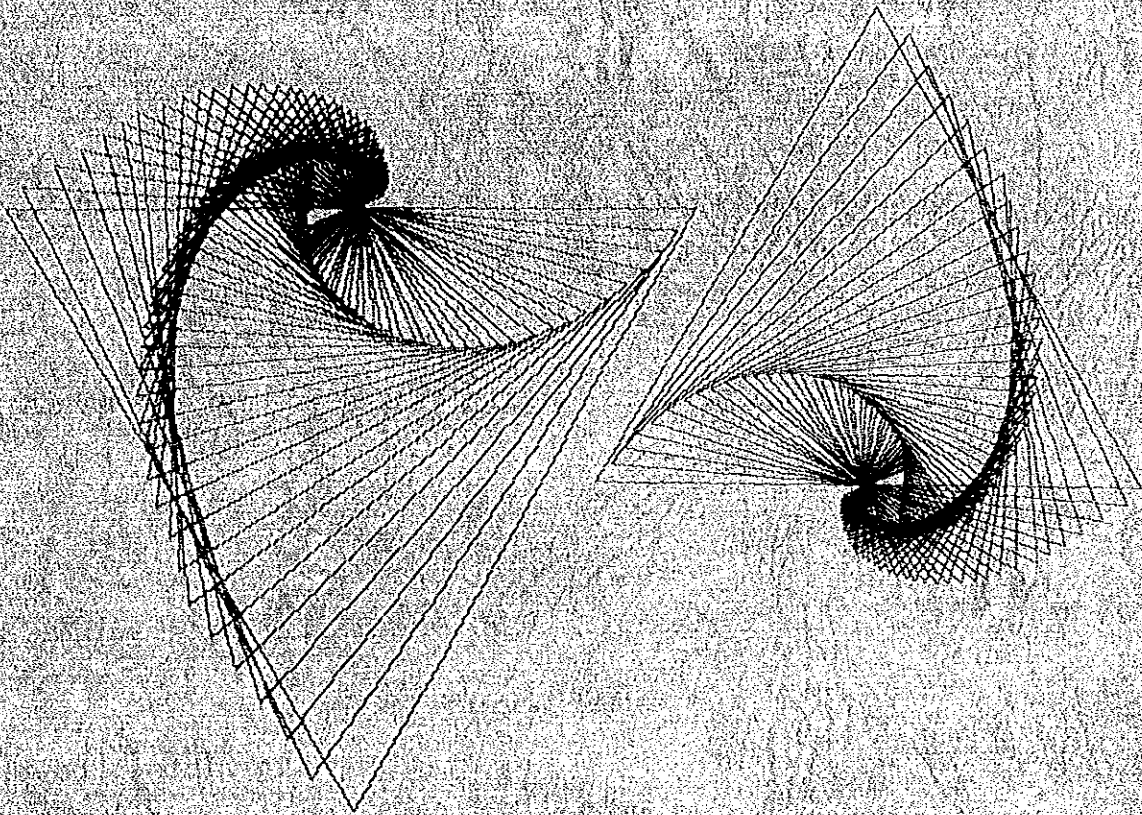


REMOTE SENSING ENGINEERING PROJECT
FOR DEVELOPMENT
OF AGRICULTURAL INFRASTRUCTURE
(REPUBLIC OF INDONESIA)



March 1989

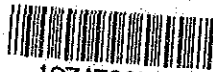
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PREFACE

The Project-type Technical Cooperation is an integrated form of cooperation whose aim is to realize technology transfer to relevant personnel of the project in the recipient country, by effectively combining such assistances as dispatch of experts, training of counterparts in Japan, and supply of equipment as required. It is intended to assure smooth and systematic implementation of technical cooperation program through planning, implementation and evaluation.

The duration of cooperation is usually about five years. When the project is actually commenced, a variety of survey teams and experts are dispatched to the recipient country, preparing work reports.

This case study of Project-type Technical Cooperation has been compiled originally in Japanese, then translated into English, based upon a number of these reports prepared at each stage of planning, implementation and evaluation of the project.

We would be pleased if it would be of some usefulness as reference material for those who are interested in our technical cooperation.

March 1989

Director
Institute for International Cooperation
Japan International Cooperation Agency (JICA)

CONTENTS

Outline of the Project	i
Map of the Project Site	iii
Outlined Schedule of the Project	v
Brief History of the Project	vii
1. REQUEST FOR COOPERATION	1
1-1 Background of the Request	1
1-2 Contents of the Request	2
2. DISCUSSION OF THE PROJECT'S IMPLEMENTATION	4
2-1 Dispatch of Implementation Survey Team	4
2-2 Activities for the Project's Implementation	4
2-3 Project Implementation System on the Indonesian Side	7
3. PROGRESS OF THE PROJECT'S IMPLEMENTATION	9
3-1 Contents of Activities	9
3-2 First Evaluation	10
3-3 Problems in Implementing the Project	18
3-4 Changes in Implementation Schedules and their Contents	20
4. RESULTS OF THE PROJECT AND EVALUATION	22
4-1 Activities in the Project	22
4-2 Attainment of the Project's Objectives	25
APPENDICES	
1. The Record of Discussions (R/D)	29
2. List of Main Machinery and Equipment Granted	36

Outline of the Project

The Government of the Republic of Indonesia, in promoting its policy of transmigration and agricultural development, requested technical cooperation from Japan regarding remote sensing engineering, with a view to making it easy to select potential areas for the development of an agricultural infrastructure.

In April 1980 a project was started for establishing remote sensing technology at the Center for Data Processing and Statistics, in the Ministry of Public Works. The project was managed by the head of the center and the project manager, under the control of the Undersecretary of Ministry of Public Works. With the reorganization of the Ministry, the Remote Sensing Section was established. A joint committee was set up when the Project was started. The committee discussed project management and planned activities pertaining to the Project, thus playing a leading role in promoting the Project.

The major objectives of the Project were to analyze and process, on a computer, remote sensed data from satellites and aircraft, as well as existing materials and the results of field surveys; to make maps of various kinds; to develop a system for drawing charts to be used in evaluating the selection of potential areas for the development of an agricultural infrastructure; and to transfer the technology to the Indonesian personnel concerned.

Technical cooperation under the Project was planned to last five years at first, but it actually lasted seven years, including a two year follow-up period. It was finished at the end of March 1987.

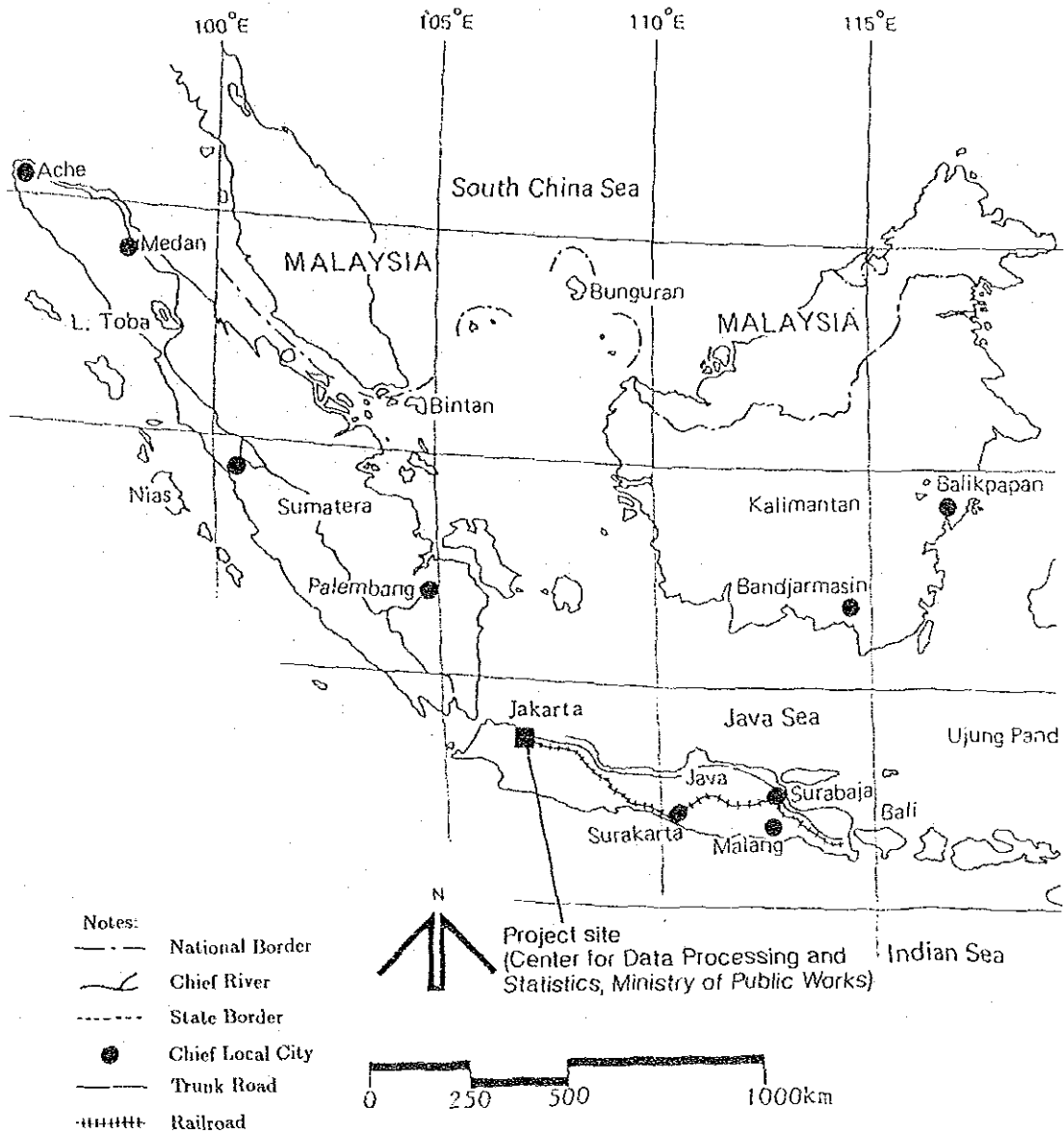
The Government of Japan conducted the following items during this period.

- (1) Provision of a main computer and its peripheral equipment
- (2) Dispatch of long-term experts and short-term experts in various fields
- (3) Training of Indonesian personnel in Japan
- (4) Development of a remote sensing method for selecting potential areas for the development of an agricultural infrastructure, and transfer of this technology to the Indonesian personnel concerned

The Government of the Republic of Indonesia conducted the following, and the Project went smoothly on the whole.

- (1) Construction of a building for the Project
- (2) Organization and manning
- (3) Management of the Project
- (4) Securing of a budget for the Project and execution of the budget

Map of the Project Site



Outlined Schedule of the Project

Country: The Republic of Indonesia
 Project: Remote Sensing Engineering Project for the Development of an Agricultural Infrastructure
 Date of request: October 1977
 Date of signing the Record of Discussions: 16 February 1980
 Period covered by the Record of Discussions: 1 April 1980 to 31 March 1985
 Period covered by the follow-up activity: 1 April 1985 to 31 March 1987

Year	1980	1981	1982	1983	1984	1985	1986
Connection with grant aid cooperation	(not linked)						
Dispatch of survey teams	Mutual consultation by four members: 7 to 20 November	Technical guidance by four members: 16 to 25 March	Technical guidance by four members: 24 February to 5 March	Technical guidance by five members: 13 to 28 September	Evaluation by four members: 24 October to 10 November	Technical guidance by three members: 5 to 13 September	Technical guidance by three members: 17 to 24 March
Dispatch of experts							
1) Long-term assignment							
Leader		6/19		6/18			3/30
Agricultural development		4/2			4/1		
System planning		6/13		9/12	3/23		3/20
Coordinator			5/18	8/12		5/17	4/1
2) Short-term assignment						5/5	5/4
Hardware	8/13 9/3	8/13 9/3 1/20 2/19		9/25 10/9		1/11 1/30	
Software		1/20 2/4 3/31					
System development		2/14 2/28					
Data processing			1/11 2/15		3/24 4/4	9/5 9/13	
Regional planning			1/11 4/24	9/9 11/7	3/1 3/31	11/22 2/19	
Agricultural development			1/28 3/27	8/5 10/4 1/5 3/4	6/2 7/30	10/16 12/14	
System evaluation			3/11 4/10		9/10 9/30	10/16 1/14	
Training in Japan		3 4	1/10 3/19				
Equipment maintenance			4/15 7/20				
Remote sensing technology			4/10 6/12	4 8 10 2 3 6		9/29 11/17	6/12 8/18
Regional planning				4 8		9/29 11/30	8/12 11/8
							9/9 12/7
							10/25 12/6

Brief History of the Project

1977	The Government of the Republic of Indonesia requested technical cooperation from Japan.
November 1978	The Government of Japan dispatched preliminary survey team for technical cooperation planning.
1979	The Government of Indonesia started its third five-year development plan.
February 1980	The Japanese Implementation Survey Team signed the Record of Discussions.
April 1980	The Remote Sensing Engineering Project was started. The Government of Indonesia started construction of a building for the Project.
November 1980	The Government of Japan made preparations for the provision of equipment and materials. The Government of Japan dispatched mutual consultation team, which made arrangements for the Project's implementation and had discussions on the management of the Project.
March 1981	The Government of Japan received the first trainees (senior class) in accordance with the Record of Discussions.
April 1981	The Government of Japan began dispatch of experts in accordance with the Record of Discussions.
December 1981	Installation of equipment was completed, and activities for the project were started after test running of the equipment.
March 1982	The Government of Japan dispatched the first technical guidance team, which made surveys and arrangements, and held seminars on project-related technology.
February 1983	The Government of Japan dispatched the second technical guidance team, which made surveys and arrangements in order to understand the progress of the Project and the problems pertaining to the Project.
September 1983	The Government of Japan dispatched the third technical guidance team which studied managerial problems and had discussions on project implementation plans for the R/D period.
October 1984	The Government of Japan dispatched the evaluation team, which evaluated the results of the Project's implementation.
February 1985	The Governments of Japan and Indonesia signed the Record of Discussions in order to extend the period of cooperation, taking into consideration the results of the evaluation.
September 1985	The Government of Japan dispatched the fourth technical guidance team, which created a detailed plan of activities.
March 1987	The Government of Japan dispatched the last evaluation team.
End of March 1987	The Project was completed; the experts returned to Japan.

1. REQUEST FOR COOPERATION

1-1 Background of the Request

In 1977, the Government of the Republic of Indonesia was executing its Second Five-year Development Plan (1974 through 1978), with the target of increased production and self-sufficiency in food.

The territory of the Republic of Indonesia includes five large islands as well as archipelagos comprising more than 13,000 smaller islands. The total area is 1,920,000 square kilometers, which is 5.5 times the size of Japan. An immense archipelago, the country extends over 5,000 kilometers from East to West.

Cultivated land, however, accounts for only 10% of the total area. Most of the islands are either marshy (covered with tropical forests) or mountainous.

The total population of the country was 130,000,000 (1977 estimation). About half of the population lives in Java, raising considerably the island's population density and resulting in consequent underpopulation of the other islands.

The number of jobholders in the agricultural sector accounts for 65% of the total job population, which illustrates that the Republic of Indonesia is an agricultural country. The scale of farming is extremely small; farmers cultivating land not exceeding 0.5 hectare in area account for 65%, and it is estimated that the number of agricultural workers and their family reaches some 40,000,000.

One of the basic objectives of Indonesia's farming policy is to increase income for farmers. Though it will be very difficult to raise the income of those ultra-small farmers, increased income plays an important role for making people's lives more secure.

Agricultural development has been one of Indonesia's policies actively promoted in order to not only attain increased production and self-sufficiency in food, raise income of farmers, and create job opportunities, but also to provide food for the population to increase naturally, and to deal with problems caused by farmland being abandoned as a consequence of economic development.

Settlement in islands other than Java has been another important policy that has been actively promoted by the government as a measure for solving the overpopulation problem on Java and the problems of the ultra-small farmers.

In order to promote these policies, the Government of Indonesia first needs to select land suitable for agricultural development and then provide good conditions for settlement. However, there is little information about land and other natural resources in Sumatra, Kalimantan, Sulawesi, and Irian Jaya, all of which contain extensive undeveloped regions.

The Ministry of Public Works is responsible for preparing an infrastructure for public works. With the expansion of its undertakings, it has become more and more important for the Ministry to collect data for map making in order to implement various projects as well as to draw thematic maps for regional development planning. The Ministry has a map making section which is working with cooperation from the Netherlands. For thematic mapping, the Government of Indonesia has tried to introduce remote sensing technology, with a view to economically and efficiently collecting and analyzing information for the promotion of increased food production

(an important issue in the country's economic development plan) and for assisting the country's agricultural development plan (important as the basis of the country's settlement plan).

In October 1977, the Government of the Republic of Indonesia requested technical cooperation from Japan, in order to establish a surveying method for selecting potential areas for the development of an agricultural infrastructure using remote sensing technology. In response to the request, the Government of Japan dispatched a preliminary survey team through the Japan International Cooperation Agency (JICA) for 12 days from 17 November 1978. The team studied possibilities for technical cooperation in this field.

1-2 Contents of the Request

The team collected basic data and materials through Landsat and aerial photography (using multiband cameras), and through field surveys. The Government of Indonesia requested technical cooperation wherein a system would be established for making various thematic maps for agricultural development and evaluation maps for selecting land suitable for such development, involving image processing of collected and existing data. The process of the technical cooperation given is shown in Fig. 1.

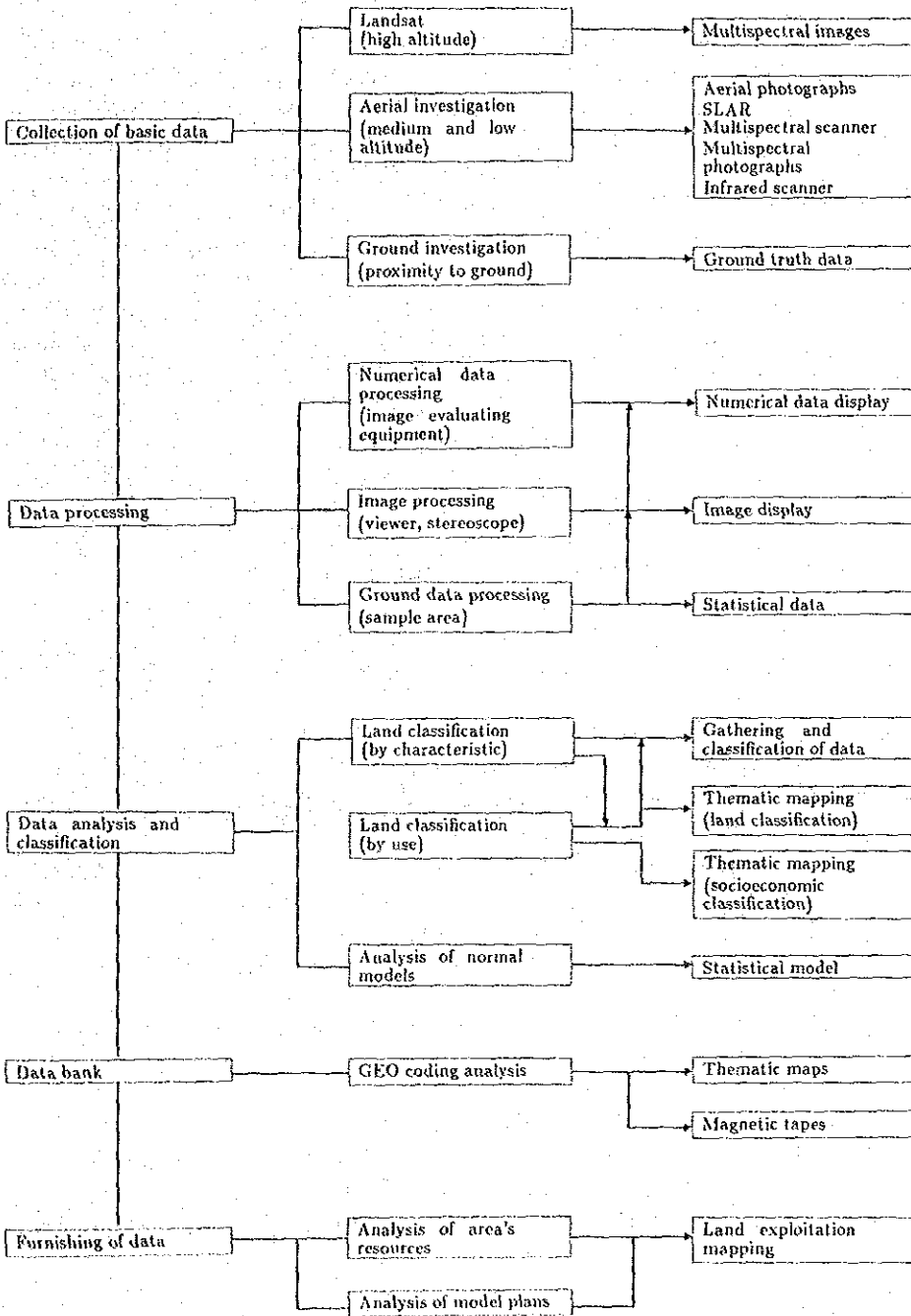
The Government of Indonesia requested that the following be conducted as a five-year project.

- (a) Orientation by the Japanese side concerning the Remote Sensing Engineering Project
- (b) Installation of equipment
- (c) Training of Indonesian experts
- (d) Application and execution of remote sensing technology

As for the training of remote sensing engineers pertaining to the Project, the government requested that ten engineers be trained in five years and that six engineers receive training in a remote sensing technology training course.

The Government of Indonesia planned to make the Mapping Center (belonging to the Center for Data Processing and Statistics, which was under the direct control of the Minister of Public Works) responsible for the Project. The Mapping Center comprised 42 personnel, of whom seven were engineers and three were remote sensing experts.

Fig. 1 Methods Applied



2. DISCUSSION OF THE PROJECT'S IMPLEMENTATION

2-1 Dispatch of Implementation Survey Team

Taking into consideration the background of the request and studying whether technical cooperation was possible, the Government of Japan examined conditions, in cooperation with the Government of the Republic of Indonesia, for implementing the Project. As a result of the surveys, the preliminary study team dispatched from Japan concluded that it was possible for the Government of Japan to extend cooperation for the Project and that this technical cooperation would meet Indonesian expectations.

JICA dispatched an implementation survey team for 20 days from 30 January 1980. The team discussed the contents of the technical cooperation and matters concerning implementation of the Project (such as the respective responsibilities of each country) with the Government of the Republic of Indonesia, the Ministry of Public Works, and the other organizations concerned. An agreement was reached, and the team and the authorities concerned of the Government of Indonesia signed the Record of Discussions on 16 February 1980. The Project began on 1 April that year.

2-2 Activities for the Project's Implementation

The following were activities necessary for the establishment of remote sensing technology aimed at selecting potential areas for the development of an agricultural infrastructure.

- (1) Development of a remote sensing system and its management
- (2) Collection of data from Landsat and aircraft
- (3) Development of analogue and digital analysis methods
- (4) Preparation of thematic maps and evaluation maps
- (5) Field surveys in case study areas
- (6) Establishment of a multistage survey method for selecting potential areas for the development of an agricultural infrastructure
- (7) Improvement of the capability of Indonesian personnel who were to take charge of survey planning.

Accomplishment of these activities required the following:

- (1) Dispatch of Japanese experts
- (2) Furnishing of materials and equipment
- (3) Training of Indonesian personnel in Japan
- (4) Establishment of remote sensing technology for agricultural development

Construction of a building and installation of equipment were actually started in the second year of the Project. Table 1 shows a program for the Project's implementation.

Table 1 Tentative Implementation Plan of Technical Cooperation for Remote Sensing in Republic of Indonesia

	1st year (1980 - 1981)	2nd year (1981 - 1982)	3rd year (1982 - 1983)	4th year (1983 - 1984)	5th year (1984 - 1985)
	Oct. Nov. Dec. Jan. Feb. Mar.	Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar.	Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar.	Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar.	Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar.
Japanese experts	Team leader				
	Agri. development				
(long term)	System planning				
	Liaison				
(short term)		hard soft regional data processing	hard data processing soft regional aerial plate agronomy	hard aerial photo regional soft data P. regional agronomy	hard soft aerial photo regional agronomy
Hardware installation		analogue digital	expansion	expansion	expansion
Ground survey	Training area	-----	-----	-----	-----
	Case study area	-----	-----	-----	-----
Data acquisition		LANDSAT film & CCT existing data & maps	CCT IR color existing data, & maps	CCT IR color existing data & maps	CCT IR color data map
Study of image data processing method		1st stage analogue LANDSAT film	2nd stage digital LANDSAT CCT	3rd stage analogue & digital Aerial photo	4th stage analogue & digital IR color
Establishment of image data processing method		1st stage	2nd stage	3rd stage	4th stage
Production of thematic and evaluation map		1st stage if necessary	2nd stage	3rd stage if necessary	4th stage Review
Selection of suitable area for development		1st stage	2nd stage	3rd stage	4th stage Review
Establishment of multistage survey technique		1st stage	2nd stage	3rd stage	4th stage 1st - 4th stage overall
Training acceptance	hard 2 Person observation 1	soft (long term) 1 Person hard 2 Person observation 1	soft 1 soft (short term) 3	soft 1 soft 3	soft 1
Holding joint committee meeting		institution	summarization of 2nd year	summarization of 3rd year	summarization of 4th year final summarization

2-3 Project Implementation System on the Indonesian Side

2-3-1 Building for the Project

Regarding a building for the Project, the Government of Indonesia at first considered taking lease on a private building. The government eventually decided to construct a new building for the Project and construction work was started in September 1980. Fair progress was made and the building was completed in March of the following year.

The building was located between the main building of the Ministry of Public Works and the Calculation Center. The building was one-story with a semibasement, in consideration of environmental conditions. Planned to exclusively for remote sensing, the building had a total area of 520 square meters. It was conveniently located and its dimensions were adequate for implementing the Project.

Rooms in the building were arranged so that the digital image processing equipment could be used efficiently in the future and so that experts dispatched from Japan and Indonesian counterpart personnel could work smoothly.

The Government of Indonesia constructed a free access floor for the digital equipment room at its own expense.

JICA in the meantime had been preparing for the Project's implementation with activities such as selecting equipment to be furnished. JICA dispatched the mutual consultation team in November 1980, in order to have them make arrangements with the Indonesian personnel concerned regarding construction work, adjustment of schedules, future management of the Project, etc.

2-3-2 Project Implementation System

The recipient organization of this technical cooperation was the Center for Data Processing and Statistics of the Ministry of Public Works.

The Center had three sections, namely the information processing section, the statistics section, and the mapping section. The Project was managed in one section independent of these three sections in terms of organization and budget. The head of the Center for Data Processing and Statistics administered the Project, under the control of the Undersecretary of Public Works. The deputy head of the Center was the project manager.

The Center for Data Processing and Statistics was involved in efforts to prepare for the Project; the Center anticipated the establishment of remote sensing technology and early utilization of it, making use of analogue and digital equipment and technical assistance to be furnished by Japan. The Center was in consultation with other general bureaus of the Ministry of Public Works (the Water Resources Bureau, the Highways Bureau, and the Housing and City Development Bureau) regarding application of remote sensing technology. Engineers from the Center were dispatched to various countries to receive training in remote sensing technology.

According to information from the Ministry of Public Works, the Steering Committee (consisting of personnel from the Ministry organizations concerned universities, LAPAN, BAPPENAS, and BAKOSURTANAL) planned to extend cooperation for managing the Project.

LAPAN constructed a ground station in Jakarta to receive data from Landsat.

2-3-3 Budgeting

Regarding local costs for the Project's implementation, in preliminary discussions the Government of Japan requested that the Government of the Republic of Indonesia bore a reasonable amount of the expense for items such as maintenance costs and expenses for ground surveys. The following was a planned budget to be born by the Government of Indonesia.

Item		
Data Acquisition	432 thou. dollars	268 mill. Rp
Ground Survey	60	37
Hardware Installation	20	12
System Mgt Cost	268	166
Software Licence Fee	114	71
Thematic/Eval. Map. Comp.	40	25
Total (five years)	934	579
Mean (one year)	186.8	116

Working expenses for fiscal 1980 was 89 million rupiahs (143 thousand dollars). Since the requested budget for fiscal 1981 was 280 million rupiahs (443 thousand dollars), the Government of Indonesia was able to pay the expenses anticipated for fiscal 1981.

3. PROGRESS OF THE PROJECT'S IMPLEMENTATION

3-1 Contents of Activities

After seven years (including a two year extension), the Project was completed and technical cooperation under the Project ended. During this period, the Government of Japan dispatched eight long-term experts as well as some short-term experts for the development of technology and to give guidance, in order to establish a method for selecting potential areas for the development of agricultural infrastructure using remote sensing. Since creation of such a method required the accumulation of information analysis technology and operation technology developed in various fields, short-term experts from a wide range of technical fields were asked to give assistance in implementing the Project.

Activities of these short-term experts were classified as follows.

- 1) Maintenance and management of hardware
- 2) Software and operation
- 3) Methods for making thematic maps for various fields
- 4) Methods for making evaluation maps of potential areas for the development of an agricultural infrastructure

The contents and results of the experts activities were compiled in their respective reports. In their activities, the experts gave technical guidance and transferred technology to the Indonesian personnel concerned.

Since the Project was a technical cooperation project, the Government of the Republic of Indonesia was responsible for constructing the necessary building and facilities.

Regarding buildings, the Government of Indonesia started construction of a new building on the premises of the Ministry of Public Works, adjacent to the building of the Center for Data Processing and Statistics, in September 1980. The new building was completed in March of the following year.

Digital image processing equipment, the nucleus of remote sensing technology, was transported from Japan during September into October 1981, in accordance with arrangements made by the arrangement team. Concurrent with the dispatch of long-term and short-term experts, machinery and equipment were installed and underwent trial runs. Indonesian counterpart personnel received training and activities pertaining to the Project were begun.

The Government of the Republic of Indonesia conducted electrical installation, water supply and drainage work, and procured office furniture for the Project. The Government of Japan furnished only machinery and equipment. It neither prepared the infrastructure nor conducted emergency work for the building and facilities. The building had a problem concerning drainage because of its semibasement; the building was flooded once through the outer wall. This problem, however, was solved by the Government of Indonesia.

Power stoppages during the time the computer was in operation were the problem that affected management of the Project most. Though it was said that power stoppages in Jakarta were less frequent than in the past, power supply was often stopped. We could find no effective measure to solve the power failure problem.

3-2 First Evaluation

Four years and seven months were spent (after the Project was started in accordance with the Record of Discussions signed on 16 February 1980) for developing a method for selecting potential areas. Using remote sensing technology to identify them these areas are to be used in the development of an agricultural infrastructure and for transferring the developed technology to Indonesian counterpart personnel. The remaining period of technical cooperation under the Project was five months.

In the last year of technical cooperation under the Project, JICA dispatched an evaluation team headed by Mr. Yuichiro Kawajiri (Director of the Tone River Basin Irrigation Survey Office, the Kanto Agricultural Administration Bureau of the Ministry of Agriculture, Forestry, and Fisheries) for 18 days from 24 October through 10 November 1984. The team evaluated the activities under the Project in cooperation with the Indonesian evaluation team headed by Drs. Soekrisno (Director of the International Cooperation Bureau, the Ministry of Public Works). The teams discussed future problems and measures to prevent them, and gave recommendations to the Governments of Japan and the Republic of Indonesia. The teams evaluation was as follows:

(1) Development of remote sensing technology and management of it

i) Implementation schedule

Including an important alteration wherein the multistage survey method was changed from four-stage to three-stage at the first joint committee in 1981. Field surveys and data collection were conducted according to this alteration. The teams considered these changes in the schedule to have been appropriate, as will be referred to later. Actual activities pertaining to the Project revealed that it had taken more time to make thematic maps and to develop a method of selecting potential areas for the development of agricultural infrastructure than had been anticipated in the original plan. The teams regarded this fact as natural in view of the Project's implementation.

ii) Furnishing of equipment

Pieces of equipment furnished were as follows:

- a) Digital image processing system 19 subsets
- b) Analogue image processing system 10 subsets
- c) Analogue image reading system 4 subsets
- d) Equipment for field surveys 7 subsets
- e) Other pieces of equipment 8 subsets

(including copying equipment, projector, and word processors)

The teams judged that these pieces of equipment had been furnished by the Government of Japan at the appropriate time and in good condition. The teams concluded, after inspecting the system so far developed, that further furnishing of equipment might become necessary.

iii) Development of systems

a) Analogue analysis system

The teams judged that the necessary equipment and software had been prepared for attaining the objectives of the Project. The equipment and software were able to satisfactorily deal with the color image production necessary in the first stage of the multi-stage surveying.

However, operation manuals of the pieces of equipment must be systematic and easy to understand.

b) Digital analysis system

The necessary pieces of equipment had already been furnished excluding preparation of systematic software. Easy-to-understand systematic operation manuals had to be prepared, as was the case with the analogue analysis system. It was necessary for counterpart personnel to continue receiving good training.

iv) Systems management

As for the maintenance of the equipment, there was a maintenance agreement concluded for the IBM computer system; the system was kept in good condition. The analogue image processing system was also kept in good condition by the counterpart personnel. However, regarding other pieces of equipment such as the photocopier, drum scanner, and color display, there were no maintenance agreements; they were maintained by short-term experts from Japan. The teams judged that it was necessary for Indonesian personnel to receive training in maintaining these pieces of equipment as well.

v) Technology transfer to Indonesian personnel

Most of the Indonesian personnel concerned were able to operate a general-purpose computer, color display, color viewer, etc. Some of them were able to operate analogue analysis equipment and an X-Y plotter. Though everyone did not need to be able to operate all the equipment completely, further training was necessary. It seemed especially necessary for them to become familiar with and responsible for the maintenance of the pieces of equipment furnished from Japan.

In operating systems pertaining to the Project, systems that required highly systematic technology, the personnel concerned needed to make decisions in due consideration of the characteristics of and situations in the target areas. Such decision making included selection of thematic maps and establishment of a standard of evaluation. The teams judged that technology transfer must be done properly, including technology transfer concerning software development.

(2) Collection of data from Landsat and aircraft

i) Implementation plan

The original plan included the obtaining of Landsat films of Java and Sumatra, CCT of the training area and case study areas, and infrared aerial color photographs. Collection of available data (including those of areas that became necessary with the alteration of the plan) was completed.

ii) Data collection

Collected data were as follows: 65 scenes and 74 chips of Landsat CCT, infrared aerial color photographs, and aerial photographs including monochromes. A ground station in Indonesia started receiving and processing images from Landsat in April 1984, and was provided with new CCT data.

Indonesia was able to continue obtaining CCT data from Landsat, and hence the teams judged that the system had become more promising.

iii) Technology transfer to Indonesian personnel

Data were mostly collected by Indonesian personnel. The short-term experts from Japan gave guidance in infrared aerial color photography. Judging from the situation at the time, technology transfer in this field was nearly complete. There remained the necessity of improvement of certain technical capabilities such as changing data from various sources into standard formats.

(3) Development of analogue and digital analysis methods

i) Analogue analysis method

a) Implementation plan

According to the plan, the first stage included general surveys of target areas using analogue analysis of film images (1:500,000) from Landsat. The third stage included close examination of target areas using the reading of infrared aerial color photographs (1:50,000). Since analogue analysis applied in the first and the third stages was still necessary at the time the teams conducted the first evaluation, they judged that the plan was appropriate.

b) Development of methods

The following were developed as analogue analysis methods in the first stage. They produced satisfactory results.

- 1) Quick look on an additive color viewer
 - 2) General survey of the entire target area through quick look mentioned in 1) above
 - 3) Analysis by reading images on the color viewer using hard copies
 - 4) Superimposition of enlarged negatives
- Analysis in the third stage, however, had not yet to be conducted at this point.

c) Technology transfer to Indonesian personnel

All the personnel concerned were able to operate and read the additive color viewer. Some of them were able to conduct superimposition. Technology transfer was satisfactory at this stage for first-stage survey methods.

Again it was necessary to prepare systematic operation manuals which were easy-to-understand.

ii) Development of digital analysis methods

a) Implementation plan

Software to be developed for the purpose of making thematic and evaluation maps, as well as supporting such map making, including three types—LARSYS, ARIS, and software developed by the experts. Development was conducted in accordance with the original plan. The software developed by the experts was named "EPOC".

The entire system was named "PRESS" (an acronym for "Productive Remote Sensing System"), as shown in Fig. 2.

b) Development of methods

In addition to LARSYS and ARIS (basic software for image processing), long-term and short-term experts together developed thematic map-making software including the following.

- Software for land cover map making
- Software for biomass evaluation map making
- Software for soil color map making
- Software for soil moisture map making

For evaluation map making, software for making evaluation maps by means of the PATTERN method, and evaluation maps by means of the RANKING method was developed.

These items of software and basic software were put together in a total analysis system named "PRESS". One issue which needed to be resolved for the system to serve as a total system was the standardization of data formats. Preparation of standardized and systematic manuals was also necessary.

c) Technology transfer to Indonesian personnel

Most Indonesian personnel concerned became skilled in operating the digital analysis system and had a proper understanding of the theory of the system to some extent. However, many of them lacked the understanding with which to effect practical application of their knowledge. The teams judged that it was necessary for the Indonesian personnel concerned to become more capable of applying their basic knowledge of programming to practical use.

(4) Preparation of thematic maps and evaluation maps

i) Thematic map making

a) Implementation plan

Since there were no established methods for selecting potential areas for the development of an agricultural infrastructure using remote sensing at the time the Project was started, what kinds of thematic map were necessary for such selection was not well understood.

b) Preparation of thematic maps

The following nine kinds of thematic map were being made from Landsat data.

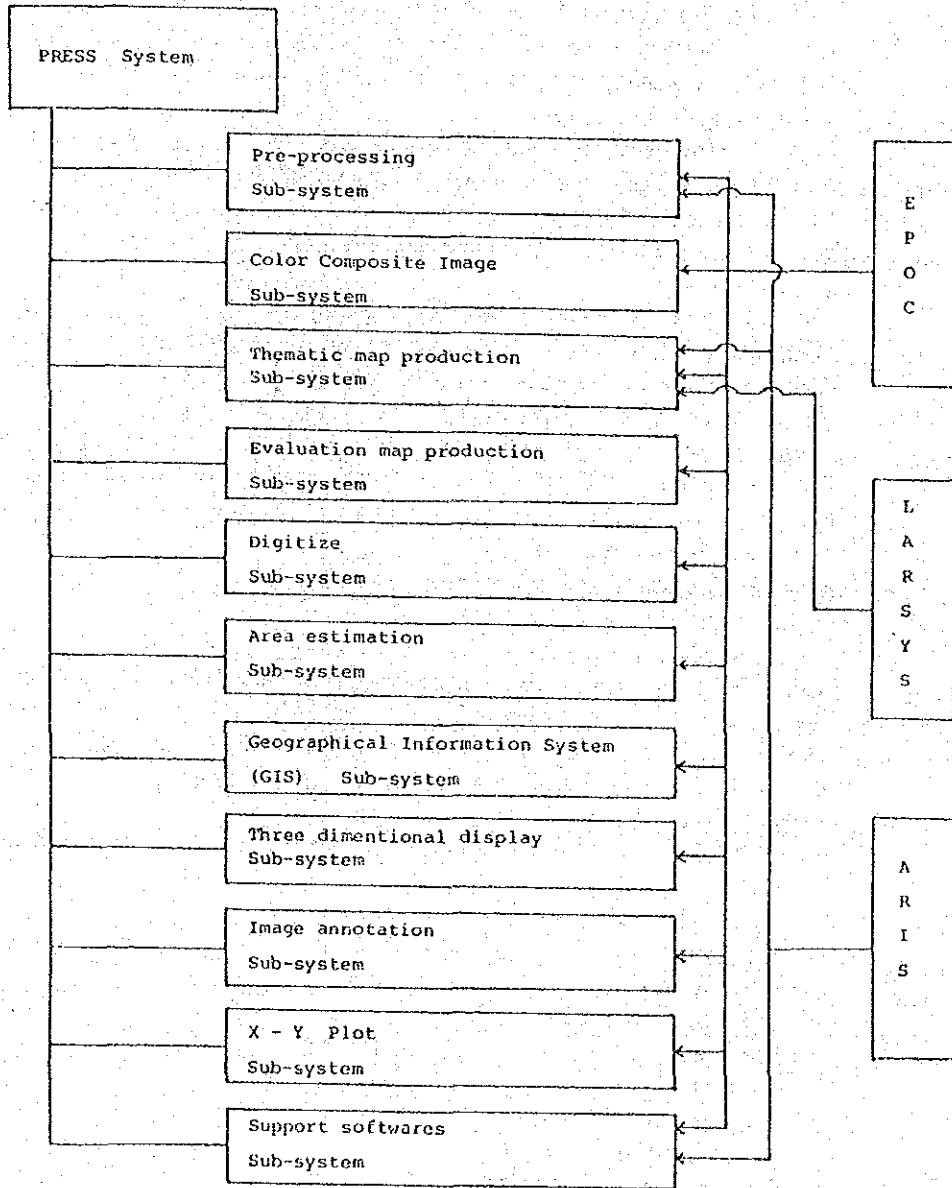
- a. False color composite map
- b. Land cover map
- c. Biomass map
- d. Soil moisture map
- e. Soil color map
- f. Geological map
- g. Topographical map
- h. Water system map
- i. Seasonal vegetation map

If, after inspection of the system, it was judged that the remote sensing system was insufficient for use in making evaluation maps for the development of an agricultural infrastructure, it would become necessary to prepare new thematic maps or revise existing ones.

c) Technology transfer to Indonesian personnel

Technology transfer to Indonesian personnel was nearly completed regarding thematic map making.

Fig. 2 Software Coverage on PRESS System



- ii) Preparation of evaluation maps
 - a) Implementation plan

In the original plan, preparation of the necessary thematic maps was not well considered, consequently methods for making evaluation maps were not defined.
 - b) Evaluation map making

By this point, the RANKING and the PATTERN methods had been developed. Application of these methods had to be established.

One evaluation map was made for North Banten and four for North Sumatra. It was necessary to evaluate these maps themselves using field surveys.
 - iii) Technology transfer to Indonesian personnel

Technology transfer was nearly completed regarding evaluation map making.
- (5) Field surveys in training areas and case study areas
 - i) Implementation plan
 - a) Implementation plan in training areas

At the first joint committee, North Banten was added to the CJC region selected in the original plan, in order to collect data through field surveys in the second and third stages for thematic map making.
 - b) Implementation plan in case study areas

In the original plan, North Sumatra was selected for the case study area however field surveys were conducted mainly in the valley of the Asahan River, in consideration of the "Project for the Development of the Asahan Valley" proposed in 1983 by the Ministry of Public Works.
- (6) Establishment of the multistage survey method for selecting potential areas for the development of agricultural infrastructure
 - i) Implementation plan

As referred to earlier, the first joint committee decided to include the fourth stage (scale: 1:10,000) in the third stage, thereby establishing a three-stage method instead of the four-stage method planned in the original plan. In view of the situation at that time and in light of the future of the Project, the teams regarded this decision as appropriate.
 - ii) Concept for selecting potential areas for the development of agricultural infrastructure

The method of selecting potential areas for the development of an agricultural infrastructure consisted of three stages. The first stage was a general investigation of target areas using analogue analysis by means of color synthetic images (1:500,000) prepared from Landsat films; the second stage was digital analysis using Landsat CCT data (1:250,000); the last stage was close investigation of target areas involving reading of photographs obtained by means of infrared aerial color photography (1:50,000).

The objective of the second and third stages of the method was to select those areas conveniently located for the development of an agricultural infrastructure, uncultivated areas which were to be developed as soon as possible, and those cultivated areas in which development of an agricultural infrastructure could be planned.

In the Project, selection was conducted from the viewpoint of conditions of location, using nine types of thematic map and other existing materials. The process of selection was as follows: first, selection of potential areas from among the target areas using field surveys, next computation of the cross total by category using thematic maps of the areas, then the making of evaluation models, and finally, the application of them to the target areas.

iii) Establishment of the multistage survey method

a) Concept of the multistage survey method

The first two stages of the multistage survey method were already established in accordance with the concept of selecting potential areas for the development of an agricultural infrastructure. As for the third stage of the method, it was planned that an analysis method using infrared aerial color photographs already taken in Indonesia would be established. By obtaining Landsat thematic mapper (TM) data instead, which were more precise than aerial photographs the establishment of the third stage could be realized through comparatively simple expansion of the second stage. However, it was not certain whether Landsat TM data could be obtained consistently in the training and case study areas, and thus it seemed more reasonable to use either infrared aerial color photographs or Landsat TM data in the third stage yet to be established.

b) Development of the method

As referred to earlier, the second stage surveying method was established as a digital analysis method. It was expected that the method be studied and that the surveying method, including the third stage, be systematized in order to serve as a method for selecting potential areas for the development of an agricultural infrastructure. Since this method could obtain very useful information for regional planning, application of it in various fields was expected, concurrent with its application in the selection of potential areas for the development of an agricultural infrastructure.

c) Technology transfer to Indonesian personnel

The Indonesian personnel concerned had a good understanding of the concept of the multistage survey method. Regarding the digital analysis method (the second stage), technology transfer was nearly completed. However, further improvement of their evaluation map-making capability and their ability to apply the method to other fields was necessary.

(7) Improvement in capability of Indonesian personnel in charge of survey planning

i) Plan for capability improvement

It was planned that the training of Indonesian personnel concerned was to be conducted through a variety of technical cooperation activities pertaining to remote sensing technology such as: receiving trainees in Japan, data collection by experts dispatched from Japan, analogue and digital analysis of data, and field surveys.

ii) Technical guidance by experts from Japan

Technical guidance by experts from Japan was conducted through operation and programming activities.

The evaluation teams regarded the number of experts and the technical fields covered by them as appropriate.

iii) Results of training in Japan

Trainees from Indonesia were received in Japan as planned. They submitted reports in order to show the results of their training. The teams were sure that training in Japan had contributed to the improved capability of the Indonesian personnel concerned.

iv) Situation of technical capability of Indonesian personnel

The teams felt highly of the improvement in the technical capability of the Indonesian personnel concerned in most fields relevant to remote sensing technology. Whether the technology in the Project took root in the Republic of Indonesia or not greatly depended on the capability of the Indonesian personnel concerned in the various fields of development. Further promotion of technology transfer therefore seemed to be necessary in order to improve their capability.

(8) The Project's operation

The teams regarded the Project's operation as appropriate on the whole.

1 Implementation system on the Indonesian side

a) The Project had been under the control of the Center for Data Processing and Statistics, a staff organization which was under the direct control of the Minister of Public Works, and which supported activities in the offices of the Ministry of Public Works. With the reorganization of the Ministry in August 1984, the center was renamed the Center for Data Processing and Mapping, and the Project became part of the organization of the Center under the name of the Remote Sensing Section. The evaluation teams regarded this fact as an indication of Indonesia's high expectations for the Project.

As for the Indonesian staff, it seemed necessary for experts in the field of land utilization planning to take part in the Project, in order to establish a method for selecting potential areas for the development of an agricultural infrastructure and in order to promote technology transfer in this field.

b) As for cooperation with the Indonesian organization concerned, the Project had a cooperation system wherein the personnel pertaining to the Project exchanged data, technology, and views with those who worked for BAKOSURTANAL (The National Geographical Authority), LAPAN (The National Aeronautics and Space Bureau), and with universities. This system already proved to be effective for the Project's implementation. Strengthening of the system would be necessary in order to make the Project take root in the country.

The joint committee created to assist in the Project's implementation was called into session once a year as planned, in order to evaluate results of activities already performed and discuss activity plans for the future.

2 Project Management System

The hardware and software systems were managed basically in accordance with the operation rules. The teams considered it necessary to strengthen the rules, through a partial revision of them.

3 Implementation and supporting system on the Japanese side

As planned, cooperation from Japan was extended involving the dispatch of experts from Japan, reception of trainees from Indonesia, and provision of equipment.

A domestic supporting committee was created as a supporting system, to study technology for selecting potential areas for the development of an agricultural infrastructure and to discuss how to make the Project take root in the Republic of Indonesia. The evaluation teams were sure that the committee contributed greatly to laying the foundations of the Project.

3-3 Problems in Implementing the Project

3-3-1 Project site

In the original plan, the Project was to be started in a government building to be constructed on the premises of the Ministry of Public Works. Economic conditions in the Republic of Indonesia, however, postponed the construction work, and construction of a new building for the Project was started instead. The construction work was completed after ten months. During this period, the main computer for the Project and its peripheral equipment were manufactured or purchased, and transported to Indonesia; upon completion of the building the necessary pieces of equipment were installed and underwent trial runs. It therefore took 22 months for actual activities pertaining to the Project to begin.

Most of this time lost before the start of activities was recovered through the efforts of the experts and strengthened support from Japan, but problems remained regarding technology transfer and the improvement of the in capability of the Indonesian personnel concerned.

For technical cooperation to be effective, besides financial assistance, an adequate period of time is necessary, in due consideration of the period needed for preparing the necessary building and facilities.

3-3-2 Management system of the Project

The Project was managed by the head of the Center for Data Processing and Statistics and the project manager, under the control of the Undersecretary of Public Works. With the reorganization of the Ministry in September 1984, the Center was renamed the Center for Data Processing and Mapping. The Project was incorporated in it and became the Remote Sensing Section.

In November 1986, the Center came under the control of the Minister regarding its organization, and under the control of the Minister's Secretariat regarding its administration (personnel affairs, budgets, and facilities), in compliance with the Minister's order. Regarding operation and planning, adjustment became necessary between the Research and Development Bureau of the Ministry of Public Works.

These changes in organization showed that the Government of Indonesia expected much of the Project and held it in high esteem. The government's attitude was reflected in the increased number of counterparts and staff members provided, and in the securing of funds for the Projects.

The Government of Indonesia requested that regional offices be established in order to strengthen the activities of the Center. Remote sensing activities were to be conducted then under the control of these regional offices, which would play an important role in data analysis, production, and sharing of information.

3-3-3 Management of equipment

Regarding the main computer, there was a maintenance agreement concluded between IBM Indonesia; a troubleshooting system was established. Annual maintenance costs amounting to 8% of the price of machinery was an enormous amount for the Government of the Republic of Indonesia to bear.

Unstable execution of the budget was sometimes a hindrance to the maintenance agreement.

For some of the machinery, including D-scan, X-Y plotter, and photograph processing equipment, maintenance agreements were concluded with local agencies. However, there were many problems, such as local agencies going bankrupt, during the period of technical cooperation.

As for the image processing equipment comprising a photo printer, a drum scanner, a color display, etc., it was not possible to conclude a maintenance agreement, and consequently the equipment was maintained by short-term experts from Japan and by the Indonesian personnel who received training in Japan.

Though measures for maintenance were not very satisfactory, daily maintenance of machinery and prompt troubleshooting greatly improved the operation of it.

3-3-4 Other problems

(1) Domestic supporting committee

The Project represented a technical cooperation of an entirely new type—trying to establish a surveying method for selecting, from uncultivated regions, potential areas for the development of an agricultural infrastructure using remote sensing technology and then transferring the technology to the local people. In the process of establishing and transferring the technology, there occurred some technical problems. Both the support from short-term experts in various fields and also guidance and support from the project supporting committee set up in Japan were very effective for the Project's implementation.

(2) Procedure for dispatching experts

The Project owed much to the short term experts dispatched from Japan. Since the timing of dispatching such experts greatly affected activity planning, it was recommended that request for the dispatch of experts and formalities for the dispatch be finished as early as possible.

3-4 Changes in Implementation Schedules and their Contents

On 16 February 1980, an agreement was reached regarding the master plan for the Remote Sensing Engineering Project in accordance with the Record of Discussions on the Project already signed.

Technical cooperation under the Project lasted seven years until 31 March 1986. During this period, seven survey teams were dispatched; a plan arrangement team was dispatched once, temporary guidance teams four times, and an evaluation team twice. Since the Project was a technical cooperation project, its main objectives were the dispatch of long-term and short-term experts, the training of Indonesian personnel in Japan, the provision of machinery and equipment, and the development of a method for selecting potential areas for the development of an agricultural infrastructure by means of remote sensing technology, and then transfer of this technology to the local people. Table 1 shows the implementation schedule agreed upon by both governments for attaining these objectives at the time the Record of Discussions was signed. Table 2 shows the implementation schedule for an extended period of two years for the purpose of following up the results of the Project.

(1) Changes in schedule due to delayed activities

Because of delayed completion of the building needed for the Project, installation and trial runs of indoor equipment, including the computer, were finished 22 months after the Project was started. This fact resulted in delayed dispatch of both long-term and short-term experts, affecting the progress of the Project and hence necessitating the extension of the period of technical cooperation in order to follow up the results of the Project.

(2) Reinforcement of information processing system

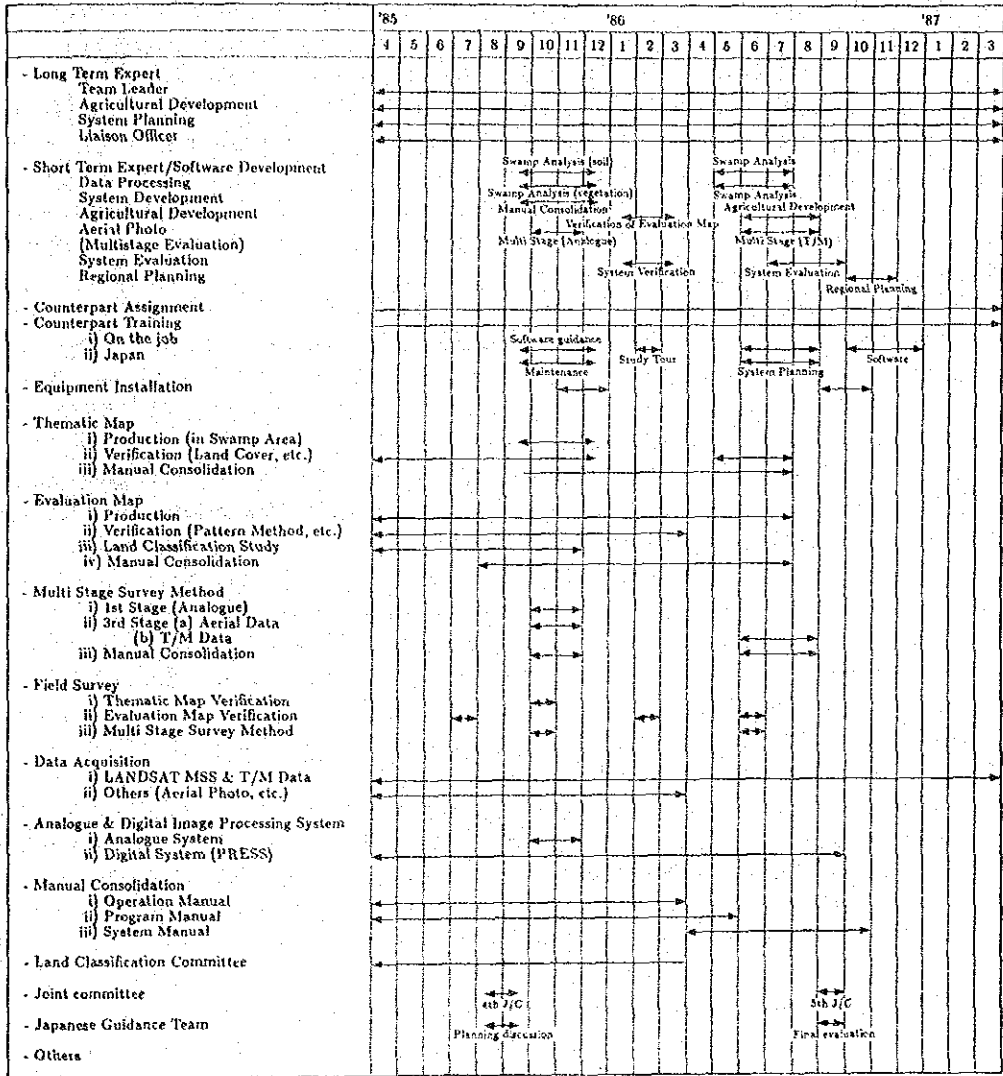
In order to reinforce the remote sensed information processing system, the image processing time was shortened; the image output display was diversified; the processing was conducted in cooperation with the organizations concerned; the capacity of the main computer was increased for the purpose of training in technology development; an X-Y plotter, an ink jet printer, and personal computers with accessories were introduced.

(3) Changes in multistage survey method for selecting potential areas for the development of an agricultural infrastructure

As referred to earlier, seven categories of activities were conducted in order to establish remote sensing technology for selecting potential areas. As for the multistage survey method—one of the seven categories—it was considered more practical in view of the situation and the future of the Project that the first three stages should be established as part of the Project and that the last stage (the multistage survey method consisted of four stages in the original plan) should be dealt with by each organization. This was discussed and decided upon at the first joint committee.

Changes in the other categories of activities were insignificant.

Table 2 Implementation Schedule for Extended Period (Two Years)



4. RESULTS OF THE PROJECT AND EVALUATION

4-1 Activities in the Project

Began 16 February 1980, after the signing of the Record of Discussions, the Project lasted seven years including the extended period of two years. Those concerned made efforts to develop technology for selecting potential areas for the development of an agricultural infrastructure in the Republic of Indonesia using of remote sensing technology and to transfer this technology to the Indonesian personnel concerned.

During this period, guidance and evaluations were provided regarding the activities pertaining to the Project, by a plan arrangement team (dispatched once), temporary guidance teams (dispatched four times), and evaluation teams (dispatched twice). In October of 1984, the first evaluation team recommended a follow-up be performed on the results of the Project, and it was decided that the period of technical cooperation should be extended two years.

4-1-1 Activities between April 1980 and March 1985

The master plan concerning the Project and agreed upon by both governments underwent some changes in the process and contents of its development. There were no changes, however, in the seven categories of activities pertaining to the Project. Those concerned made every effort to attain their objectives in line with these policies.

The first year was devoted to constructing a building for the Project; the first half of the second year was devoted to installation and test runs of machinery and equipment with the assistance of experts dispatched from Japan. Actual activities were started at this time.

(1) Results of dispatch of experts

Three long-term experts—the leader, an expert on agricultural development, and an expert on systems development—were dispatched to the Republic of Indonesia for four years beginning in the second year of the Project. One long-term expert on job adjustment was dispatched for three years in the third year. They were in charge of surveying and development training.

Twenty-four short-term experts were dispatched to the Republic of Indonesia. They were in charge of guidance in technical development; nine were experts in hardware, three in software, three in data processing, three in systems development and evaluation, three in regional planning, two in agricultural development, one in aerial photography, and two in the concept of remote sensing technology.

(2) Manning, the Indonesian side

The Remote Sensing Section of the Center for Data Processing and Mapping consisted of 20 personnel including the section chief. Counterparts for the Project included 15 persons; the section chief and project manager Suroso, ten engineers, two persons in charge of maintenance, and two technical assistants. The remaining members of the section were clerical staff. Two other counterparts in charge of maintenance transferred to other sections.

Having majored in topography, geology, agriculture, mathematics, physics, and photoelectronics, the counterparts were high in technical level and highly motivated regarding remote sensing technology.

Only two of them transferred to other sections during the period of technical cooperation. This fact seemed to indicate the importance of the Project's technical cooperation being continued with the aim of developing special technology.

(3) Training of counterparts in Japan

Training of counterparts in Japan was very important in achieving the results expected from the Project. All the counterparts received training in Japan. Not only the technical training but also their experiences in Japan were indeed very useful for them in implementing the Project.

The number of counterparts who training in Japan was two (higher officials) and thirteen (members of the section).

(4) Provision of equipment and materials

Installed equipment was as follows: machinery and equipment necessary for the Project, the CPU and terminals of a computer system, a color display, a printer, magnetic disc equipment, an X-Y plotter and its peripheral equipment, developing and printing equipment, analogue and digital analysis image processing equipment including a viewer. These were all high level facilities in Indonesia. Also furnished were a copying machine and a word processor for stationery, as well as vehicles and surveying instruments for field surveys.

As for maintenance of these pieces of equipment, it was necessary to have counterparts conduct daily maintenance without fail.

(5) Development of system

Collection of data, preparation of thematic and evaluation maps, construction of the entire system, establishment of a multistage survey method, technology transfer to counterparts, etc. (seven categories of activities) were already referred to.

4-1-2 Activities between April 1985 and March 1987

In accordance with the evaluation of and recommendations by the first evaluation team, it was decided in October 1984 that the period of technical cooperation should be extended, with the following four categories of activities to be continued. The implementation schedule for that period is shown in Table 2.

- 1) To examine the applicability of the system developed so far, in due consideration of swampy areas.
- 2) To establish the third stage of the multistage survey method.
- 3) To standardize data formats and prepare technical manuals.
- 4) To transfer technology for software development in order to improve applicability of remote sensing technology

(1) Dispatch of experts

Four long-term experts were dispatched as before. Nine short-term experts were dispatched to give guidance in technology development; one expert on software, one on data processing, four on system development evaluation, one on aerial photography, one on regional planning, and one on agricultural development.

- (2) Training of counterparts in Japan
General training was given to six Indonesian counterparts. One of the six was a clerical staff member who participated in group training in computer operation at the Okinawa Training Center of JICA.
- (3) Provision of equipment and materials
During this period of technical cooperation, those pieces of equipment which had been frequently used and consequently were worn out were replaced with new ones. Spare parts of the machinery already introduced were purchased. With the progress of activities pertaining to the Project, a personal computer with its peripheral equipment and a video set was introduced for the purpose of training. Stationery was also purchased.
- (4) Four categories of activities
 - 1) Examination of thematic and evaluation map making system
Examination was conducted regarding several kinds of thematic (land cover maps in particular) and evaluation maps made through field surveys in case study and the Asahan areas using the system established in the training and North Banten areas. Details of the examination were compiled in the report "Examination of Thematic Maps and Evaluation Maps".
As for analysis of swamp areas, the possibility for collecting information concerning swamp areas using remote sensing was considered, as thematic maps and evaluation maps had been made for the Asahan area. Though investigation and analysis of swamp areas was conducted under the guidance of short-term experts in the fields of soil, vegetation, and agricultural development, it was not possible to establish an applicable system.
 - 2) Establishment of the third stage of the multistage surveying system
Because of the considerably delayed construction of receiving equipment, TM data were not available by the time the term of technical cooperation expired. Obtaining of TM data and SPOT data, which were more accurate than TM data, was not realized.
The third stage was therefore mainly aimed at analogue analysis through reading existing infrared aerial color photographs and monochromes. Only manuals of reading were compiled.
 - 3) Standardization of data formats and preparation of manuals
As for the standardization of data formats, a variety of programs were made for converting formats, and technical guidance in programming was given. Regarding preparation of manuals, long-term and short-term experts compiled various manuals. The counterparts also created some manuals during on-the-job training.
 - 4) Improvement in capability of applying remote sensing technology
The transfer of remote sensing technology was conducted over a two year period.
Manual making and training in ARIS programming, evaluation map making through the PATTERN method, and three-dimensional image processing resulted in a full understanding of the system and improvement in the capability of developing technology.

The counterparts gained an understanding of a considerable portion of the important system and the capability of its practical application. More efforts seemed to be necessary for them to be able to develop software themselves. As far as advancing from merely operating the system to understanding the theory and application of it is concerned, the counterparts' capability was greatly improved.

4-2 Attainment of the Project's Objectives

Results of activities and attainment of objectives in five years from the start of the Project were already referred to. This section treats the attainment of objectives and evaluation of it for the two year follow-up period. This is the results of surveys conducted by the last technical guidance team dispatched in March 1987:

Activities during the follow-up period included the following:

- (1) Examination of the applicability of developed systems
- (2) Establishment of the third stage of the multistage survey method
- (3) Preparation of technical manuals for analogue and digital analysis systems
- (4) Transfer of technology or software development

Concerning the examination of the applicability of systems: development of a remote sensing system, including preparation of thematic maps and evaluation maps, has been successfully completed and operated. Evaluation maps are made as basic materials related to the development of an agricultural infrastructure. Thematic maps are selectively prepared as necessary for evaluation maps.

Concerning the establishment of the third stage, a manual of readings has been compiled conveniently for the tropics, for the purpose of analysis through aerial photographs. Accurate analysis can be expected through use of this manual.

Obtaining and analysis of Landsat TM data, a great expectation of the Project, have yet to be realized. Early obtaining and analysis of such data are recommended in order for activities pertaining to the Project to be effective. The inability to obtain TM data is due to the delayed completion of the TM receiving equipment of LAPAN.

Regarding the technical manuals for analogue and digital analysis systems, a standardized CCT format has been developed wherein a standard header is placed at the beginning of image data which are to be converted from several types of format such as BIL and BSQ.

A standardized digitizer format has been developed for conversation between equipment offline from the host computer. Introduction of input by means of a standardized data format has improved the adaptability of the PRESS system. Additionally, several kinds of technical manual, such as ARIS and EPOC have been prepared concerning evaluation map making.

In order to improve the counterparts' capability of developing software, training in basic programming and on-the-job training have been given. Most counterparts are capable of elementary programming, and some of them are skilled in software creation which requires an understanding of advanced technology.

Effectively used, the system developed in the Project has the fullest confidence of technical experts. All conditions as mentioned above are expected to contribute to the utilization of the system for the development of an agricultural infrastructure and in structuring application systems in the future.

APPENDICES

1. The Record of Discussions (R/D) 29
2. List of Main Machinery and Equipment Granted 36

1. The Record of Discussions (R/D)

The Record of Discussions between
the Japanese Project Implementation Survey Team and
the Authorities Concerned of the Government
of the Republic of Indonesia
on the Japanese Technical Cooperation
for the Remote Sensing Engineering Project
for the Development of Agricultural Infrastructure

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as JICA) and headed by Mr. Yasuo Maeda, visited the Republic of Indonesia from January 30 to February 18 for the purpose of working out the details of the technical cooperation program concerning the Remote Sensing Engineering Project for the Development of Agricultural Infrastructure in the Republic of Indonesia.

During its stay in the Republic of Indonesia, the Team exchanged views and had a series of discussions with the Indonesian authorities concerned in respect of the desirable measures to be taken by both Governments for the successful implementation of the above-mentioned Project.

As a result of the discussions, the Team and the Indonesian authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

Jakarta, February 16, 1980

Yasuo Maeda
Head, the Japanese
Implementation Survey Team

Tubagus Haedar Ali
Head of Center for Data Processing
and Statistics,
Ministry of Public Works

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and the Government of the Republic of Indonesia will cooperate with each other in implementing the Remote Sensing Engineering Project (hereinafter referred to as "the Project") for the purpose of increasing capabilities of survey and planning for the development of agricultural infrastructure in Indonesia by adopting regional development approach.
2. The Project will be implemented in accordance with the Master Plan which is set forth in Annex I.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense services of the Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. Privileges, exemptions and benefits to be granted by the Government of the Republic of Indonesia to the Japanese experts and their families in the Republic of Indonesia will be no less favorable than those granted to experts of third countries or of international organizations such as the United Nations performing similar missions, and will include the following:
 - (1) Exemption from income tax and charges of any kind imposed on or in connection with the living allowances remitted from abroad in relation with the implementation of the Project;
 - (2) Exemption from import and export duties and any other charges imposed in respect of personal and household effects which may be brought into from abroad or taken out of the Republic of Indonesia;
 - (3) Exemption from import tax, import sales tax, sales tax, and other taxes and charges of any kind imposed on or in connection with the purchase in the Republic of Indonesia by the Japanese experts of one motor vehicle per each expert;
 - (4) Free local medical services and facilities to the Japanese experts and their families.

III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense such machinery, equipment and other materials necessary for the implementation of the Project as listed in Annex III, through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The articles referred to in 1. above will become the property of the Government of the Republic of Indonesia upon delivery c.i.f. to the Indonesian authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively for the implementation of the Project in consultation with the Japanese experts referred to in Annex II.

IV. TRAINING OF INDONESIAN PERSONNEL IN JAPAN

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense the Indonesian personnel connected with the Project for technical training in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Government of the Republic of Indonesia will take necessary measures to ensure that the knowledge and experience acquired by the Indonesian personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

V. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE REPUBLIC OF INDONESIA

1. In accordance with the laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to provide at its own expense:
 - (1) Services of the Indonesian counterpart personnel and administrative personnel as listed in Annex IV;
 - (2) Buildings, incidental facilities and other direct costs as listed in Annex V;
 - (3) Supply or replacement of machinery, equipment, instrument, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided through JICA under III above;
 - (4) Transportation facilities and travel allowance for the Japanese experts for the official travel within the Republic of Indonesia;
 - (5) Suitably furnished accommodations for the Japanese experts and their families.
2. In accordance with the laws and regulations in force in the Republic of Indonesia, the Government of the Republic of Indonesia will take necessary measures to meet:
 - (1) Expenses necessary for the transportation within the Republic of Indonesia of the articles referred to in III above as well as for the installation, operation and maintenance thereof;
 - (2) Customs duties, internal taxes and any other charges, imposed in the Republic of Indonesia on the articles referred to in III above;
 - (3) All running expenses including those in connection with the change of project site in the course of the technical cooperation, necessary for the implementation of the Project.

VI. ADMINISTRATION OF THE PROJECT

- (1) The Project Leader appointed by the Minister of Public Works will be responsible for the administration and implementation of the Project, and the Japanese experts will provide necessary technical guidance and advice for the implementation of the Project.
- (2) For the effective implementation of the Project, The Joint Committee consisting of the members as listed in Annex VI, will be established and meet at least once a year. The Committee will formulate the details of the Master Plan referred to in paragraph I and the annual operational work plan of the Project. The details of the Master Plan and the annual operational work plan will be submitted to the authorities concerned of the two Governments for approval.

VII. CLAIMS AGAINST JAPANESE EXPERTS

The Government of the Republic of Indonesia undertakes to bear claims, if any arises, against the Japanese experts engaged in the Project resulting from occurring in the course of, or otherwise connected with the discharge of their official functions in the Republic of Indonesia except for those arising from the willful misconduct or gross negligence of the Japanese experts.

VIII. MUTUAL CONSULTATION

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

IX. TERM OF COOPERATION

The duration of the technical cooperation for the Project under this Attached Document will be five (5) years from April 1, 1980.

ANNEX I MASTER PLAN

1. Objective

It is regarded as important matters to introduce remote sensing system so as to select potential areas for the development of agricultural infrastructure in Indonesia, especially in outer territories.

This project is carried out to establish multi-stage survey method of remote sensing engineering which comprises analogue and digital analyses of data and information collected from the LANDSAT and aerial survey.

2. Activities

- (1) Development and management of remote sensing system
- (2) Collection of LANDSAT and aerial survey data
- (3) Study of analogue and digital method
- (4) Making out of thematic and evaluation maps
- (5) Practice of ground investigation in case study areas
- (6) Development of multi-stage survey method to select potential areas for the development of agricultural infrastructure
- (7) Improvement of capabilities of the officials in charge of survey and planning

ANNEX II JAPANESE EXPERTS

1. Long-term assignment

- (1) Team leader
- (2) Engineers covering the following fields
 - (a) Agricultural development
 - (b) System planning
- (3) Liaison officer

2. Short-term assignment

Additional experts on short-term assignment in the fields mentioned below as well as in other fields may be dispatched as necessity arises.

- (1) Software development
- (2) Agronomy
- (3) Aerophotography
- (4) Data processing and programming
- (5) Regional planning

ANNEX III LIST OF THE ARTICLES TO BE PROVIDED BY THE GOVERNMENT OF JAPAN

- (1) Analogue image processing system
- (2) Digital image analyzer and its operation system
- (3) Computer and accessories
- (4) Equipment, machinery, instruments, and tools for field and aerial survey and their data processing
- (5) Vehicle
- (6) Other necessary minor equipment, materials and spare parts

ANNEX IV LIST OF INDONESIAN STAFF

1. Project leader
2. Administrative assistant
3. Counterpart engineers to the Japanese experts
4. Operators for image processing equipment
5. Technical assistants including key punchers
6. Clerical personnel including typists, clerks, drivers, etc.

ANNEX V LIST OF BUILDINGS, INCIDENTAL FACILITIES, AND OTHER DIRECT COSTS TO BE PROVIDED BY THE GOVERNMENT OF THE REPUBLIC OF INDONESIA

1. Buildings (laboratory and offices)
 - (1) Digital processing room
 - (2) Analogue processing room
 - (3) Data stock room
 - (4) Map drawing room
 - (5) Meeting room
 - (6) Offices for Japanese experts and Indonesian counterparts
 - (7) Other necessary rooms
2. Incidental facilities
 - (1) Electric facilities
 - (2) Office facilities (table, desk, shelf, etc.)
3. Cost for system management
 - (1) Installation of hardware
 - (2) Operation and maintenance of hardware

4. Cost for image data collection
 - (1) LANDSAT data
 - (2) Aerial IR color photography
 - (3) Ground truth data

ANNEX VI. COMPOSITION OF THE JOINT COMMITTEE

1. Chairman:
Head of Center for Data Processing and Statistics Ministry of Public Works
2. Indonesian side
 - (1) Project leader
 - (2) Officials of the Ministry of Finance
 - (3) Officials of BAPPENAS
 - (4) Other officials appointed by the chairman
3. Japanese side
 - (1) Team leader
 - (2) Experts designated by the team leader
 - (3) Liaison officer
 - (4) Representatives of JICA

Note:

Officials of the Embassy of Japan may attend the Joint Committee as observers

2. List of Main Machinery and Equipment Granted

			Price (Yen)
I. DIGITAL IMAGE PROCESSING			294,138,000
1) Central Processing Unit (4 MB)	IBM 4341 - K01	1 set	63,533,000
2) Magnetic Disk Storage	IBM 3370-A01/B01	4 set	14,718,000
3) Storage Control Unit	IBM 3880 - 001	1 set	26,134,000
4) Magnetic Tape Drive	IBM 3420 - 004	3 set	18,374,000
5) Tape Control Unit	IBM 3803 - 002	1 set	10,444,000
6) Color Graphic Display	KIMOTO	1 set	19,522,000
7) Drum Scanner Unit	KIMOTO	1 set	11,312,000
8) Photo Printer Unit	KIMOTO	1 set	9,760,000
9) High Speedline Printer	IBM 3203 - 005	1 set	9,694,000
10) Diskette I/O Unit	IBM 3540 - B01	1 set	7,292,000
11) Programmable Data System	IBM 5285 - B01	1 set	1,408,000
12) Display Terminal	IBM 3278	7 set	7,385,000
13) Color Unit	IBM 3274 - D01	1 set	4,705,000
14) Printer	IBM 3207 - 001	2 set	2,935,000
15) Soft Programs	KIMOTO	1 set	20,000,000
16) X - Y Plotter	XP - 3100	1 set	25,597,000
17) D - Scan Data Gathering System	DS - 1900	1 set	21,374,000
18) Photo Printer Controller	KIMOTO	1 set	5,550,000
19) Color Ink - Jet Printer	CJ - 5600	1 set	3,298,000
20) Personal Computer Set	NEC PC-9801 VMO	1 set	722,800
21) Color Display (for P.C.)	KIMOTO	1 set	4,500,000
22) Digitizer (for P.C.)	KIMOTO	1 set	238,000
23) Printer (for P.C.L)	NEC PC-PR-101L	1 set	175,000
24) Ink - Jet Printer (for P.C.)	IO - 720	1 set	269,000
25) Basic Soft Programs (for P.C.)	KIMOTO	1 set	740,000
26) Color Monitor (part for Display)	KIMOTO		1,330,000
27) Others			3,108,000

II. PHOTO PROCESSING SYSTEM			45,836,000
1) Photo enlarging System	DEVERE 10R	1 set	12,000,000
2) Color Paper Processor	HOPE 146 PC 52-14	1 set	11,150,000
3) Rewind Film Processor	CARL ZEISS FE-120	1 set	2,600,000
4) PC Paper Dryer	KING AIR DRYER 230	1 set	
5) Thermo Controller	NESEIKOGYO	1 set	1,100,000
6) Reflection Densitometer	KIMOTO	1 set	432,000
7) Polaroid 8 X 10 Processor	POLAROID	1 set	304,000
8) Film Dryer	CARL ZEISS TG-24	1 set	3,477,000
9) Photo Typesetter	MC - 507	1 set	3,058,000
10) Others			11,741,000
III. PHOTO INTERPRETATION EQUIPMENT			20,749,000
1) Additive Color Viewer	NAC AC - 50	1 set	11,550,000
2) Stereo Zoom Transferscope	BAUSCH & LOME ZTS	1 set	4,800,000
3) Pocket Stereoscope Viewer	SOKKHISA PS 24	5 set	19,000
4) Light Table	AL - 204	1 set	2,130,000
5) Video Interface		1 set	2,250,000
IV. FIELD SURVEY EQUIPMENT			14,144,000
1) Mobil	NISSAN PATROL	2 set	3,703,000
	OPEL RECORD	2 set	5,113,000
2) Camera	NIKON	1 set	187,000
	PENTAKS	1 set	262,000
3) Photo Meter	KIMOTO PM - 12A	1 set	550,000
	KIMOTO PM- 2500	1 set	2,000,000
4) Aneloid Altimeter		1 set	25,000
5) Transreciver	SONY ICB - 680	5 set	184,000
6) Soil Sampler	KANTO RIKA 300-C	1 set	45,000
7) Hassel Blad Camera	HASSEL BLAD	1 set	2,075,000

V. OTHERS			35,802,000
1) Overhead Projector	SUMITOMO 3M	1 set	280,000
2) Slide Projector	CABIN SUPER3	1 set	200,000
3) Refrigerator	SANYO SR 43 - F	1 set	260,000
4) Air Conditioner	DAIKIN	1 set	8,811,000
5) Photo Copy	FUJI XEROX 4800	1 set	2,800,000
	CANON NP 7550	1 set	2,523,000
6) Typewriter	IBM 50	1 set	700,000
7) Electrical Distribution Equipment		1 set	13,394,000
8) Word Processor	IBM	1 set	5,007,000
9) Video Camera	SONY BMC 500	1 set	242,000
10) Video Recorder	SONY SLK 95	1 set	153,000
11) Video T.V.	SONY KF27PSI	1 set	437,000
12) Paper Guillotine set	UCHIDA H - 46	1 set	350,000
13) Book Binder set	UCHIDA C - 450	1 set	645,000
			TOTAL 410,696,000

JICA