (TYPE AND QUANTITY)			-Grant Letter of Agreement -Periodic reports of advisors, monitors -AID budget and financial reports -RTG budget -ESCAP budget	ASSUMPTIONS FOR PROVIDING INPUTS -Funding will be available as planned -AIT acquires computer capacity -ESCAP secures UNDP financing of fellowships -NASA acquires data for imagery and stores it -ESCAP countries recognize value of Center activities and select trainees (including financing of their international travel).
AID: $5.600 million		Phase I	Phase II		
AID: $4.660 million	AID:				
	T.A.	1,247	858		
RTG: $1.835 million	Commod.	2,019	280		
	Other	790	400		
ESCAP: $500,000	AID:				
	Local Costs	1,080	1,080		
	Commod.	1,750	750		
	RTG:				
	Ground Sta.	1,335			
	Local Costs	200	300		
	ESCAP:				
	Fellowships	200	300		

ANNEX C: Detailed Technical Analysis

To understand the full implications of satellite technology, its applicaions, and just as importantly, its limitations, some discussion of the basic factors involved may be helpful. The LANDSAT space vehicles do not use conventional cameras for remote sensing but rather scanners, somewhat similar to television apparatus, which record what they sense in a series of dots of different intensity rather like a printed pciture. Most satellite imagery, then, is not photography but an image constructed by a computer.

This is necessitated in part by the velocity with which the satellite moves around the earth at an altitude of 570 miles, making a full circuit every 103 minutes. The satellite has a linear orbital speed of 16,596 mph in its 28,490 mile orbit, but because the earth is only 24,902 miles in circumference, the ground coverage is at the rate of 14,506 miles per hour.

The multispectral scanning sensor on board observes areas 115 miles by 115 miles (13,225 square miles) at a time and the data recorded in each of these frames have to be stored on tape or spewed out by radio to earth at a prodigeous rate in order to finish the operation in less than the 28.53 seconds which are required for the satellite to travel 115 miles and have to start sending data from a new frame. Since each line utilizes 3,240 six bit samply bytes and 2,340 lines per frame 30,326,400 bytes of data are generated per picture in each of four or five wave lengths.

These data are captured on high density digital tapes at the receiving station where they are scanned to eliminate scenes of poor quality, or those not applicable to the region under study, or those having too great a percentage of cloud cover for utility. Each ground station is located so that it can reliably receive data from any satellite over 5 degrees above the horizon within its field of view, and thus each receiving station can receive data from a LANDSAT satellite directly over any point on earth less than 3,226 km (2,004.54 miles) away from the station. (If LANDSAT D is launched as presently planned, this distance will be reduced to 2,713 km or 1,685.78 miles due to its lower orbital altitude.)

The scenes selected for further study are then transferred from high density digital magnetic tapes to Computer Compatible Tapes (CCT) containing raw, uncorrected information just as it was received from space. However, to make the data usable, these tapes must be computer-processed to remove distortions, noise, errors due to variations in altitude of the satellite, and be keyed to known geographical indices. This step is generally called servicing and requires a sophisticated computer. The output of the servicing step is another CCT containing corrected data, images and film positives.

However, the most advanced and sometimes the most useful employment of satellite imagery requires using a computer to enhance or classify data on one or more corrected tapes from the area under study. For example, the user's computer can sort or classify like signals and obtain, say, the area of flood water increase in a river between two successive overflights of the satellite. The ratio of signal between the four different wave lengths may give a characteristic spectral "signature" for rice paddy. Then, with great rapidity and fair accuracy, the computer can indicate the area of rice cultivation in a given frame. The user's computer can produce images, maps and overlays on command, and provides the most versatile and advanced outputs so far available.

For countries not yet possessing data with advanced computer facilities, however, a great deal can still be accomplished by study of images by optical methods. In this simpler and more conventional procedure, images prepared by a service facility or an end-use facility can be studied optically and enhanced by controlled diazo printing. Special problems requiring digital computational procedures can be referred for research at the Remote Sensing Center.

Limitations of satellite imagery must be understood to insure its application to appropriate problems. The most prevalent limitation is cloud cover. Different geographic areas with different climates are obscured for varying percentages of time. Parts of the Amazon drainage basin in South America are virtually invisible from satellites carrying visual and near infrared sensing due to clouds and Side-look radar (SLAR), an expensive system of remote sensing, had to be employed by Brazil for mapping the area. Asia, fortunately, is mainly not so handicapped, although scenes will have to be carefully chosen. Due to the scanning geometry, the smallest distinguishable resolution distance on present LANDSAT multi-spectral scanner imagery is 80 meters. On LANDSAT D, this will be improved to 30 meters. Present imagery permits identification of fields 20 acres or larger with 9[illegible] accuracy. Crop identification has been achieved with about 75% accuracy on plots as small as five acres. Improvement in these figures can be expected as methodology improves and instrumentation becomes more advanced. Groups of small plots can be integrated to form areas amenable to sensing in some cases.

LANDSAT data have been used successfully to prepare soil maps at scales ranging from 1:100,000 to 1:250,000 and, of course, the more ground truth and supporting data available, the better the result.

One of the more attractive features of satellite sensing is that it is extremely cost effective. For the above soil maps, the computer analysis may cost 0.2 cents per hectare (approximately 2.471 acres) while aircraft data cost 1.5 cents per hectare. In addition, the ability to digitally overlay soil maps on base agricultural maps leads to the possibility of determining not only present agricultural output, but potential increases as well.

A limitation, imposed by orbital geometry, is significant in its future implications for the Asian Remote Sensing Center. In the first LANDSAT experiments, because there were very few receiving stations in the world, memory capability was built into the satellites to permit controlled areas out of range of receiving stations to have data frames recorded and then these data could be sent to the receiving station on command as the satellite came within range. Only very limited memory capacity remains flying now, and future satellites are not planned with memories. All data acquired out of range of receiving stations must, in the future, be linked to the Tracking and Data Relay Satellite System (TDRSS) which will have the EROS Data Center at Sioux Falls as its outlet with resulting delay in receipt of Asian data where it is needed.

In July 1972, NASA launched LANDSAT 1, the first Earth Resources Technology Satellite, to gather and publish widely information on the light and other radiation visible from a satellite and its relation to the earth's natural resources. Now, there are three U.S. LANDSATS orbiting the earth and two are broadcasting down data to a number of receiving stations. (LANDSAT 1 ceased functioning July 1978.) LANDSAT D is scheduled for launching in 1981. More receiving stations will be constructed including the one recently authorized by the RTG for $4 million of Thai funds.

Sarabhai's influence was felt throughout the Government of India, which is now well on the way to self-reliance in space. Having fired its first sounding rocket in 1967, the Indian Space Research Organization (ISRO) is now making its own second satellite and pay-load to be placed in orbit by a Russian booster. The National Remote Sensing Agency (NRSA) possess a complete set of Computer Compatible Tapes from the USGS EROS Center in Sioux Falls, and has access to an IBM 370/155 computer and an Iris 55 computer to enhance satellite data in addition to sophisticated aircraft sensing systems. A ground receiving station is being constructed at Hyderabad. Agriculture and flood-control are problems being attacked now by remote sensing studies in India. The GOI also plans to participate in the up-coming U.S. Space Shuttle Experiments.

For Sri Lanka, remote sensing and geophysical surveys have engaged the government's attention since the collaborative project with Canada, in 1956, provided aerial photographic coverage of the entire island at a scale of 1:40,000. A gravity survey of the country was completed with assistance from New Zealand in 1975, and a USAID grant of $20,000 has resulted in the in-house capacity to process LANDSAT data in photographic and digital modes. These capabilities include B/W enlargements, B/W 2-band composites, 3-band color diazo composites, and color prints in Cibachrome. There is also limited capacity for simple processing and classifiecation using Computer Compatible tape on a small capacity general-purpose IBM computer. A USAID grant of $40,000 is now introducing an interactive data analysis system to the existing limited digital process facility. Pilot studies to interpret the information and estimate rice cultivation areas have been initiated. Agriculture and water resources will be studied next, but there is need for personnel trained in the disciplines contemplated at the Center. A problem which has surfaced in Sri Lanka and some other ESCAP countries is the low pay of government technicians who often gravitate to higher paid jobs elsewhere.

Indonesia, with vast areas of inaccessible territory, is making extensive cartographic use of remote sensing, and by Presidential Decree No. 27/1975, has established a National Committee for National Resources Inventory and Evaluation. It has a school which teaches image interpretation as applied to landforms, geomorphology, hydrology, watershed management, and land evaluation. However computer application to remote sensing is not taught, and thus the courses at the Remote Sensing Center in Bangkok will fill a needed gap. An innovation, perfected by the Indonesians, is the use of balloons for aerial photography at 100,000 feet or more. Perhaps they can add this technique to the Bangkok Center's arsenal of disciplines.

Pakistan, though plagued by financial problems, has formed a Space and Upper Atmosphere Research Committee (SUPARCO) and, although they will probably be heavily dependent on Iran and the USGS for imagery for some time to come, they are seriously thinking about a ground receiving station. There is a sizeable need for more trained technicians there, particularly in computer applications which they need for crop inventory studies.

Bangladesh, long concerned about its perennial bad weather, its forests, and its crops, has a program with the World Bank to update, using satellite data, thematic maps, and develop data banks for forestry and hydrology. Perhaps some of the $700,000 UNDP program in Bangladesh which includes scholarships, could be utilized to train people from Bangladesh to perform some of the tasks for which they now hire the Environmental Research Institute of Michigan (ERIM). As they are planning a ground receiving station, primarily for meteorological data, but hopefully later for LANDSAT, they will require expertise like that to be taught at the Asian Remote Sensing Training Center. The Bangladesh Government has suggested that management of the waters of the Ganges/ Brahmaputra basins might provide a practical problem for the Asian Center and future students from India, Nepal, China, and Bangladesh, riparian countries.

Thailand's commitment to the use of remote sensing dates from aerial photography of the entire country in 1952-59 and again from 1966-70. From the earliest LANDSAT experiments when a Thai Principal Investigator discovered, to the national chagrin, that a large forest reserve under study, had in fact, been nearly 50% reduced by unrecorded cutting, Thai scientists have recognized the part which could be played by properly interpreted satellite imagery in development planning. The "Country Report of Thailand" for the Inter-governmental Meeting on Remote Sensing and Satellite Surveying sponsored by ESCAP at Bangkok in June 1977, says in part:

> "The Thailand National Remote Sensing Program operates through the National Remote Sensing Coordinating Committee appointed by the Council of Ministers. The Committee is composed of the Secretary General of the National Research Council as Chairman, and Representatives of the related governmental agencies and educational institutions interested in the applications of remotely sensed data acquired both by spacecraft and by aircraft.

Investigations carried out by Thai governmental agencies confirmed the findings elsewhere that the remotely sensed data obtained by LANDSAT-1 and LANDSAT-2 were beneifcial to planning the economic development program of the country in agriculture, forestry, landuse, geology, and hydrology. In order to make maximum use of the LANDSAT system, how to acquire the data in a timely fashion and at the right time is the most important thing. Equally important is the organization of an efficient data processing and analysis capability. Finally, the departments concerned should apply the information derived from the whole acquisition and analysis system to routine work or planning purposes."

43/44

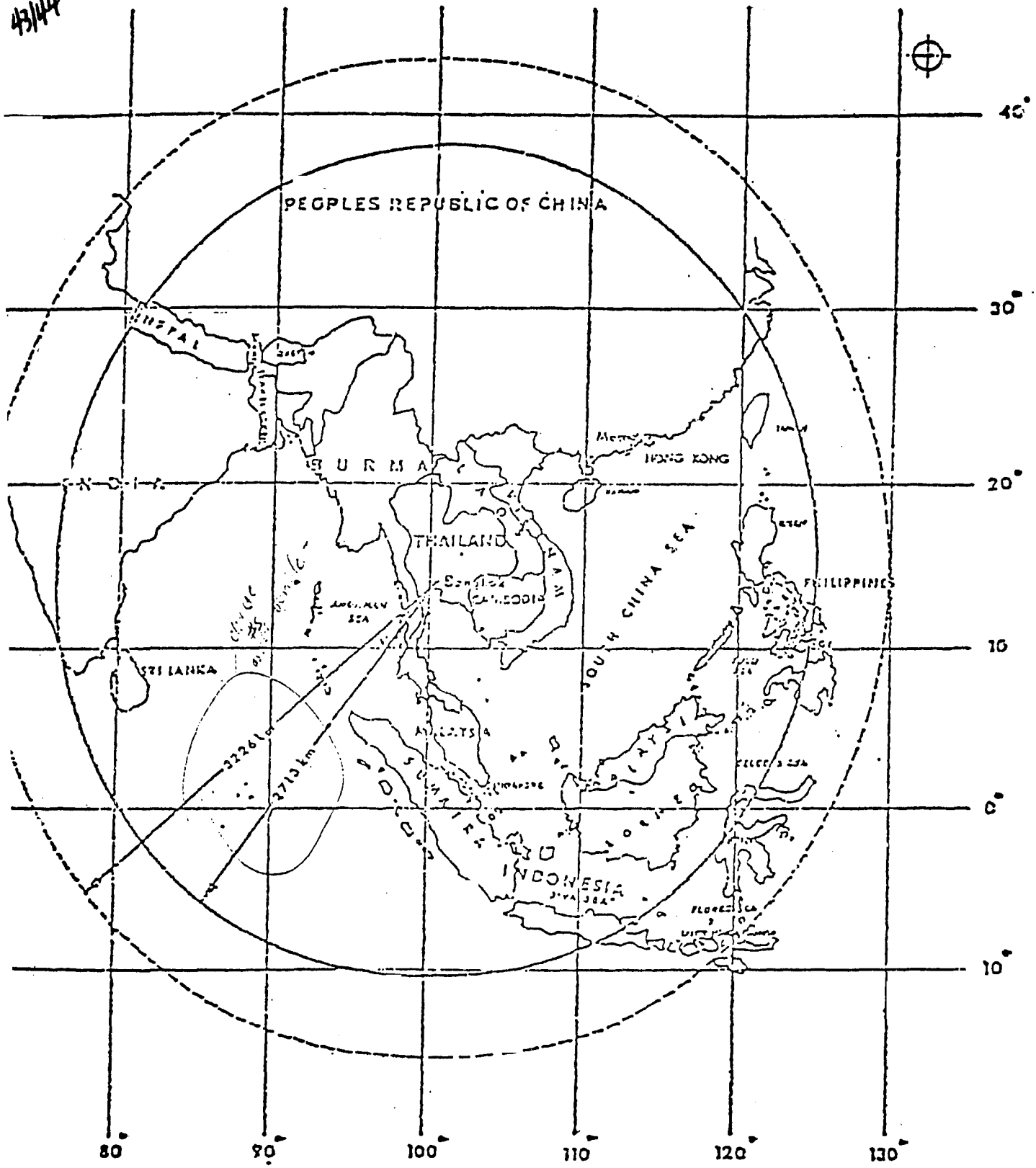

Figure 2. Geographical Region Covered by a Receiving Station Located at Bangkok

ANNEX E

REMOTE SENSING APPLICATIONS

ASIA REGIONAL REMOTE SENSING CENTER

ASIAN DEVELOPMENT PROBLEMS SOLVABLE WITH REMOTE SENSING INPUTS

INPUT FOR BENEFITS IN PROJECT PAPER

Landsat Results to Date in Asia:

These results have had indirect benefits to the poor majority. In general, remote sensing provides information on natural resources which are useful for comprehensive planning. The linkage to the direct poor is somewhat hard to make. In the last section of this paper I attempt to make this linkage.

1. Bangladesh: Landsat imagery has been successfully used to delineate patterns of Boro and Rabi rice crop during the 1975 winter season. In conjunction with this activity, changing ponds, streams, and flood patterns were also identified. The objective in carrying out this type of activity in Bangladesh is the staggering population density problem, 1,291 people per square mile and growing at the rate of 3.2 percent per year. Thus the successful identification of the areal extent of the Bangladesh haors is very important. Since the haors, or large depressions, maintain soil moisture from flooding longer than other areas of Bangladesh, it has been discovered that an additional rice harvest can be obtained by planting in the bottoms of these haors. Near the tops of the haors the land is sufficiently dry to support grazing and orchards. The Government of Bangladesh, in achieving higher rice crop production, is now able to feed more people and, thus, this activity has indirect benefit to small farmers.

Land is being accreted in the Bay of Bengal at the rate of several hundred square miles per year. This land is being formed by silt and sediment brought by the Ganges River from areas in Northern Bangladesh and Nepal. Similarly, water shed areas of the Chittigong hill tracks in Bangladesh were studied by Landsat to deduce the rate of siltation into the Karnafuli Hydroelectric Reservoir.

2. Pakistan: Landsat imagery and data processing was used in the location of a new port in Pakistan, Port Qasim. Coastal currents and sediment loads from rivers flowing into the ocean were mapped over time from Landsat. The

creation of Mangrove swamps were noted from this siltation loading. The Indus delta is changing dramatically, rendering the present port of Karachi less suitable for shipping due to the necessity of having to continually dredge the area around it. The Port Qasim Development Authority sited the new port from the analysis performed from Landsat imagery. Although the optimal location of a new Pakistan port is of direct benefit to large shipping conglomerates, direct benefits to the small fishermen were provided in the sense that the changing river patterns, shoaling conditions in the coastal areas, and creation of new mangrove swamps are presently used by many small fishermen in the area in navigating their craft.

3. Philippines: The Island of Mindoro has been extensively studied from Landsat and aircraft for the identification of volcanos and fracture lineaments. These lineaments, as well as some curious circular features, have been studied in the field and indicate possibility of new copper deposits. Mineral exploration, per se, provides, again, indirect benefits to the poor, underemployed in rural areas.

4. Sri Lanka: General land-use maps have been made of various forests, rice fields, etc., again having only indirect benefits to the poor, as these products are used for general, comprehensive mapping.

5. Thailand: A partial area frame has been developed for agriculture statistics in Thailand. A continuing follow-on project in DS/ST in this area will assuredly improve forecasts for rice, corn, casaba, and sugar cane. These improved forecasts directly benefit the small farmer as will be shown by the linkage proposed in the last section of this paper. It was also in Thailand where illegal poaching of forest in the northern areas was discovered by the use of Landsat satellite. As the satellite imagery indicated far less land in the forest than the Royal Thai Government thought presently existed, inspection teams were dispersed to the area where the illegal poaching was discovered. There are presently severe laws in Thailand for illegal poaching, with again, indirect benefits to the poor in long term preservation of this valuable resource.

Satellite imagery has also been used in direct support of several USAID-assisted projects in Northern Thailand: 1) Landsat imagery maps were used to determine the more seriously denuded highland watershed areas

and based on these results and subsequent use of larger-scale aerial photo maps, sites were selected for USAID-assisted pilot projects for restoring the watersheds with tree planting programs. One criteria in site selection was that hilltribe villages be contiguous to areas to be replanted so that the local rural poor could be employed. Thus, a direct result was benefits in the form of added income. 2) This same technique, involving use of Landsat imagery and aerial photography, was used to select several watershed areas for USAID-supported socio-economic surveys preparatory to formulating a program for stabilized agriculture among the slash-and-burn shifting cultivators of Northern Thailand. Major benefits to be realized would be an improved standard of living among the target population and a reduction in the loss of the forest resource.

6. Singapore: The Straits of Singapore/Malaca are being studied for sources of water pollution using Landsat imagery.

7. Nepal: A USAID-assisted remote sensing center is presently programmed for Nepal. The center will initially be a modestly endowed activity which will rely heavily on support from the proposed Regional Remote Sensing Center in Bangkok; i.e., interpretation, data acquisition with computer facilities, training of professionals and problem solving activities. Use of Nepalese remote sensing expertise is expected to be used in various USAID-assisted projects such as the Rural Area Development (RAD) and Resource Conservation and Utilization (RCU) projects. In these cases, use of Landsat imagery is anticipated in the selection of project target areas; i.e., for the RCU, selection of six sites which will be most advantageous in terms of natural resource features which can best support the project elements of diversified agriculture, fuel wood plantations, livestock fodder and forage activities, etc. Correct selection of sites, which should be enhanced with use of Landsat imagery, will better assure the benefits that are identified for the rural poor among these several projects.

General Benefits to Small Farmers (Direct Link to Poor):

1. Flooding: Although flooding has continuously been a problem in Asia as far as its destructive impact on crops is concerned, recent flooding in Bangladesh,

Thailand, India and Pakistan illustrate the direct links that remote sensing technology has to the poor. Timely reception of weather satellite data, which is now further enhanced by the construction of a new weather satellite station in Bangladesh, has allowed Bangladesh small farmers to seek higher ground within the two to three hour time frame in which a tropical storm can generate in the Bay of Bengal and devastate their country. Landsat data has been turned on by NASA over Thailand and India, as well as other countries outside of the Asia region, in the last two months to assess the areal extent of flooding and its potential destruction to crops. Here, the benefits accruing to the small farmers are direct, as the potential destruction from monsoons and flooding in the Asia area are serious problems. Landsat imagery has also been used for snow-line mapping in the mountains of northern Pakistan and in Nepal. From mapping the aerial extent of snow and using ground instruments for detection of snow depths, it is possible to accurately predict the water run-off which is available for crops during the spring thaws. This has direct benefits to the small farmer in that accurate water run-off forecasts are necessary for determining which lands to put into crops.

2. Agriculture: The direct link to the poor which the Regional Remote Sensing Center will provide in training resource managers in this technology is seen in agricultural commodity markets. The greatest economical benefit to the poor will be in monitoring agricultural fields by the use of area frame sampling techniques to derive better crop statistics. Better agricultural area and yield statistics translates to less erratic fluctuations in commodity prices. When prices are fluctuating, either through government decisions or unexpected changes in crop production, rich families benefit for they have the capital to buy up food during excess at low prices and sell during periods of shortages at high prices. The poor people benefit from stable prices because stable prices allow them to maintain a more even allocation of their funds between food and non-food items. The assumption in this assertion that better crop statistics translate to less erratic prices and hence directly benefit the poor, of course, hinges on the assumption that the government will make the statistics known to people and will make decisions based on those statistics rather than other political factors.

The most direct benefit to small farmers, based on better knowledge of crops, is one yet unrealized. This is a plan which is presently being planned by the Mexican National Bank System, and could very well serve as a model for other LDCs. Banks normally lend to small farmers on the basis of the only collateral that the farmer has, his crops. Because banks generally cannot possibly survey the crop status of all their borrowers, they have a tendency to be conservative and assume the worst. Thus, the small farmer does not obtain the loan that he needs, but must settle on a loan based on average expected yield and acreage results. Assuming the crop status is indeed healthy, remote sensing offers a means of monitoring crop conditions which can improve the small farmer's chance of obtaining the loans he needs.

DETAILED FINANCIAL TABLES

A. PROJECT LEADER (Family of Four) - ARRIVE: August 1980

	CY Year 1980 (5 mos)	1981	1982	1983	1984	1985 (7 mos)	TOTALS
Salary	18,300	47,100	50,400	53,900	57,700	36,000	263,400
Post Diff. 19% (1)	1,830	4,710	5,040	5,390	5,770	3,600	26,340
Fringe. Ben. 20% (1)	3,660	9,420	10,080	10,780	11,540	7,200	52,680
Def. Base Act. Insur. 8.75% (1&2)	1,760	4,530	4,850	5,190	5,550	3,470	25,350
Post Assignment							
(a) Travel	6,800					6,800	13,600
(b) Shipment HHE	3,400					3,400	6,800
(c) Storage HHE	417	1,000	1,000	1,000	1,000	583	5,000
(d) Car Shipment	2,000					2,000	4,000
Quarters Allow. & Supp. Post Allow.	6,870*	7,310	7,310	7,310	7,310	4,260	40,370
Education Allow.	4,600	4,600	4,600	4,600	4,600	4,600	23,000
Home Leave & R&R Travel		6,800	6,800	6,800	6,800		27,200
Medicals & Passport Costs	800						800
Contractors O.H. 60% (1)	10,980	28,260	30,240	32,340	34,620	21,600	158,040
TOTALS	61,417	113,730	120,320	127,310	134,890	88,913	646,580

Salary Based on 1980 Base of $44,000 and 7% Inflation Per Year

*For 1980 Quarters Allowance, Two Months at Hotel @ 5040 plus 3 Months QA

B. CARTOGRAPHER; SYSTEM ANALYST (ARRIVE: January 1981)

	CY 1981	CY 1982	CY 1983	CY 1984	TOTALS
Salary	33,000	35,300	37,800	40,400	146,500
Post Diff. 10% (1)	3,300	3,530	3,780	4,040	14,650
Fringe Benefit 20% (1)	6,600	7,060	7,560	8,080	29,300
Def. Base Act. Ins. 8.75% (1+2)	3,180	3,400	3,640	3,890	14,110
Post Assignment					
(a) Travel	6,800			6,800	13,600
(b) Shipment HHE	3,400			3,400	6,800
(c) Storage HHE	1,000	1,000	1,000	1,000	4,000
(d) Car Shipment	2,000			2,000	4,000
Quarters Allow. & Supp. Post Allow.	11,130*	7,310	7,310	7,310	33,060
Education Allow.	4,600	4,600	4,600	4,600	18,400
Home Leave & R&R Travel	6,800	6,800	6,800		20,400
Medicals & Passport Costs	800				800
Contractor's O.H. 60% (1)	19,800	21,180	22,680	24,240	87,900
SUBTOTAL	102,410	90,180	95,170	105,760	393,520
TOTAL (Times 2 Persons) =					787,040

Salary based on 1981 base of $33,000 and 7% Inflation per Year.

*For 1981 Quarters Allowance, 2 Months at Hotel @ $5,040 plus 10 Months QA.

35,300

C. GEOLOGIST/HYDROLOGIST; LAND-USE SPECIALIST (ARRIVE: January 1981)

	CY 1981	CY 1982	TOTALS
Salary	38,500	41,200	79,700
Post Diff. 10% (1)	3,850	4,120	7,970
Fringe Benefit 20% (1)	7,700	8,240	15,940
Def. Base Net. Ins. 8.75% (1+2)	3,700	3,960	7,660
Post Assignment			
(a) Travel	6,800	6,800	13,600
(b) Shipment HHE	3,400	3,400	6,800
(c) Storage HHE	1,000	1,000	2,000
(d) Car Shipment	2,000	2,000	4,000
Quarters Allow. & Supp. Post Allow.	11,130*	7,310	18,440
Education Allow.	4,600	4,600	9,200
Home Leave and R&R Travel	6,800		6,800
Medicals & Passport Costs	800		800
Contractors O.H. 60% (1)	23,100	24,720	47,820
SUBTOTAL	113,380	107,350	220,730
TOTAL (Times 2 Persons) =			441,460

Salary based on 1981 base of $38,500 and 7% Inflation per Year.

*For 1981 Quarter Allowance, 2 Months at Hotel @ $5,040 plus 10 months QA.

D. A.I.D. ARSTC Costs

Visual Analysis Hardware

Density Slicer (1)	$ 40,000
Color Additive Viewer (1)	26,000
Optical Pantograph (1)	8,000
Zoom Transfer Scope (1)	5,600
Desensitizer + ARea Measurer (1)	10,000
Rear View Projector (2)	500
Diazo Printer and Developer (2)	1,000
Mirror Stereoscope (12)	24,000
Blueprint Machine (1)	4,000
Miscellaneous pocket Stereoscopes, paper, mylar, pencils, drafting equipment	20,000
Richard O 10 light tables (20)	1,000
Locally Built light tables (5)	1,000
Stereoviewer light table (1)	6,000
Slide projectors (2)	600
Overhead Projectors (2)	500
Tape Recorders - for coordinated slide presentations (2)	500
35mm SLR Cameras (2)	700
ROUNDED FIGURE.....	$150,000

Total Itemized Procurement	$1,090,000
Contingency for as yet unidentified procurement	150,000
Shipping costs	205,000
Procurement and Integration Contract	190,000
SUBTOTAL.....	$1,635,000
Maintenance of equipment (4 1/2 years)	400,000
TOTAL.....	$2,035,000

E. Analog Equipment

To select appropriate equipment for these functions at AIT requires consideration of the different voltage and cycle rate of Bangkok electric power, availability of hardware maintenance, etc., and needs further study. Also, it must be stressed that all such equipment must interface effectively with the 3031 Main Frame Computer to be furnished by IBM.

1.	Scanning microdensitometer Perkin-Elmer This equipment requires a stable current.	$130,000
2.	Film recorder for producing images Dicamed film recorder + tape drive	$130,000
3.	Color/B/W/Graphics CRT's Ramtek or Comtal terminals including computer interfaces - 2 required	$200,000
4.	I^2S viewer The I^2S viewer is a showpiece, is valuable for fast scans of long film rolls, and provides enlargement capability.	$ 30,000
	TOTAL ANALOG	$490,000

F. Computer Peripheral Equipment

In terms of computer peripherals to support image storage (disc and tape) and student access terminals and controllers.

These include:

2 terminal controllers) 7 terminals) 6 disk units) 1 tape controller) 3 tape drivers)	450,000

G. Results and Recommendations

This cost includes no software development efforts

The equipment listed are the best available, to meet the functional requirements, and are all manufactured by companies of sound status and good reliability.

SUMMATION

Cost of 5 long-term trainers	$1,875,000
Equipment	2,035,000
Salary Photo-Liaison position for NRC/AIT	60,000
Computer software support	64,000
Purchase of 1000 CCTS	200,000
SUBTOTAL.....	$4,234,000
Scholorship Costs trainees	$ 500,000
Short-term consultants/lecturers	140,000
Specifications preparation	40,000
Evaluation	40,000
Travel Costs by U.S. Staff (Regional)	50,000
SUBTOTAL.....	$5,004,000
Contingency	$ 596,000
TOTAL.....	$5,600,000

AIT Costs Resulting from ARSTC Training

5 Faculty Members (Asian))	
2 Operators)	
1 System Programmer)	$ 800,000
1 Instrument Engineer)	
Administrative Support	$ 50,000
Building and system Facilities	$ 780,000
Utilities (Electricity)	$ 25,000
TOTAL.....	$1,655,000

AIT Costs for Processing Center

1 Documentation Specialist)	
1 Processing Center Specialist)	$ 200,000
2 Operators)	
Administrative Costs	$ 50,000
Building and System Facilities	$ 168,000
Supplies (Tapes and Reproduction)	$ 80,000
IBM computer plus maintenance	$2,500,000
TOTAL.....	$2,998,000

TOTAL BOTH ABOVE AIT COSTS..... $4,653,000

59158

Center Costs to be Assumed by RTG

In addition, the RTG is making a major contribution to ARSTC by providing the Ground Receiving Station which is vital to utility (and partly to credibility) of ARSTC.

For this they have budgeted $4 million (80,000,000 Baht). This is credited at approximately 33% or $1,335,000.

IMPLEMENTATION PLAN

July	1979	PP is submitted to AID/Washington
August	1979	- PP is approved by AID/Washington - Project Agreement is submitted to AIT and signed
September	1979	- Project Agreement is submitted to RTG and signed - AID prepares to hire two short-term specialists (2 months): - A Computer specialist to prepare detailed specifications for all hardware and software alternatives compatible with 303 IBM computer and equipment needed for processing and correcting computer compatible tapes - A Remote Sensing and Ground Truth Specialist to prepare detailed specifications for laboratory equipment for photographic and optical processing
October	1979	Conditions Precedent are met
January	1980	USAID/T prepares PIO/C and submits to AID/Washington for contracting with "Integration Contractor" for procurement of equipment as proposed by the specialists
April	1980	AID undertakes to contract for services of U.S. institution to provide services of a Project Leader, Geologist/Hydrologist, Land-use Specialist, Cartographer and Systems Analyst.

August	1980	Project Leader proceeds to Thailand to arrange Center establishment and help in project setup arrangements
January	1981	Training Team proceeds to Thailand. They become members of the staff of the Asian Institute of Technology. They check out the equipment and prepare a first year short-term training curriculum in active liaison with the NRC and AIT
March	1981	Commodities arrive Thailand and are installed and tested
May	1981	First training begins under leadership of U.S. Project Leader
August	1981	The U.S. and Asian instructors of the Center, in consultation with ESCAP officials, prepare curricula for 10 month diploma Course (and 20 month Master's Degree Course) and submits it/them to the Academic Seante of AIT for approval
April	1981	Indepth Evaluation
August	1982	Project Phase II begins
December	1982	Geologist/Hydrologist and Land Use Specialist return to the U.S.

61|62

January	1983	Asian counterparts assume responsibility for geo/hydro and land-use training
May	1983	Long term training begins
January	1985	Cartographer, Systems Analyst return to U.S. Only U.S. Project Leader remains at AIT
June	1985	End of Project Evaluation
April	1985	- Asian counterparts take over the administration of the ARSTC at AIT - Cartographer and Systems Analyst return to U.S.
August	1985	Project Leader returns to U.S.
September	1985	Project Assistance Completion Date

63

ASIAN INSTITUTE OF TECHNOLOGY

P.O. BOX 2754 • BANGKOK • THAILAND • CABLE: AIT BANGKOK
TEL: 5168311 • 5168321 • 5168333

Office of the President

Our Ref: P 79/24

February 1, 1979

Mr. Josiah Royce
DS/ENGR
Agency for International Development
Washington 20523
U.S.A.

Dear Mr. Royce:

I am extremely pleased to inform you that the Board of Trustees of the Asian Institute of Technology, at its January 25 meeting at AIT, endorsed the following:

- To approve in principle the establishment of an Asian Remote Sensing Training Center at AIT.

- To authorize the President of AIT to conclude agreements for this purpose with

  U.S. Agency for International Development
  National Research Council of Thailand
  Economic and Social Commission for Asia and the Pacific
  IBM World Trade Americas/Far East Corporation
  Other participating organizations.

For your information, I am attaching a document entitled "Status Report and Recommendations Concerning the Establishment of an Asian Remote Sensing Training Center at the Asian Institute of Technology". I submitted this document to the members of the Board at its January 25 meeting.

Needless-to-say, we at AIT are now very anxious to proceed with the next steps to bring to fruition this much-needed academic program.

With all best wishes,

Sincerely yours,

Robert B. Banks

Robert B. Banks
President

enc.
RBB/pk

STATUS REPORT AND RECOMMENDATIONS

concerning the establishment of an

ASIAN REMOTE SENSING TRAINING CENTER

at the

ASIAN INSTITUTE OF TECHNOLOGY

by

Dr. Robert B. Banks
President, Asian Institute of Technology
Bangkok, Thailand

January 15, 1979

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Contents

Section	Topic
1.0	Summary and Recommendations
2.0	Technical Aspects of Remote Sensing
3.0	Applications of Remote Sensing
4.0	Chronology of Events
5.0	The Proposed Program
6.0	The Financial Aspects
7.0	The Proposed Curriculum for the One-Term Course
8.0	References

1.0 Summary and Recommendations

In September 1977, a letter was received from USAID-Thailand to inquire about AIT's possible interest in developing and operating a Remote Sensing Training Center with financial assistance from AID.

I reported this development to the Executive Committee of the Board of Trustees at its meeting of September 19, 1977. Subsequently I replied to AID to the effect that "... the Institute expresses its very serious interest in the possibility of establishing the Remote Sensing Training Center at AIT".

During the ensuing months, we at AIT had several meetings with representatives from the National Research Council of Thailand. A pattern of cooperation was promptly developed in which AIT would presumably take on the education and training aspects of remote sensing technology and NRC would seek to acquire and operate a ground receiving station as well as to conduct appropriate ground truth surveys.

In March 1978, at the ESCAP meeting in Bangkok, Ambassador M.F. Wells, U.S. Representative to ESCAP, indicated that "... the U.S. announces readiness to provide $2 million to help finance a Southeast Asia Regional Remote Sensing Training Center at the Asian Institute of Technology near Bangkok".

With this announcement, momentum began to gather. Over the following several months, numerous discussions were held with representatives from organizations likely to be involved in the contemplated training center. In the meantime, USAID proposed an escalation of the undertaking from a $2 million, three-year program to a $6.37 million, six-year program.

This endeavor has now reached the point in which the following five organizations will be involved in this proposed remote sensing training program:

- Asian Institute of Technology
- U.S. Agency for International Development
- National Research Council of Thailand
- Economic & Social Commission for Asia and the Pacific
- IBM Americas/Far East Corporation

The operational and financial roles of each of these five organizations is presented in Sections 5.0 and 6.0 of the present report.

In my opinion, we are now at the stage where AIT should begin to make definite agreements with the other organizations involved in this undertaking. There is no doubt in my mind that this project is greatly needed. I am confident that the undertaking will be financially sound.

A 1977 report(3)* of the National Academy of Sciences is entitled "Remote Sensing from Space: Prospects for Developing Countries". The following quotation is taken from this report:

*Numerals in parentheses correspond to the references listed in Section 8.0 of this report.

> Shortage of trained personnel is the primary factor limiting the ability of developing countries to assimilate remote sensing technology. There is need for programs to inform policymakers, planners, and resource managers of the potentials of the technology; for short-term, in-depth training of scientists and resource specialists to enable them to analyze satellite data applicable to their resource sectors; and for longer-term academic training for those who will be involved with its technically more demanding aspects. To accommodate the larger number of people who will have to be trained in the next decade, educational institutions will need to modify their orientation and enlarge their capacities in this field.

I make the following recommendations:

- That AIT agrees in principle to the establishment of an Asian Remote Sensing Training Center to be located at AIT.
- That the Board of Trustees approves the development and conclusion of definite agreements with the above-indicated organizations who will assist AIT in this undertaking.

2.0 Technical Aspects of Remote Sensing

Over the past 15 years, an extremely powerful and versatile new technology has been developed which will assist in obtaining solutions to a great many of mankind's most serious problems.

This new tool has been labelled remote sensing technology. A definition of this term is implicit in the following paragraph, abstracted from a recent report of the National Academy of Sciences (3):

> All objects, inanimate or living, reflect the radiation of the sun in the form of electromagnetic waves. This reflection may be characterized by the length or frequency of the reflected wave. The physical properties of a particular object establish how much of the solar radiation of each wavelength is reflected. Such reflected energy, with distinct wavelength distributions of each object, can be selectively observed by a "multispectral scanner" installed in a satellite. Information received by the scanner is transmitted to a ground station in a digital form which can be processed and enhanced by computers.

It is clear that the fast pace of development of remote sensing technology has been due to very rapid development of satellite technology and computer technology.

A recent report by ESCAP (2) presents the following rather concise definition of remote sensing:

- Data acquisition (satellites and command stations)
- Data reception (antennas and receivers)
- Data pre-processing (formatting and recording)
- Storage and dissemination (archiving and reproduction)
- Data analysis (interpretation and processing)
- Information utilization (practical application by user)

As indicated in the report of the National Academy of Science (3):

> Aerial photography missions can be flown over a specified area to collect data of an intermediate level between satellite sensing and ground observation. If acquired concurrently with a satellite overpass, or reasonably soon thereafter, the data may be used as "ground truth" with which to calibrate the data from the space sensors.

A number of countries are currently planning or developing satellites to be launched to obtain remote sensing data to assist their national programs. However, at the present time, virtually all of the world's remotely-sensed earth-resource information is being provided by the Landsat satellites placed into orbit by the United States.

Landsat 1 was launched in July 1972. It is a 950 kilogram spacecraft, 3 meters high and 4 meters wide when its two solar panels are extended. The solar arrays, connected to storage batteries, provide the power for the control, sensing, recording, and transmitting equipment aboard.

The satellite travels at an altitude of about 920 kilometers in a circular, near-polar orbit and crosses the equator at a 99 degree angle. It makes 14 orbits a day and repeats its coverage of any specific point on the earth at about 9:30 a.m. local time every 18 days.

On each satellite pass, the strip viewed by the sensors is 185 kilometers wide. A day later the satellite passes over a point at the equator 170 kilometers west of that same strip and senses a contiguous strip also 185 kilometers wide. This provides a 14 percent overlap at the equator so that at least 15 kilometers at the edge of each strip are always viewed twice on consecutive days in each 18-day cycle.

The instrument package on Landsat 1 consists of two sensor systems: a "multispectral scanner" (MSS) and three "return beam vidicon" (RBV) cameras plus two "data collection system" (DSC) receivers and two video tape recorders. These two sensor systems use seven bands in the visible (0.4 to 0.7 micrometers) and near-infrared (0.7 to 1.1 micrometers) portion of the radiation spectrum. The resolution capability of the sensor system allows the detection of ground features or objects larger than 80 meters square.

Because of mechanical failures, Landsat 1 was terminated in January 1978. During its nearly six years of operation, Landsat 1 made 28,824 orbits and travelled 1.32 billion kilometers. It acquired 151,157 MSS and RBV scenes at ground stations in the U.S. and 122,290 scenes at ground stations in Canada, Brazil and Italy.

Landsat 2 was launched in January 1975. Its orbit was selected such that it would be precisely 9 days out of phase with Landsat 1. The two satellites are essentially the same. As of July 26, 1978, Landsat 2 had completed 17,859 orbits and had acquired 273,461 MSS and RBV scenes at ground stations in the U.S., Canada, Brazil, Italy and Iran.

Landsat 3 was placed into orbit in March 1978. Its instrument package includes those contained in Landsats 1 and 2. A fifth wavelength band in the thermal region of the radiation spectrum (10.5 to 12.5 micrometers) was added. The resolution capability of Landsat 3 was reduced to 30 meters. As of July 26, 1978, Landsat 3 had completed 1,991 orbits and had acquired 32,601 scenes at ground stations in the U.S. and other countries.

Landsat 4(D) is scheduled to be launched in late 1981. It will incorporate a new 7-channel multispectral scanner termed the "thematic mapper" (TM) along with a 4-channel "multispectral scanner" (MSS). An additional satellite, presently labelled Landsat D-prime, will probably be launched a year after Landsat 4(D) is placed in orbit.

The major objectives of the Landsat 4(D) program are the following:

- To assess the capability of the TM band to provide improved information for earth resources management.

- To provide a transition, for both U.S. and foreign users, from the MSS data to the higher resolution and data rate of the TM.

- To encourage continued and expanded foreign participation in the program.

At the present time, there are three Landsat ground stations in operation in the U.S., two in Canada, and one each in Brazil, Italy and Iran. Several other countries are either planning or constructing ground stations.

The existing ground stations in the U.S. are located at Goldstone, California; Greenbelt, Maryland; and Fairbanks, Alaska. The two Canadian stations are at Prince Albert, Sask. and St. Johns, Newf. The other stations in operation are located at Culaba, Brazil; Fucino, Italy and Teheran, Iran. During the next one or two years ground stations will most likely be in operation in the following countries: Argentina, Australia, Chile, India, Japan, Sweden, Thailand, and Zaire.

The three U.S. ground stations receive the information transmitted from the Landsat satellites and record it on high density magnetic tapes. These tapes are then sent to the NASA Data Processing Facility at Beltsville, Md. (Stations outside the U.S. tape the satellite transmissions and do their own processing.) From these video tapes, the NASA Data Processing Facility produces "high density digital tapes" (HDDT). Subsequently, these tapes are sent to the EROS (Earth Resources Observation Systems) Data Center, operated by the U.S. Geological Survey, at Sioux Falls, South Dakota. Here the data on the HDDTs is converted and recorded on "computer compatible tapes" (CCT). The CCTs are then fed into computers for digital analysis of the spectral properties of each scene and for production of desired information in tabular form.

In the U.S., the tasks of cataloguing, storing, reproducing, and distributing the film and tape products from satellites are performed by the EROS Data Center. These final products are distributed worldwide.

A good many of the technical aspects of remote sensing technology are described in a 1976 book edited by Schanda (4) and in an article published in Science by Adrian and Baumgardner in 1977 (1).

3.0 Applications of Remote Sensing

Remote sensing technology can be utilized in many ways to assist in the improvement of economic and social conditions in the developing countries. The National Academy of Science report (3) lists the following general areas of application:

3.1 Agricultural Production. Better crop forecasting based on improvement of crop identification, better information on crop yields, improvement in acreage estimates, better definition of soil types and properties.

3.2 Rangeland Management. Improved monitoring of vegetative conditions, better plant community boundary definition for improved inventories.

3.3 Forest Management. Improvement in sampling, monitoring of clear cutting, burns, dead timber, and plant association mapping in little-known areas.

3.4 Water Resource Management. Higher quality geomorphic analyses for ground water investigation, improved estimates of rainfall over large areas of the tropics and subtropics. Development of near-surface soil moisture bookkeeping for crop and pasture yield estimates; better information on near-surface soil moisture in arid and semiarid areas; better estimates of small-area runoff; improved forecasting of floods and assessment of flood damage.

3.5 Geological Survey and Mineral and Petroleum Exploration. Detection of thermal anomalies indicating possible faults; improved techniques for determining mineral properties of rock; better definition of structures, fracture patterns, and sedimentary rock sequence for use in mineral and petroleum exploration.

3.6 Cartography. Capability for revising additional feature of line maps at scale of 1:250,000 or larger because of better spatial resolution.

3.7 Land Use and Urban and Regional Planning. Improved identifications in areas of urban structures and of zones with and without trees; improvement in identification of boundaries and categories of classification.

3.8 Demography. Better sample design and sample extrapolation of population; better delineation of urban areas and villages and improvement in establishing land use relations in surrounding areas.

3.9 Environmental Protection. Sharper observation of environmental problem areas that have temperature related or emissivity related effects: water pollution, oil spills, thermal pollution; improved definition of deteriorating land areas such as those undergoing desertification.

3.10 Marine Resources and Coastal Engineering. Better determination of small to moderate features of ocean circulation; likely detection of upswellings, oil spills and waste discharges; detection of topographic changes of shorelines due to tidal and wave action.

3.11 Disaster Warning and Assessment. Improved disaster assessment and monitoring in flooded areas; possible improvement in monitoring of major volcanic eruptions and large remote-area forest fires; improved weather forecasting and weather patterns.

3.12 Human and Animal Health. May identify and map the types of vegetation that serve as reservoirs for disease-bearing insects and as habitats of carrier animals.

Specific examples of present or proposed applications of remote sensing have been described in a recent issue of the Landsat Newsletter (4). Some of these applications are listed as follows:

- Landsat 2 and 3 data are being acquired over the Portuguese coast to aid in the construction of a breakwater near Lisbon.

- The USAID has requested Landsat coverage at sites in Costa Rica, Upper Volta, Thailand, and Mali. In Thailand the data will be used in a rubber plantation survey. In Costa Rica there is to be a project to study the rate of deforestation, urbanization, and watershed and land use management. In Upper Volta and Mali the data will be used in a study of desertification.

- A Canadian engineering company has requested more Landsat coverage over Malaysia to plan a hydroelectric facility on the Perak river.

- The Senegal Basin is being monitored by the Food and Agriculture Organization with the use of Landsat data. NASA is presently obtaining Landsat 2 and 3 data to assist the study of flood conditions.

- The Ministry of Agriculture and Natural Resources in Malawi is receiving Landsat coverage to assist them in their crop studies.

- Landsat coverage is being provided of the Palawan Island area of the Philippines for shoreline mapping, particularly in zones of shallow water reefs and shoals.

- For the environmental assessment of Alaskan coastal areas prior to offshore petroleum leasing, the Geophysical Institute of the University of Alaska is obtaining Landsat data over the Prudhoe Bay area.

- The Government of Pakistan has requested Landsat coverage of various sites for hydrometeorological studies and to monitor flooding conditions, to assess damage, and to develop protection from future floods.

- The Director of Mineral Development in Fiji has requested Landsat imagery over Fiji for geologic and natural resources interpretation.

- Marine pollution is being studied at the University of Singapore with Landsat imagery.

- The Korean Institute of Technology, in conjunction with the Bedfort Institute of Oceanography in Canada, is studying sediment migration in the Gulf of Inchon with the use of satellite imagery.

- A snow survey in India is being assisted by the use of Landsat data.

- Present road networks of the Binghazi Region in Lybia are being updated by the use of Landsat 3 data.

- The National Taiwan University is using Landsat information to study shorelines and to determine water depths.

- An American oil company has requested Landsat data of Chad to aid in their studies of operational conditions of oil and gas reservoirs in the Doba and Doseo Troughs.

There are numerous other examples of the application of remote sensing technology in helping to solve many kinds of problems. The Office de la Recherche Scientifique et Technique Outre-Mer, at its laboratories near Paris, is conducting a hydrological study of the Niger River in Central Africa using Landsat imagery. The same group at ORSTOM is investigating the natural resources of southern Venezuela utilizing satellite data backed up by ground truth surveys.

Bangladesh is employing satellite imagery to assist in the planning of disaster preparedness projects, coastal zone management, and water resource development.

Japan continues to employ remote sensing technology to study problems of the marine environment, such as thermal pollution and oil spills. Japanese experts utilized remote sensing techniques in a survey of the damage caused by the eruption of the Usuzan volcano in August 1977.

Another example of how remote sensing technology can be utilized to assist developing countries is the project being planned in the Ministry of Agriculture & Cooperatives of Thailand to inventory agricultural lands for crop harvest prediction. This project, which will be carried out in collaboration with the

Office of Science and Technology of USAID, will utilize Landsat imagery to obtain statistics concerning Thailand's total crop areas and yields. It has been proposed that crop classification programs will be developed and implemented with the use of AIT's computer.

A final example of an application of remote sensing technology is quite close to home. This application is the study carried out during 1975 and 1976 by Dr. Tongchat Hongladaromp and Mr. Nimitra Kattiyakulwanich of AIT for the Committee for Coordination of Investigations of the Lower Mekong Basin. In their final report of March 1977 (6), Tongchat and Nimitra summarized the work carried out at AIT on computer program development for the classification of information recorded on computer compatible tapes from Landsat satellites passing over Thailand and the Lower Mekong Region. To demonstrate the capability of the program, various topographical features were selected for classification; these features included reservoirs, estuaries, deltaic areas, mangrove areas, roads, and waterways.

4.0 Chronology of Events

Date	Event
September 13, 1977	I received a letter from Mr. Charles L. Gladson, Director of USAID-Thailand, to inquire whether AIT had interest in the possible establishment of a center for training specialists in remote sensing technology. A draft proposal prepared by USAID was attached to Mr. Gladson's letter. The proposal called for training 165 people from 12 Asian countries over a three-year period. An amount of $2 million would be provided by USAID; an additional $1 million would be provided by participating countries.
September 17, 1977	The above-indicated matter was presented to the Executive Committee of the Board of Trustees for its information and consideration (Minute E.77.91).
September 21, 1977	I replied to Mr. Gladson's inquiry as follows:- "The Executive Committee's view, which I strongly endorse, is that the Institute expresses its very serious interest in the possibility of establishing a Remote Sensing Training Center at AIT." I added that "I shall look forward to receiving at an early date a more comprehensive document and/or visit by USAID-USGS personnel".
September 30, 1977	I received a letter of acknowledgement from Mr. Gladson. He indicated that he had recently met with Dr. Sanga Sabhasri, Secretary General of the National Research Council of Thailand (NRC), regarding the proposal. He reported that the NRC had positive interest in developing remote sensing technology activities.

Date	Event
January 5, 1978	Dr. Kearns and I met with Dr. Sanga Sabhasri and Mr. Suvit Wibulset, Coordinator at NRC, for discussions on the subjects of a possible training center at AIT and a possible ground station at NRC.
February 2, 1978	Dr. Kearns and Dr. Kanchit Malaivongs met with Dr. Sanga Sabhasri and Mr. Suvit Wibulset to commence a program of collaboration between AIT and NRC.
March 10, 1978	H.E. Mrs. Melissa Wells, U.S.Ambassador to ESCAP, announced the offer of the U.S. "to help finance the establishment of a Southeast Asian Regional Remote Sensing Center to train Asian specialists to use satellite technology in their countries' economic development. The Center would be located at the Asian Institute of Technology near Bangkok and would employ AIT's Computer Center".
March 16, 1978	I sent the following cable to Dr. John A. Hrones: "USIS PRESS RELEASES OF FRIDAY MARCH TEN INDICATED THAT AMBASSADOR MELISSA WELLS HEAD OF US DELEGATION ANNOUNCED AT ESCAP MEETING HERE THAT QUOTE THE UNITED STATES OFFERS TO FINANCE ESTABLISHMENT OF A SOUTHEAST ASIAN REGIONAL REMOTE SENSING TRAINING CENTER ETC. THE CENTER WOULD BE LOCATED AT THE ASIAN INSTITUTE OF TECHNOLOGY ETC AND EMPLOY AITS COMPUTER CENTER UNQUOTE LETTER FOLLOWS.
May 3, 1978	Dr. Hrones replied to my March 16 cable and letter and indicated that he had talked with AID officials in Washington on the subject of the proposed remote sensing training center at AIT.
May 8-9, 1978	An IBM site survey team visited AIT. The following people comprised this team: - Mr. Paul G. Ellinghaus, Director, Corporate and Scientific Programs, IBM A/FE, New York - Dr. G. Eric Marler, Program Manager, Scientific Programs, IBM A/FE, New York - Mr. Alex Taylor, Director of Staff Services, Southeast Asia Region, IBM A/FE, Hong Kong Among numerous other topics, we discussed with this team the implications which the contemplated remote sensing training center would have on AIT's Regional Computer Center.

Date	Event
May 11, 1978	During my two weeks' visit in France, I visited the Central Scientific Laboratory of the Office de la Recherche Scientifique et Technique Outre-Mer near Paris. I observed some of their Landsat remote sensing activities, particularly their projects on hydrological studies in Central Africa and natural resources in Southern Venezuela.
June 28, 1978	In Washington, Dr. Kearns and I met with USAID officials to discuss the proposed remote sensing training center. We were informed that a team of USAID/USGS/NASA specialists would be coming to Bangkok in August to conduct a site survey.
August 31, 1978	Mr. Josiah Royce (USAID/Washington) and Mr. Robert A. Cahn (Director, Office of Special Projects, USAID, Bangkok) were at AIT to discuss the proposed program. The level of contemplated activity had been increased from the earlier proposal (3 years, $2 million, 165 people) to a new level (5 years, $5 million, 275 people). The proposed budget categories and AIT's computing capabilities were discussed.
August 31, 1978	By fortunate coincidence, Mr. James Linen was at AIT. At a luncheon meeting, attended by Mr. Linen and Mr. Royce, the subject of remote sensing technology was discussed at length.
September 15, 1978	I was informed by USAID-Thailand that the Royal Thai Government had approved an appropriation of $4.0 million to the National Research Council (NRC) for stage-one construction and equipment for a ground station to be operated by the NRC.
September 25, 1978	I presented a verbal report to the Executive Committee of the Board of Trustees of the progress made to date on the proposed Remote Sensing Training Center.
November 1, 1978	I appointed an ad hoc committee (Dr. Kearns, Dr. Sharif, Prof. Anat, Prof. Fuda I, Dr. Jordan, Dr. Valls, Mr. Long) to prepare a proposal for submission to IBM A/FE for the continuation of a five-year program of assistance commencing in January 1980. This proposal will be completed and forwarded to IBM in late January 1979. The proposal will contain two basic patterns: (a) the need to increase our computer capability due to the Institute's ever-growing activities in research, and (b) the need to increase our computer capability due to (a) and, in addition, the proposed training program in remote sensing.

Date	Event
November 3, 1978	Dr. Kearns, Dr. Jordan and I had another meeting with USAID-Thailand officials. We learned that a NASA specialist would be coming to Bangkok in mid-November to ascertain what additional demands would be imposed on our computer by a training program in remote sensing technology.
November 5, 1978	We received a report from USAID, prepared by Mr. Josiah Royce, which outlined in detail the program and budget being proposed by USAID. The program had again been enlarged; USAID is proposing a 6-year program (two phases, each of three years duration) at a cost of $6.37 million to USAID.
November 20, 1978	I presented a written and verbal report to the Executive Committee of the Board of Trustees concerning the progress made thus far on the proposed remote sensing training center.
November 28, 1978	Dr. Kearns, Dr. Jordan and Mr. Nimitra Kattiyakulwanich were participants at an ESCAP meeting held in Bangkok during the period from November 28 to December 2. The meeting was devoted entirely to the subject of "Remote Sensing Activities in the ESCAP Region". A good fraction of the meeting was devoted to discussions of the proposed training center at AIT. Topics concerning ESCAP's financial and advisory roles in the training center were examined. It is understood that ESCAP has earmarked about $1 million for scholarships for students to study remote sensing technology at AIT.
December 15, 1978	Mr. J.B.P. Maramis, Executive Secretary of ESCAP, wrote to Mr. D.D. Cohen, Director of USAID-Thailand, indicating that "I am very pleased that our people have continued to work closely together, and that there was complete agreement at the recent Meeting on Remote Sensing Activities in the ESCAP Region, concerning the relationships between these programmes." Mr. Maramis added that "... funds from the general regional project would be used to support attendance by trainees at the AIT centre".

5.0 The Proposed Program

As indicated in Section 4.0 of the present report, there have been numerous discussions with the several organizations involved or interested in the proposed remote sensing technology training center. These organizations include the following:

- U.S. Agency for International Development (USAID)
- U.S. Geological Survey (USGS)
- U.S. National Aeronautics and Space Administration (NASA)
- National Research Council of Thailand (NRC)
- Economic & Social Commission for Asia and the Pacific (ESCAP)
- IBM Americas/Far East Corporation (IBM A/FE)

In addition to discussions with representatives from the above-indicated organizations, we have had several sessions with the Prime Minister, the Deputy Prime Minister, and the Foreign Minister of Thailand to discuss the general pattern of thinking and direction at AIT in connection with the proposed remote sensing training center.

The time has now arrived for AIT to make solid and positive advances to establish the training center and its associated training program.

Specifically, the training program will be extended over a six-year period commencing in 1980. It is envisaged that a total of approximately 300 students from 12 or more countries of Asia will receive training in remote sensing technology at AIT.

The major thrust will be special intensive courses of four-months' duration involving about 30 students in each course. The course will be offered three times each year, timed to coincide with AIT's academic calendar. The students will be eligible for "certificates" from AIT; they will be "regular" students as regards living accommodations and stipends provided by the Institute. The students will be selected by AIT from candidates proposed by ESCAP and ASEAN member countries.

After the special four-months program is in operation, the need may arise to develop diploma and masters degree programs in remote sensing technology. Clearly, those are matters which the Academic Development & Review Committee, the Academic Senate, and the Educational Policy Committee will need to consider at the appropriate time.

The instructors for the special four-months special courses will be seconded by the United States under financing provided by the USAID grant. Five professors from the U.S. will be provided with specializations in the following areas:

- Project Leader
- Geologist-Hydrologist
- Land Use Specialist
- Cartographer
- Systems Analyst

During the six-year period, there will be a programmed phase-out of the U.S. specialists and a phase-in of qualified Asian specialists.

At AIT, the proposed Asian Remote Sensing Training Center (ARSTC) will be an academic operation of the Division of Computer Applications and the Regional Computer Center. The Asian Remote Sensing Training Center will utilize the excellent facilities and equipment of the Air-Photo Laboratory in our Division of Geotechnical & Transportation Engineering.

This new program in remote sensing, as another component of our overall academic programs, will be under the surveillance and control of the Vice President & Provost of AIT. It is worthwhile to point out that this new program will clearly reinforce the Institute's growing commitment to the enlargement of its overall activities in continuing education.

6.0 The Financial Aspects

As indicated above, a number of organizations will be involved in setting-up and operating the proposed Asian Remote Sensing Training Center (ARSTC). These organizations include the following:

- Asian Institute of Technology (AIT)
- U.S. Agency for International Development (USAID)
  U.S. Geological Survey (USGS)
  National Aeronautics & Space Administration (NASA)
- National Research Council of Thailand (NRC)
  Department of Technical & Economic Cooperation (DTEC)
  Meteorological Department of Thailand
- Economic & Social Commission for Asia and the Pacific (ESCAP)
- IBM Americas/Far East Corporation (IBM A/FE)

The roles which each of these organizations will play is summarized below. A summary of the cost estimates and financial plan is presented in Table 6.1.

Asian Institute of Technology (AIT). The Center, of course, will be physically located at AIT. No new construction will be required. All teaching and support staff will be housed in the Regional Computer Center. If additional office space is required, some staff can be housed in the AIT Center.

At the outset it is planned that three intensive courses will be offered each year. Each intensive course will be of four months' duration with no more than 30 students per course. These students will live in the student dormitories or the student villages. At present we have 610 student bed spaces and our current enrollment is about 480. Accordingly we have, and will have for the foreseeable future, sufficient bed spaces for the special students in remote sensing. Incidentally, we are at work to develop a Student Village 3 which hopefully will be ready in two or three years time.

As an obvious contribution by AIT to the training program, it goes without saying that all staff and students involved in the ARSTC's program will have complete use of all of the Institute's educational and recreational facilities.

AIT will need to employ, on a direct-hire basis, two new faculty members initially and a few others later on. One of the initial faculty members should have expertise in digital processing of remotely sensed data; the other should possess experience in digital image processing. We will also need two

Table 6.1 - Cost Estimates and Financial Plan for the Asian Remote Sensing Training Center
(Amounts are in US$1,000)

Project Component	AIT		AID		NRC		ESCAP		IBM		TOTAL	
	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II	Phase I	Phase II
Ground Station					1,335						1,335	
Technical Personnel	260	395	1,234	979							1,494	1,374
Equipment			1,674						2,000		3,674	
Computer Maintenance			164	246							164	246
Scholarships & Local Costs			400	600	200	300	200	300			800	1,200
Sub-total	260	395	3,472	1,825	1,535	300	200	300	2,000		7,467	2,820
Contingency (10%)			347	183							347	183
Inflation (6% p.a.)			174	366							174	366
Total	260	395	3,993	2,374	1,535	300	200	300	2,000		7,988	3,369
Grand Total	655		6,367		1,835		500		2,000		11,357	

applications programmers. A few laboratory assistants, computer operators and a secretary will be required. Funds to engage the above-indicated direct-hire personnel will be derived from scholarships made available by USAID and ESCAP. As indicated in Table 6.1, it is estimated that AIT will spend about $260 thousand during Phase I (1980 to 1982) and approximately $395 thousand during Phase II (1983 to 1985) in this program. USAID will allocate $1 million for scholarships to AIT at our regular cost of $6,000 per student-year. The actual amount of ESCAP's contribution for scholarships over the six-year period is not precisely known at the present time. The $500 thousand indicated in Table 6.1 is probably conservative.

U.S. Agency for International Development (USAID). The USAID is planning to provide approximately $6.37 million during the six-year period, spread over Phases I and II, each of three-years duration.

Of this total amount provided by USAID, approximately $2.21 million (34.7%) will be spent on seconded personnel from the United States. As mentioned in Section 5.0, five U.S. specialists will be assigned to the ARSTC as follows:

- Project Leader (6 years)
- Geologist-Hydrologist (2 or 3 years)
- Land Use Specialist (2 or 3 years)
- Cartographer (4 or 5 years)
- Systems Analyst (4 or 5 years)

It is planned that these U.S. specialists will become full-fledged members of the Institute's faculty. Each will be assigned an academic rank commensurate with his overall qualifications.

Over $1.67 million of USAID funds are earmarked for equipment for the ARSTC and $400 thousand is budgetted for computer maintenance.

An amount of $1.0 million of USAID funds is to be allocated for scholarships for students enrolled in the program. Using our regular figure of $6,000 per student-year, the proposed amount will finance about 167 student-years of study. If the training course is devoted entirely to the one-term certificate program, 167 student-years would provide training for about 500 students. This is somewhat more than the envisaged 300 students. Accordingly and, for example, the 167 student-years could be distributed in the following way:

Program	Duration	No. of Students	Student-terms	Student-years
Certificate	1 term-4 mon	240	240	80
Diploma	3 term-12 mon	60	180	60
Masters	5 term-20 mon	15	75	25
	Total	315	495	165

From the amount of $6,000 per student-year, it is the Institute's current policy to extract $4,500 per year for tuition and fees; the remaining $1,500 is utilized for a monthly stipend of $100 (for room, board, other expenses), a book allowance of $150, and travel costs of $150. Thus, the Institute will

obtain $750 thousand in tuition and fees over the six-year period, i.e., an average of $125 thousand per year, from USAID funds. This income, of course, does not include income from ESCAP or other sources.

National Research Council of Thailand (NRC). The Royal Thai Government has approved an appropriation of approximately $4.0 million to the NRC for stage-one construction of a ground receiving station to be operated initially by the NRC. Later on, the Meteorological Department will take over the operation of the ground station.

A memorandum of understanding will soon be signed between the NRC and NASA. Such an agreement will allow NRC to receive transmissions from the Landsat satellites. NASA experts are expected to come to Thailand soon to advise NRC on the location of the ground station. The NRC station will be capable of receiving Landsat data and producing computer compatible tapes and transparencies for the countries of the region and for AIT's ARSTC. The ground station will also be capable of receiving meteorological data from weather satellites. Once the MOU between NASA and NRC is signed, construction of the ground station will commence; it should be in operation 15 months later.

As indicated in Table 6.1, about one-third of the cost of NRC's ground station, i.e., $1.335 million, is attributed to the project since the ARSTC will be a major end-user of the ground station. The NRC will finance all operational costs of the ground station and, in addition, will provide data to ARSTC without cost.

Economic & Social Commission for Asia and the Pacific (ESCAP). The area of involvement of ESCAP coincides almost exactly with the countries represented at AIT. Thus it is not unexpected that ESCAP is showing sincere interest in providing support to the proposed remote sensing center at AIT.

A meeting was held at ESCAP Headquarters in Bangkok during the period November 28 to December 2, 1978 to consider "Remote Sensing Activities in the ESCAP Region". Numerous country reports were presented and discussed at this meeting. Considerable interest was shown by the participants at this meeting in AIT's ARSTC; the plan to establish this activity at AIT was strongly endorsed.

It appears probable and certainly desirable that ESCAP will want to establish an advisory committee to handle those matters which will appear at the interface between ESCAP and AIT. Considerable assistance can be provided to ARSTC by ESCAP in helping to identify participants from the various Asian countries for the special four-month course.

It is expected that significant funds from UNDP, channeled through ESCAP, will be available for scholarships for trainees studying remote sensing at AIT. An amount of $500 thousand is shown in Table 6.1; this amount is most likely quite conservative.

IBM Americas/Far East Corporation (IBM A/FE). If there is a single most-important and crucial factor in the entire plan to establish the ARSTC, it is the computing capability of AIT's Regional Computer Center. It is recalled that at the outset, the entire scheme was directed toward AIT primarily because of its IBM 370/145 system. In his letter of September 13, 1977 to me, Mr. Charles L. Gladson, Director of USAID-Thailand wrote:

As you are aware, a proposal to establish a Remote Sensing Training Center in Southeast Asia has been under consideration for some time, with Thailand being given primary consideration for locating this Center because of the computer capability and training facilities available at AIT. Another reason for such consideration is that AIT is an already established regional institution.

In August 1978 and again in November 1978, NASA and USGS specialists from Washington were in Bangkok for discussions at AIT as well as at USAID-Thailand, the NRC and ESCAP.

An extremely important outcome of our meetings with these specialists was the clear indication that our 370/145 machine does not have sufficient capacity to handle the computing load imposed by the contemplated remote sensing activities. Indeed, our 145-computer is virtually saturated at the present time with our own expanding activities in teaching and research.

Accordingly, if the Asian Remote Sensing Training Center is to become a reality, it is absolutely imperative that the computer capability of the RCC be very substantially enlarged. Failure to do so, of course, would be the end of ARSTC, the end of the USAID project, and the end of our collaboration with ESCAP in remote sensing. It would seriously affect the operations of NRC's ground station.

It is therefore absolutely essential that the RCC's capability be increased to a level provided by, say, an IBM 3031 or 3032 system. An amount of $2.0 million is shown in Table 6.1 to reflect IBM's involvement in the project. This amount is perhaps artificial but it does reflect the extremely substantial contribution that we strongly hope IBM will provide to the ARSTC.

For several weeks, a faculty committee has been preparing a proposal for submission to IBM for a second five-year program of assistance to AIT. Included in this proposal is a request to substantially expand AIT-RCC's computer capability.

This proposal is now completed and should be in the hands of IBM A/FE officials in New York in February. We are extremely hopeful of receiving an "agreement in principle" from IBM by April 1.

7.0 The Proposed Curriculum for the One-Term Course

A tantative curriculum has been developed, for the one-term, four-months intensive course in remote sensing technology. This curriculum has been developed by AIT professors in consultation with specialists from USGS and NASA.

The following is an outline of the proposed curriculum:

General Subjects and Specific Topics	Hours
1. Remote sensing principles and applications	25
Purpose of remote sensing	
History of remote sensing	
Principles of electromagnetic interaction with materials	
Sensor principles	
Remote sensing systems	
Applications of remote sensing	
Remote sensing and its future	
2. Basic radiometry	15
Spectroscopy, atoms and molecules	
Electromagnetic wave flux	
Sunlight characteristics	
Atmospheric characteristics	
Sunlight scattering	
Radiometry of water	
Spectrometer principles	
Ground truth data collection techniques	
Utilization of ground truth data	
3. Data processing for remote sensing	60
Data conversion processes of remote sensing data	
Digital image and Landsat MSS data	
Image geometry	
Image enhancement	
Pattern recognition	
Image and graphics editing	
Image generation and its application	
Image properties	
Other techniques	
Data processing systems	
4. Mathematical data handling	20
Fourier transforms and their application	
Multivariate analysis	
Statistical analysis and estimation	
5. Geographical data handling	20
Map projection systems	
Cartographic and graphic data processing	
Map editing and processing basics	
6. Photo processing, photo interpretation and photogrammetry	30
Characteristics of satellite photos	
Fundamentals of photo characteristics	
Basic systems for photo processing	
Keys for photo interpretation	
Photo interpreted information to digital processing	
Map conversion processing techniques from photos	
Digital photo correction techniques	

General Subjects and specific Topics	Hours
7. Application oriented training projects Agriculture Forestry Hydrology and water resources Land use, urban and regional planning Geology Environmental Science	180
8. Workshop/on-site training How to use the facilities Landsat data processing - case studies Application oriented case studies Ground truth data collection Photo interpretation training	100

There will be 450 hours of instruction during the one-term period of 15 weeks. A total of 170 hours will be devoted to formal lectures (above subjects 1 to 6) and 280 hours devoted to projects, workshops, and on-site training (above subjects 7 and 8).

8.0 References

(1) Adrien, P.M. and M.F. Baumgardner, "Landsat, Computers, and Development Projects", Science, 198, November 4, 1977 (466-470).

(2) Economic & Social Commission for Asia and the Pacific, "Remote Sensing and Satellite Surveying", prepared by S.A. Hempenius, F.C. d'Audretsch and Jacub Rais, ESCAP, Bangkok, July 1976.

(3) National Academy of Sciences, "Remote Sensing from Space: Prospects for Developing Countries", report of the ad hoc Committee on Remote Sensing for Development, NAS, Washington, 1977.

(4) National Aeronautics and Space Administration, Landsat Newsletter, No.23, NASA-GSFC, Greenbelt, Md., October 1, 1978.

(5) Schanda, Edwin, "Remote Sensing for Environmental Sciences", Springer-Verlag, Berlin, 1976.

6) Tongchat Hongladaromp and Nimitra Kattiyakulwanich, "Computer Processing of Remote Sensing Data", Final Report to the Committee for Coordination of Investigations of the Lower Mekong Basin, Asian Institute of Technology, March 1977.

95

REMOTE SENSING TRAINING PROGRAM

SHORT COURSE (4 MONTHS) TENTATIVE PLAN

Training Programs - 4 months (Tentative)

Assumption 30 hrs/week x 15 weeks = 450 hrs.

170 hrs. = lectures

280 hrs. = workshop/on-site training

This program is consisted of the following units:

1.	Remote sensing principle and applications	25 hrs.
2.	Radiometry basic	15 hrs.
3.	Data processing for remote sensing	60 hrs.
4.	Mathematical data handling - esp. multi variate analysis filtering theory	20 hrs.
5.	Geographical data handling (basic)	20 hrs.
6.	Photo processing, photo interpretation and photogrammetry	30 hrs.

7. Application oriented training - mini project

   Ex: Agriculture, Forestry, Hydrology/Water Resources, Geology, Geography, Land-use/Urban Planning/ Regional Planning, Ecology/Environmental Science

(and)

8. Work shop/on-site training

   Ex: a) how to use the system

   b) case study : b-1. Landsat data processing
   b-2. Application oriented case study

   c) ground truth data acquisition hands-on

   d) photo interpretation hands-on — 280 hrs.

(1) Remote Sensing - basic (25 hrs)

- Remote Sensing: for what?
- History of Remote Sensing
- Principle of electromagnetic interaction with materials
  - * Emission & radiation temperature
  - * Reflection of light & electromagnetic waves
  - * Absorption of electromagnetic waves

    Ex: photo synthesis & absorption of light
    Ex: water light transmittance
  - * Scattering of electromagnetic waves

    Ex: Mie-scattering principle
  - * Basic characteristics of electromagnetic wave esp. polarization & dielectric constant
- Sensor principle
  - * Sensor mechanism

    Ex: MSS, SLAR, SAR, etc.
  - * Detector characteristics
  - * Sensor geometry

    Ex: FOV, Resolution concept, IFOV.
  - * Sensor characteristics

    Ex: LANDSAT system
    LANDSAT data characteristics
    LANDSAT data format
- Remote Sensing System - platform, orbit, data communication system

  Ex: LANDSAT system
  other satellite, Ex: weather satellite, etc.
- Application of remote sensing
  - * Application areas of remote sensing
    - Earth Science/Geology/Geography/Oceanography/Meteorology
    - Resource Management
    - Environment Control

(1) Remote Sensing (Cont'd)

* Resource managements
  - Agriculture
  - Forestry
  - Land-use
  - Water Resources
  - Mineral/Energy Resources

- Remote sensing and its future

(2) Radiometry

- Basic: (15 hrs)
  * Spectroscopy & atoms & molecules
  * Electromagnetic wave flux & radiometry
  * Sun light characteristics
  * Atmospheric characteristics & sun light scattering
  * Radiometry of water
  * Spectrometer principle & mechanism -visible/IR
  * Ground truth data collection techniques
  * Utilization of ground truth data

(3) Data Processing for Remote Sensing (60 hrs)

- Data conversion process of remote sensing data
  Ex: System & hardware principle
- Digital image & Landsat MSS data:
  - Presentation & handling of digital images
- Image geometry:
  - Geometrical analysis
    Ex: Distortion analysis
  - Location identification for satellite mapping system
  - Geometrical correction principle
    Ex: Resampling techniques
  - Ground control points & image registration
  - Geometrical distortion of LANDSAT data
- Image enhancement:
  - Enhancement technique objectives & overview
  - Noise source of LANDSAT data
  - Image smoothing/filtering
  - Radiometrical correction
  - Edge enhancement/density stretching
- Pattern recognition:
  - Principle of pattern recognition in remote sensing
  - Pattern features & classifier
  - Feature selection & separabilities among classes
  - Classification method
    Ex: Distance, most-likelihood classification, potential
  - Non-parametric classification principles
    Ex: Cluster analysis, K-L transformation
- Image & graphics editing
  - Boundary trace & map generation
  - Mosaic image generation
  - Overlay techniques & area pick up
- Image generation & its application
  - Add/subtraction, multiple image and their application

(3) Data Processing for Remote Sensing (Cont'd)

- Image properties
  - Basic
  - Histogram
  - Profile
  - Contrast
  - Textural properties
  - Application of textural properties to remote sensing data
- Others
  - Temporal change detection technique
  - Meshuration techniques
  - Image cataloging techniques
- Data processing system
  - Concept
  - Facilities
  - Software consideration

(4) Mathematical Data Handling (20 hrs)

- Fourier transform & its application
  Ex: Filtering/registration
- Multivariate analysis
  Ex: Principal component analysis,
  cluster analysis,
  canonical correlation, etc.
- Statistical analysis & estimation
  Ex: Data distribution & testing,

(5) Geographical data handling (basic) (20 hrs)

- Map projection system
  Ex: UTM/polar, mercator, etc.

- Cartographer & graphic data processing
  Ex: Line following, data structure, metric conversion, hidden line, editing

- Map editing, processing basic

(6) Fundamentals of Photo processing, photo-interpretation, and Photogrametry (30 hrs)

- Characteristics of satellite photo

- Fundamentals of photo characteristics - film Y, contrast, etc.

- Basic system for photo processing
  Ex: Optical filtering, color composite, application of density slicing

- The keys for photo-interpretation

- How to use the photo-interpreted information to digital processing

- Map conversion processing techniques from photos

- Basic of digital photo correction techniques

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  Ex: UTM/polar, mercator, etc.

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- Map conversion processing techniques from photos

- Basic of digital photo correction techniques

(7) Application Oriented Training - Mini Projects

The followings are the tentative subjects for application oriented training as mini projects:

- Agriculture
  - Spectral characteristics of vegetation
  - Spectral ground truth collection for vegetation
  - Photo synthesis & sun light energy
  - Crop recognition & acreage
  - Soil mapping
  - Soil water content estimations
  - Crop growth modelling
  - Crop yield modelling
  - Agricultural information system
  - Detection of diseased crop
- Forestry
  - Spectral characteristics of trees
  - Forest type classification
  - Forest growth assessment
  - Diseased tree detection
  - Timber volume estimation problems
  - Application of remote sensing to forestry management
- Hydrology/Water Resources
  - Hydrological system extraction from remote sensing data
  - Spectral characteristics of water
  - Hydrological system modelling
  - Water resources budgets assessment
  - Flood forecasting system modelling
  - Management of water resources from space

- Land-use/Urban planning/Regional planning
    - Land-use mapping
    - Detection of urban growth
    - Environmental analysis of urban area
    - Land-use management
    - Land development planning
    - Site selection
    - Route selection
- Geology
    - Geological feature extraction
    - Rock/soil type classification
    - Geological feature enhancement
    - Underground Water analysis
- Environmental Science
    - Water qualities & spectral characteristics
    - Thermal water pollution
    - River discharge simulation
    - Impact assessment of development

95

Case Study (II) (mini project) Program

Objectives:

1. Training on problem identification and definition for remote sensing application.

2. Training on establishing strategies for the problem solving.

3. Training on information collection & analysis

4. Training on evaluation techniques for application of R/S.

Approaches:

1. Grouping the students: 3 - 4 students/group.

2. Problem definition according to the students backgrounds, interests and the following standpoints of view:

   a) What can be extracted from the remote sensing data?

   b) For the application-oriented problem solving, how to utilize remote sensing data?

3. Applying the data processing techniques.

4. Analysis of obtained results and compilation of other information.

5. Evaluation of results.

6. Presentation to other groups.

Case Study (II) (mini project) Program

Objectives:

1. Training on problem identification and definition for remote sensing application.

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CHECKLIST OF STATUTORY CRITERIA ANNEX J

ASIAN INSTITUTE OF TECHNOLOGY REMOTE SENSING TRAINING PROJECT JUNE 27, 1979

COUNTRY CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY	A. GENERAL CRITERIA FOR COUNTRY
1. FAA Sec. 11[illegible]. Can it be demonstrated that contemplated assistance will directly benefit the needy? If not, has the Department of State determined that this government has engaged in consistent patterns of gross violations of internationally recognized human rights.	Activity is regional in nature and scope to such extent that no participating country can be severed from the project.
2. FAA Sec. 481. Has it been determined that the government of recipient country has failed to take adequate steps to prevent controlled substance (as defined by the Comprehensive Drug Abuse Prevention and Control Act of 1970) produced or processed, in whole or in part, in such country, or transported through such country, from being sold illegally within the jurisdiction of such country to U.S. Government personnel or their dependents, or from entering the U.S. unlawfully?	not applicable
3. FAA Sec. 620(b). If assistance is to a government, has the Secretary of State determined that it is not controlled by the international Communist movement?	not applicable
4. FAA Sec. 620(c). If assistance is to government, is the government liable as debtor or unconditional guarantor on any debt to a U.S. citizen for goods or services furnished or ordered where (a) such citizen has has exhausted available legal remedies and (b) debt is not denied or contested by such government?	Assistance is not to the government of Thailand, but is a regional activity with member governments of ESCAP participating in the project.

5. FAA Sec. 620(e)(1). If assistance is to a government, has it (including government agencies or sub divisions) taken any action which has the effect of nationalizing, expropriating, or otherwise seizing ownership or control of property of U.S. citizens or entities beneficially owned by them without taking steps to discharge its obligations toward such citizens or entities.	not applicable
6. FAA Sec. 620(a), 620(f); FY 79, App. Act Sec. 108, 114, 606. Is recipient country a Communist country? Will assistance be provided to the Socialist Republic of Vietnam, Cambodia, Laos, Cuba, Uganda, Mozambique, or Angola?	Not applicable; However, Provisions will be inserted into Grant to limit U.S. funding to ESCAP participants from specific countries (Communist countries will be excluded)
7. FAA Sec. 620(l). Is recipient country in any way involved in (a) subversion of, or military aggression against, the United States or any country receiving U.S. assistance, or (b) the planning of such subversion or aggression?	Not applicable
8. FAA Sec. 620(j). Has the country permitted, or failed to take adequate measures to prevent, the damage or destruction, by mob action, of U.S. property?	Not applicable
9. FAA Sec. 620(i). If the country has failed to institute the investment guaranty program for the specific risks of expropriation, inconvertibility, or confiscation, has the AID Administrator within the past year considered denying assistance to such government for this reason?	Not applicable

.99

10. FAA Sec. 620(o): Fishermen's Protective Act of 1967, as amended, Sec. 5. If country has seized, or imposed any penalty or sanction against, any U.S. fishing activities in international waters,

Not applicable

a. has any deduction required by Fishermen's Protective Act been made?

b. has complete denial of assistance been considered by AID Administrator?

11. FAA Sec. 620(q): FY 79 App. Act Sec. 603.

Not applicable

a. Is the government of the recipient country in default on interest or principal of any AID loan to the country?

b. Is country in default exceeding one year on interest or principal on U.S. loan under program for which App. Act appropriates funds.

12. FAA Sec. 620(s). If contemplated assistance is development loan or from Economic Support Fund, has the Administrator taken into account the percentage of the country's budget which is for military expenditures, the amount of foreign exchange spent on military equipment and the amount spent for the purchase of sophisticated weapons systems? (An affirmative answer may refer to the record of the annual "Taking Into Consideration" memo: "Yes, as reported in annual report on implementation of Sec. 620(s)." This

Not applicable

report is prepared at time of approval by the Administrator of the Operational Year Budget and can be the basis for an affirmative answer during the fiscal year unless significant changes in circumstances occur.)	
13. FAA Sec. 620(t). Has the country severed diplomatic relations with the United States? If so, have they been resumed and have new bilateral assistance agreements been negotiated and entered into since such resumption?	No. Provision will be made in Grant to limit funding to ESCAP participants from specific countries (countries which have no diplomatic relations with U.S. will be excluded)
14. FAA Sec. 620(u). What is the payment status of the country's U.N. obligations? If the country is in arrears, were such arrearages taken into account by the AID Administrator in determining the current AID Operational Year Budget?	Participants from governments which recieve U.S. funds not in arrears to U.N. obligations
15. FAA Sec. 620A; FY 79 App. Act, Sec. 607. Has the country granted sanctuary from prosecution to any individual or group which has committed an act of terrorism?	Not applicable
16. FAA Sec. 666. Does the country object on basis of race, religion, national origin or sex, to the presence of any officer or employee of the U.S. there to carry out economic development program under FAA?	Not applicable
17. FAA Sec. 699, 670. Has the country, after August 3, 1977, delivered or received nuclear reprocessing or enrichment materials or technology, without specified	Not applicable

arrangements or safeguards?
Has it detonated a nuclear
device after August 3, 1977,
although not a "nuclear-
weapon state" under the
non-proliferation treaty?

CHECKLIST OF STATUTORY CRITERIA

PROJECT CHECKLIST

A. GENERAL CRITERIA FOR COUNTRY	**A. GENERAL CRITERIA FOR COUNTRY**
1. FY 79 App. Unnumbered; FAA Sec. 653(b); Sec. 634A.	Notification in process.
(a) Describe how Committees on Appropriation of Senate and House have been or will be notified concerning the project;	
(b) is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than $1 million over that figure?)	Yes.
2. FAA Sec. 611(a)(1). Prior to obligation in excess of $100,000, will there be (a) engineering, financial, and other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the United States of the assistance?	
3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?	Such action is not required. AIT is legal entity capable of receiving assistance
4. FAA Sec. 611(b); FY 79 App. Act, Sec. 101. If for water or water-related land resource construction, has the project met the standards and criteria as per the principles and standards for planning water	Not applicable.

and related Land Resources dated October 25, 1973?	
5. FAA Sec. 611(e). If project is Capital Assistance, and all U.S. assistance for it will exceed $1 million, has Mission Director certified the country's capability effectively to maintain and utilize the project?	Yes
6. FAA Sec. 209. Is project susceptible of execution as part of a regional or multilateral project? If so why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.	Project is regional in scope and nature.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; (c) encourage development and use of cooperatives, credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture, and commerce; and (f) strengthen free labor unions.	This project is not designed to encourage such efforts.
8. FAA Sec. 601(b). Information and conclusion on how project will encourage U.S. private trade and investment abroad and how it will encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).	Most of the equipment procurement financed under this project is to be manufactured in the U.S.

9. FAA Sec. 612(b); Sec 636(h). Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the United States are utilized to meet the cost of contractual and other services.

Over 50% of the funds required for the Project will be from participating governments of ESCAP, and will be in the form of local currencies.

10. FAA Sec. 612(d). Does the United States own excess foreign currency and, if so, what arrangements have been made for its release?

No.

11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise?

Yes.

12. FY 79 App. Act Sec. 608. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity?

There will be no financing of commodities to be procured for export.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b); 111; 113; 281 (a). Extent to which activity will: (i) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive

FUNDING CRITERIA FOR PROJECT

The diffusion of technology and information about local resources and their development which is a key element of the Project, is expected to ultimately benefit the poor by stimulating the development process in the urban and rural areas of countries participating in the Project.

105

production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (ii) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward a better life, and otherwise encourage democratic private and local governmental institutions; (iii) support the self-help efforts of developing countries; (iv) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (v) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105 106, 107. Is assistance bei made available: (include onl applicable paragraph: e.g., b, etc.,--which corresponds source of funds used. If mo than one fund source is used for project, include relevan paragraph for each fund sour

(4)(106) for technical assistance, energy, research, reconstruction, and selected development problems; if so, extent activity is:
(i) technical cooperation and development, especially with U.S. private and voluntary, or regional and international development, organizations;
(ii) to help alleviate energy problem;
(iii) research into, and evaluation of, economic development processes and techniques;
(iv) reconstruction after natural or manmade disaster;
(v) for special development problem, and to enable proper utilization of earlier U.S. infrastructure, etc., assistance;
(vi) for program of urban development, especially small labor-intensive enterprises, marketing systems, and financial or other institutions to help urban poor participate in economic and social develo

Project is technical cooperation with a regional entity to stimulate resource development and conservation for each of the participating governments of ESCAP; U.S. private technology is an integral element of the U.S. assistance and will be used for diffusion of economic development related skills.

107

c. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or has the latter cost-sharing requirement been waived under Sec. 124(d) "relatively least-developed" country)?	Member participants will contribute over 50% of funds required for the Project.
d. FAA Sec. 110(b). Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing or is recipient country "relatively least developed?"	No.
e. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual development; and supports civic education and training in skills required for effective participation in governmental and political processes essential to self-government.	The Project reflects the desires of participating governments of ESCAP to acquire necessary skills in new satellite technology related to resource development and management. It will support the development efforts of each participating government and will add to the skills of the participants.
f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?	By upgrading satellite technology related skills, the Project is expected to stimulate resource development and management such that the participating governments will be better able to sustain themselves and to promote their economic development.

CHECKLIST OF STATUTORY CRITERIA

STANDARD ITEM CHECKLIST

A. PROCUREMENT	A. PROCUREMENT
1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of goods and services financed?	Yes.
2. FAA Sec. 604(a). Will all commodity procurement financed be from the U.S. except as otherwise determined by the President or under delegations from him?	Yes.
3. FAA Sec. 604(d). If the cooperating country discriminates against U.S. marine insurance companies, will agreement require that marine insurance be placed in the U.S. on commodities financed?	Yes.
4. FAA Sec. 604(e). If offshore procurement of agricultural commodity or product is to be financed, is there provision against such procurement when the domestic price of such commodity is less than parity?	Yes.
5. FAA Sec. 608(a). Will U.S. Government excess personal property be utilized wherever practicable in lieu of the procurement of new items?	Yes.
6. FAA Sec. 603. Compliance with requirement in Sec. 901(b) of the Merchant Marine Act of 1936, as amended, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent that such vessels are available at fair and reasonable rates.	Yes.

104:

7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished to the fullest extent practicable as goods and professional and other services from private enterprise on a contract basis? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

Yes.

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will provision be made that U.S. flag carriers will be utilized to the extent such service is available?

Yes.

9. FY 79 App. Act Sec. 105. Does the contract for procurement contain a provision authorizing the termination of such contract for the convenience of the United States?

Yes.

B. CONSTRUCTION

B. CONSTRUCTION

1. FAA Sec. 601(d). If a capital (e.g., construction) project, are engineering and professional services of U.S. firms and their affiliates to be used to the maximum extent consistent with the national interest?

Yes.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

Yes.

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed $100 million?

Not applicable.

C. OTHER RESTRICTIONS	C. OTHER RESTRICTIONS
1. FAA Sec. 122(e). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter?	Yes.
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights?	Not Applicable
3. FAA Sec. 620(h). Do arrangements preclude promoting or assisting the foreign aid projects or activities of Communist-bloc countries, contrary to the best interests of the U.S.?	Yes.
4. FAA Sec. 636(i). Is financing not permitted to be used, without waiver, for purchase, long-term lease, or exchange of motor vehicle manufactured outside the U.S. or guaranty of such transaction?	Yes.
5. Will arrangements preclude use of financing:	Yes.
a. FAA Sec. 104(f). To pay for performance of abortions or to motivate or coerce persons to practice abortions, to pay for performance of involuntary sterilization, or to coerce or provide financial incentive to any person to undergo sterilization?	Yes.
b. FAA Sec. 620(g). To compensate owners for expropriated nationalized property?	Yes.
c. FAA Sec. 660. To finance police training or other law enforcement assistance, except for narcotics programs?	Yes.

111/112

d. FAA Sec. 662. For CIA activities?	Yes.
e. FY79 App.Act Sec. 104. To pay pensions, etc., for military personnel?	Yes.
f. FY79 App.Act Sec. 106. To pay UN assessments?	Yes.
g. FY79 App.Act Sec. 107. To carry out provisions of FAA Sec 209(d) and 251(h)? (Transfer to multilateral organizations for lending.)	Yes.
h. FY79 App Act Sec. 112. To finance the export of nuclear equipment, fuel, or technology or to train foreign nationals in nuclear fields?	Yes.
i. FY79 App.Act Sec. 601. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?	Yes.

PROJECT AUTHORIZATION AND REQUEST FOR ALLOTMENT OF FUNDS

PART II

COUNTRY: ASIA REGION

PROJECT: Asian Remote Sensing Training Center

NUMBER: 498-0253

Pursuant to Part I, Chapter I, Section 106 of the Foreign Assistance Act of 1961, as amended, I hereby authorize a Grant to the Asian Institute of Technology (A.I.T.) in Bangkok, Thailand, of not to exceed Three Million Two Hundred and Ten Thousand United States Dollars ($3,210,000) (the "Authorized Amount") to help in financing certain foreign exchange and local currency costs of goods and services required for the Project as described in the following paragraph:

The Project is designed to establish an Asian Remote Sensing Training Center with the capacity to: (1) provide training to technicians from full and associate member countries of the Economic and Social Commission for Asia and the Pacific (ESCAP), (2) demonstrate the usefulness of remote sensing in development planning, as well as resource management and weather forecasting, and (3) provide specific planning data derived from remote sensing, as requested by Asian development agencies. It is intended that by the project assistance completion date the Asian Remote Sensing Training Center will have become an integral part of A.I.T., as an internationally recognized program being utilized by ESCAP countries.

I approve the total level of A.I.D. appropriated funding planned for this Project of not to exceed Five Million Six Hundred Thousand United States Dollars ($5,600,000) of which the additional increment(s) of up to $2,390,000 for certain other foreign exchange and local currency costs will be grant funded during the period FY 1979 to 1985, subject to the availability of funds in accordance with A.I.D. allotment procedures, and subject to satisfactory results of an evaluation to be completed six months prior to the end of Year 3.

I hereby authorize the initiation of negotiation and execution of a Grant Letter of Agreement between USAID/Thailand and A.I.T. by the Officer to whom such authority has been delegated in accordance with A.I.D. regulations and Delegations of Authority, subject to the following essential terms and major conditions together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin Of Goods and Services

Except for ocean shipping, goods and services financed under the Grant shall have their source and origin in Thailand or in the United States, except as A.I.D. may agree in writing. Ocean shipping financed under the Grant shall be procured in the United States, except as A.I.D. may otherwise agree in writing.

b. Nationality Positive List

The Grant Letter of Agreement between USAID/Thailand and A.I.T. shall include a nationality positive list which includes all those full and associate ESCAP member countries eligible for A.I.D.-funded scholarships for short-term training.

c. Conditions Precedent for Grant Disbursement Other Than For Equipment Procurement Advisory Services

1. Evidence that A.I.T. has made arrangements to secure and maintain adequate mainframe computer capacity to service project requirements.

2. Evidence of firm commitments and agreements between A.I.T. and the National Research Council (NRC) of the Royal Thai Government (RTG) detailing the services each is to provide the other, including quantification (e.g. number of images to be computer enhanced by A.I.T. and number of copies of photo reproduction to be processed by NRC), timing, and costs to be charged, if any.

d. Blanket Waiver to Code 941.

On the basis that costs of international travel and seminars to be conducted within participating countries will involve certain foreign exchange costs in countries included in A.I.D. Geographic Code 941; Provided however, that the United States Dollar value of all such expenditures does not exceed $50,000.

John H. Sullivan
Assistant Administrator
Bureau for Asia