TOPOGRAPHIC MAPPING PROJECT FOR CAGAYAN VALLEY REPUBLIC OF THE PHILIPPINES (GENERAL REPORT)

FEBRUARY, 1983

JAPAN INTERNATIONAL COOPERATION AGENCY

Preface

In response to the request of the Government of the Republic of the Philippines, the Government of Japan decided to conduct a survey on the topographic mapping of the Cagayan area, Northern part of the Luzon Island, (coverage: approximately 11,000 Km^2) and entrusted the survey to the Japan International Cooperation Agency (JICA).

The JICA has sent several survey teams to the Philippines since January 1978 and conducted the field survey including aerial photography. Following the field survey, aerial triangulation, stereo-plotting, scribing, printing, etc., were carried out in Japan and the present report has been prepared together with 1/25,000 topographic maps (72 sheets).

I hope that this report and the topographic maps will be useful as a basic reference for development of the project area and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines, particularly the Bureau of Coast and Geodetic Survey, for their close cooperation extended to the teams.

February 1983

Keisuke Arita

Keisuke Arita
President
Japan International Cooperation Agency

Letter of Transmittal

Mr. Keisuke Arita
President
Japan International Cooperation Agency

Dear Sir,

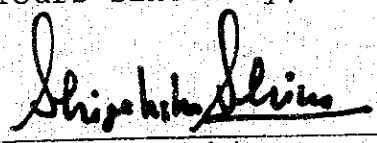
The project was carried out from February, 1979 to February, 1983 on commission from the Agency. Upon completion of the project, this General Report is presented. The report covers the works done during the past five years and details the fifth year plan.

The project is a large surveying project covering the Cagayan Valley Area. We are very happy to report the successful completion of all works planned, though we have encountered many difficulties since the commencement of the first year field work in February, 1979.

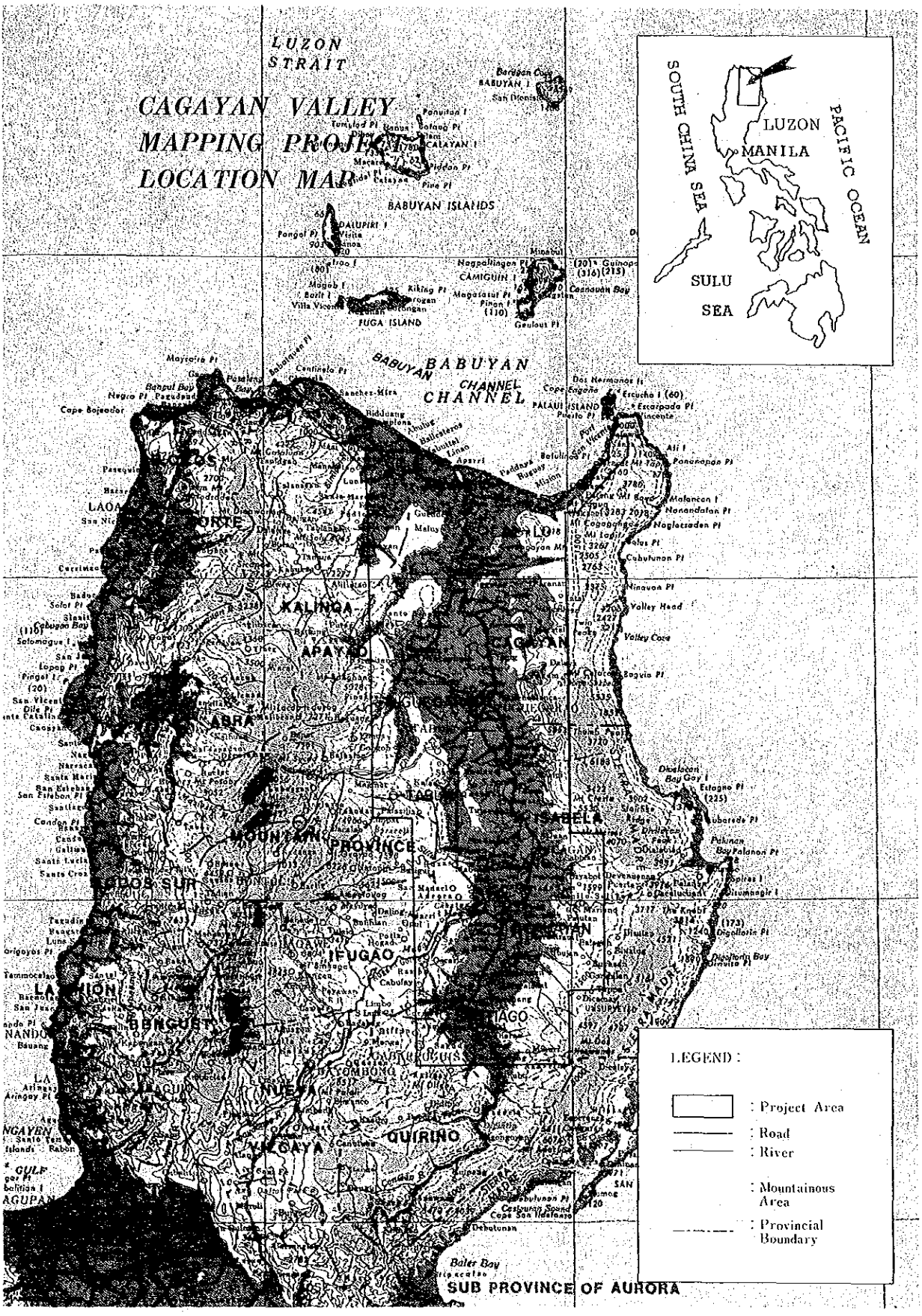
The survey conducted and its achievements will make a great contribution to the improvement of surveying techniques and various project in the Philippines, and we are confident that our technologies, attitude for works and good will have been transferred to the Philippines through this technical cooperation.

Taking this opportunity, we would like to express our sincere gratitude to the government of the Philippines and various agencies which cooperated with us in carrying out the project and also to various Japanese organizations which guided us in the project.

Yours sincerely,

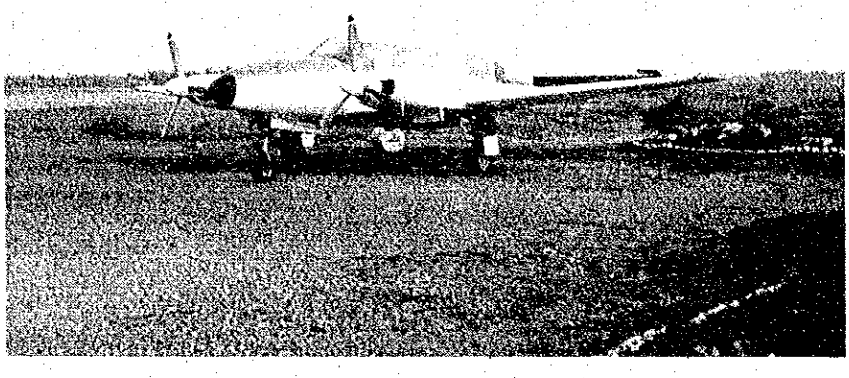


Shigehiko Shino
Leader
Cagayan Valley Topographic
Mapping Project
International Engineering
Consultants Association

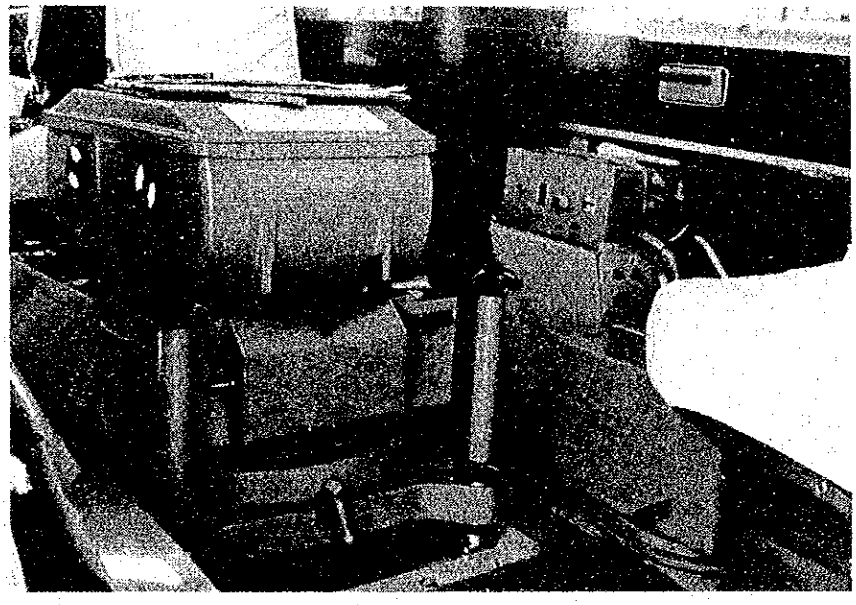

LUZON
STRAIT
CAGAYAN VALLEY
MAPPING PROJECT
LOCATION MAP
BABUYAN ISLANDS
FUGA ISLAND
BABUYAN CHANNEL
SOUTH CHINA SEA
PACIFIC OCEAN
LUZON
MANILA
SULU
SEA
KALINGA
APAYAO
ABRA
MOUNTAIN PROVINCE
ILOCOS SUR
LA UNION
BENGUET
NUEVA VIZCAYA
QUIRINO
ISABELA
CAGAYAN
SUB PROVINCE OF AURORA
LEGEND :
: Project Area
: Road
: River
: Mountainous Area
: Provincial Boundary

Cagayan River Basin

Meeting with BCGS



Aircraft (Piper Navajo)

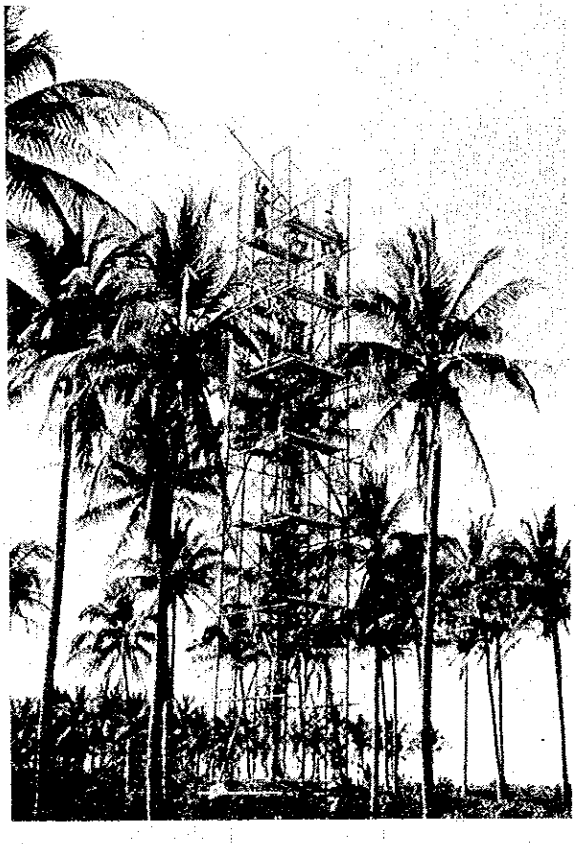


Aerial Camera (RMK-A)

Levelling

Bench Mark

Control Point Survey



Erecting Observation Tower

Monumenting

Meeting on Survey Work

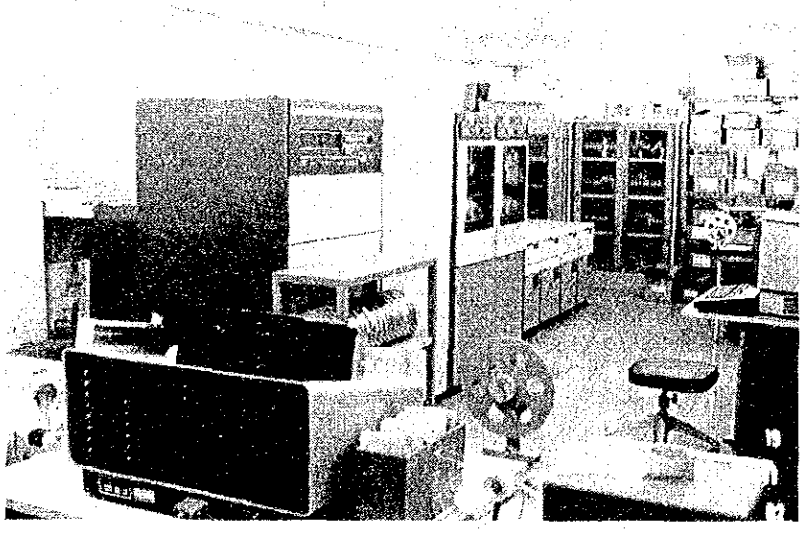
Field Identification

Field Completion Survey

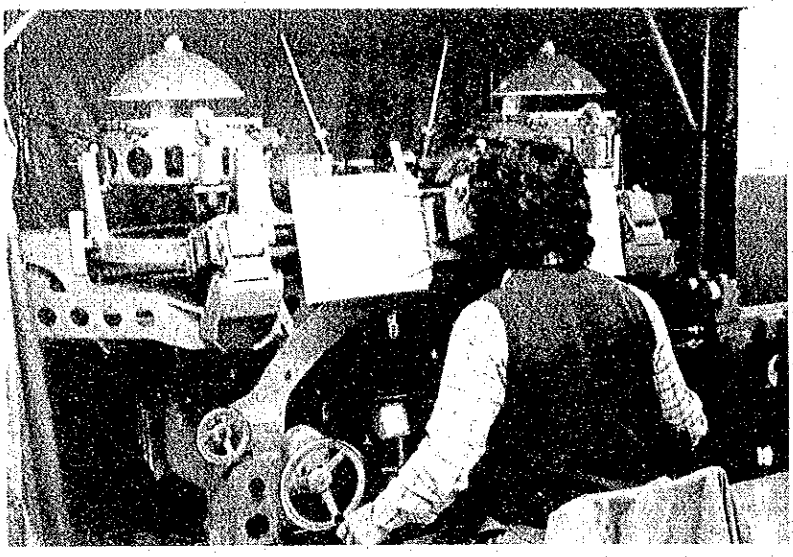
Affixing Signature to the Minute

Presentation of Orthophoto Map

Aerial Triangulation (Point Transfer Device)

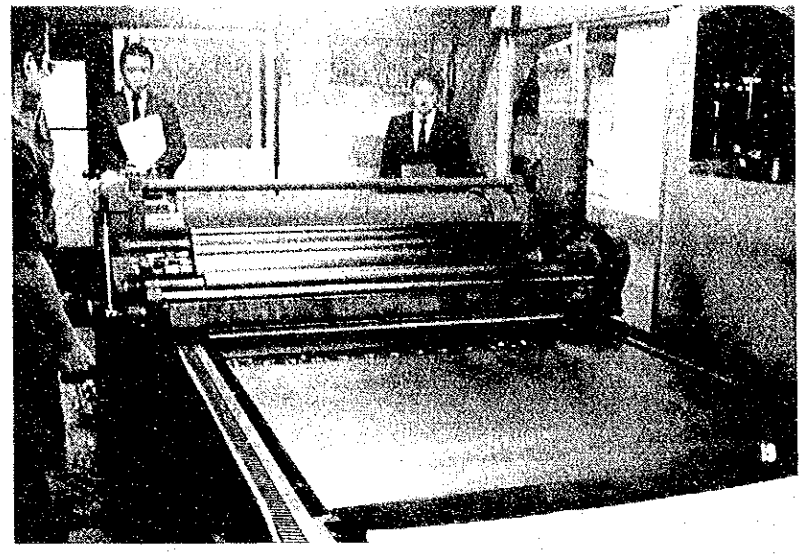


Aerial Triangulation (Electronic Computer)

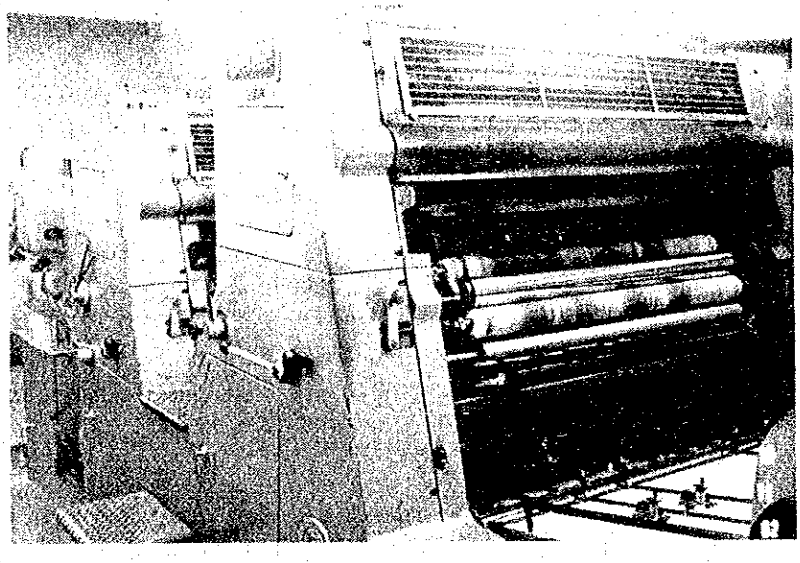


Stereo Plotter (Wild A-8)

Quality Control



Color Proof Press



Offset Printing Machine

Topographic Mapping Project of Cagayan Valley, the Republic of the Philippines

Table of Contents

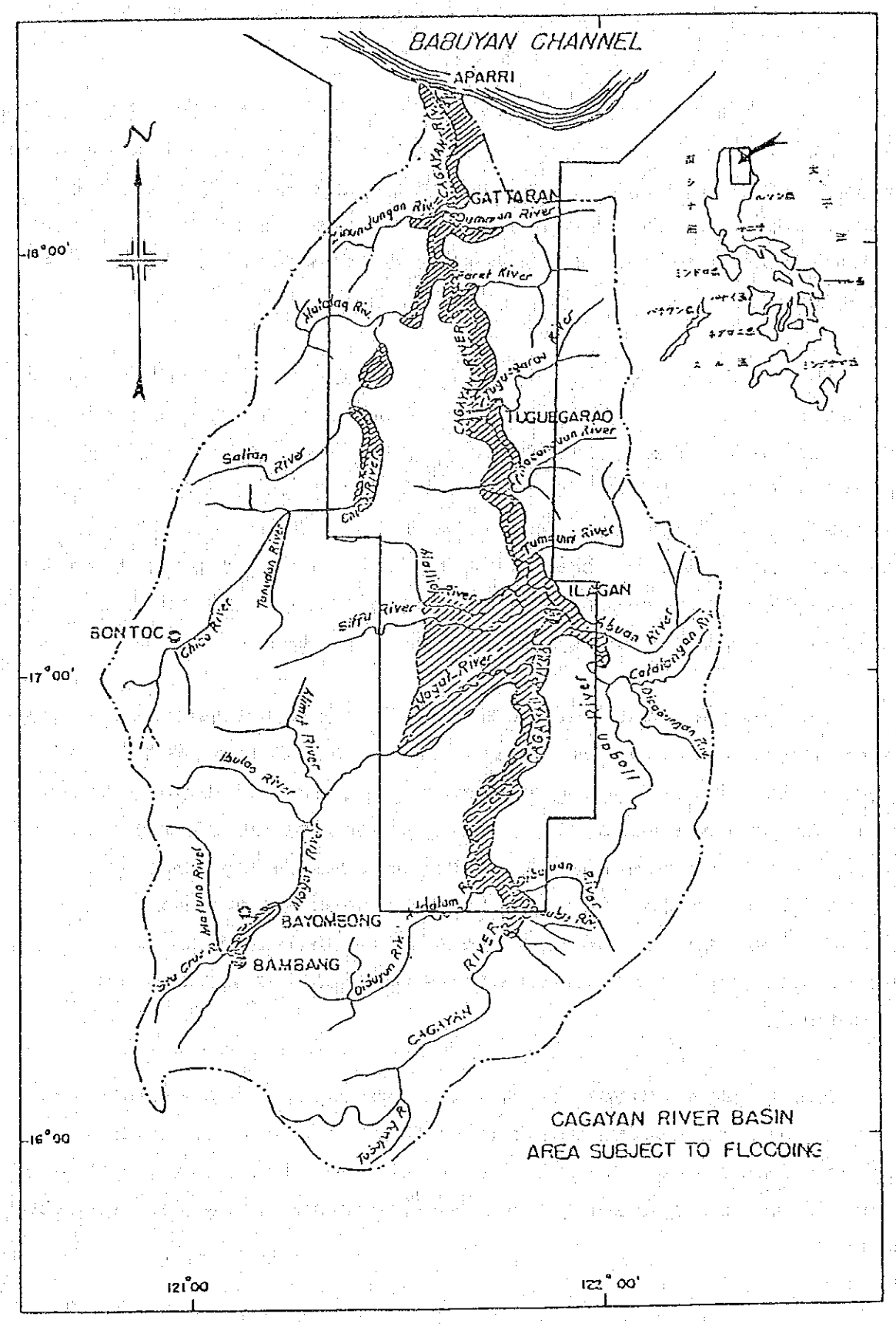
1. INTRODUCTION

This Report is on the production of 1/25,000 topographic mapping and 1/10,000 orthophotomapping, covering the Cagayan Valley Area in Region II situated on the northern part of Luzon, which has been carried out by the Japan International Cooperation Agency upon request from the Government of the Philippines.

The project is unique in that whereas the past mapping projects which have been conducted by the Government of Japan as part of technical cooperation for developing countries have produced 1/50,000 topographic maps, the project has developed for the first time 1/25,000 topographic maps and that it has been the first operation to produce 1/25,000 topographic maps which are considered important in the National Mapping Program of the Philippines.

The project has been unique also in that whereas local counterpart usually have very limited knowledge and technique related to mapping and surveying in our cooperative works to produce maps, the Philippines, especially BCGS, which is our counterpart, has histolical background and potential abilities in the field of geodesy and mapping. In addition, there was a command and control to carry out works, resulting in smooth communications among those concerned.

The Cagayan River Basin is a so-called depressed area with insufficient transportation networks and frequent typhoon disasters, despite its vast and rich plane. It has been therefore considered a most important area for development.


BABUYAN CHANNEL
APARRI
CAGAYAN RIVER
GATTARAN
Dumaran River
Taret River
TUGUEGARAO
Salitan River
Chico River
Tuguegarao River
Tumauini River
ILAGAN
Siffu River
Matalag River
Tanudan River
SONTOC
Chico River
Ilagan River
Cataliñgan Riv
Alimit River
Ibulao River
Magat River
Malunu River
BAYOMBONG
Ibulao River
Ilagan River
Addalam River
Casibuan River
Ruby River
BAMBANG
Dupinit River
CAGAYAN
Tuguegarao River
Ilagan River
Magat River
Addalam River
Casibuan River
Ruby River
Dupinit River
CAGAYAN RIVER BASIN
AREA SUBJECT TO FLOODING
18°00'
17°00'
16°00
121°00
122° 00'

The Government of Japan has been making contribution to the development of the area, including technological and financial assistances in various projects such as the Phil-Japan Friendship Highway whose northern starting point is located at Aparri at the Cagayan River mouth as a part of the Pan Philippine Highway, the Cagayan Integrated Agricultural Development Project and the Cagayan Valley Electrification Project, and execution of feasibility studies for various social infrastructure development projects.

In carrying out works in the area with a high development potential as stated above, special attention was paid to hydrological utilization and land use and also to vegetation and topographic characteristics, and high accuracy was emphasized. At the same time, control points and bench marks have been newly established for future development works.

In the process of works, emphasis was placed upon transfer of the following technics:

(1) Adjustment computation between control point networks by the precise traversing method and existing old triangulation points and Doppler primary geodetic control points.

(2) Manual of Guide-lines for Field Identification.

(3) Specification and Standard Rules for Application of Map Symbols.

We are confident that we have transferred technique which will be useful when the Philippines conducts similar works.

As for map symbols, simplified and refined ones were used, after giving the criteria to each symbol upon consultation with BCGS.

In the following parts, annual works and individual processes will be detailed. The works carried out by BCGS survey team will not be covered here:

(1) Doppler geodetic control point survey.

(2) Road classification.

(3) Geographical names and administrative boundaries.

The report also does not cover the training done through the Colombo Plan during the period of work done in Japan.

2. OUTLINE OF PROJECT

2-1 Background of Project

2-1-1 Request for Technical Cooperation from the Republic of the Philippines in Topographic Mapping

In view of the conditions stated below, the Government of the Philippines asked the Government of Japan in December, 1976 to offer technical cooperation for mapping.

(1) As topographic maps which are necessary as basic tools in making national development plans, there are 1/50,000 maps made by the U.S. Army in 1954, but they are old and not accurate enough, causing many difficulties in making various development plans.

(2) BCGS plans to make new 1/25,000 maps as a part of National Mapping Program. However, it will be extremely difficult to implement without technical assistances from abroad.

(3) In view of the urgency of producing National Base Map in scale of 1/25,000 for national development plan, the Philippines expects to receive technical assistance from Japan to produce topographic map for the selected area where requires the socio-economic development. And also, BCGS expects to learn Japanese modern surveying technique and system through actual implementation of the surveying works.

(4) After acquirement of survey technique and system, BCGS will produce base map by their own power to cover other areas.

On the assumption to accept the request, the Government of Japan started to study backgrounds for the request, its contents, local conditions and laws and regulations of the Philippines. Then, in June, 1977, the government of the Philippines notified the Government of Japan further details of the request.

The request were extensive as follows:

(1) Area to be covered:
The area from Ilagan, Isabela to Aparri, Cagayan (including neighboring towns along the coast).

(2) Mapping area:
about 10,000Km^2

(3) Specifications:

Scale	1/25,000
Accuracy	Meet the international standards
Projection	Universal Transverse Mercator (UTM)
Neat Line	7.5' x 7.5'

(4) Period:
Within five years.

(5) Final results:
Five-color maps (10-meter intermediate contour lines, 5-meter supplementary contour lines).
If possible, orthophotomaps (a scale of 1/10,000).
The Philippines proposed to provide or to arrange the following:

a. To furnish base camp facilities.

b. To communicate and coordinate with local people and government agencies whenever necessary,

particularly with respect to security.

c. To arrange hiring of laborers as needed.

d. To establish additional primary geodetic controls (by JMR-Doppler Survey Set).

e. To conduct field identification.

f. To offer an office space in Manila for the Japanese mission.

g. Printing of the maps.

In addition, BCGS added the following conditions to which attention should be paid.

a. Under the existing security regulations of the Philippines, aerial photographing must be done by local companies.

b. Control point survey, aerial triangulation, plotting (excluding classified areas), scribing and other and related works may be done either by the Japanese or Philippines side.

c. Under the existing security regulations, compilation must be done as a rule within the Philippines. When making compilation outside the Philippines, security officers from the Philippines must be present.

d. BCGS desires that equipment (photogrammetric, geodetic, computer-based plotting machine) will be given to it after all works have been completed.

e. Alternative mapping area:
Ilocos or Samal.

2-1-2 Topographic Mapping Program in the Republic of the Philippines

Prior to the request for the assistance, the government of the Philippines made "National Mapping Program" in 1975 with objectives:

(1) To make and up date hydrographic charts for the entire terriorial waters.

(2) To up date existing 1/50,000 maps.

(3) To make and periodical up dating 1/25,000 topographic maps of the planes along the major river basins and of the coastal areas.

(4) To make and periodical up dating 1/10,000 maps of cities and places where provincial capitals are located.

(5) To make geological maps and topographic maps for the continental shelf and the 200-nautical-mile economic waters.

Due to lack of funds, facilities and human resources, works were not started.

2-1-3 Dispatch of a Preliminary Survey Mission

In responce to the request from the Government of the Philippines and on the assumption to cooperate in mapping, the Government of Japan dispatched a preliminary Survey Mission to study backgrounds for the request from the Philippines, its contents and local conditions, examined project size, work period, necessary funds and local conditions, and on the basis of such studies and examination

made a feasible project plan which the Japanese side considers possible.

Discussions were repeated on the project plan proposed by Japan and finally made a project plan based on the mutual consent of both parties. Then, it was decided to execute the five-year project from 1978, in accordance with the Project Plan with Note Verbale agreed between Japan and the Philippines in March, 1978.

2-1-4 Determination of Mapping Area

Upon making a comprehensive examination of urgency, feasibility and effects of regional development, the preliminary survey mission agreed to start detailed technical studies on the Cagayan River basin which is considered to have most urgent needs for regional development and whose basic maps are considered to play the most important role in making a wide-area comprehensive development plan among the three regions of the Cagayan River basin, Samal and Icolos.

In the Japanese original proposal, the plotting area covered the north-to-south rectangular area along the Cagayan River, but it was decided to include the coastal area in plotting for future coastal development plans including construction of ports. As for the total mapping area, the Japanese original proposal which would cover a total area of 11,000Km^2 was adopted, but it was decided to photograph a total area of about 15,000Km^2 to prepare for future regional development.

As for 1/10,000 orthophotomaps, it was decided to cover of the areas for which maps are urgently needed

(Tuguegarao, Gonzaga, Port Irene and Ilagan respectively, covering about 300Km^2).

2-1-5 Project Plan

The project is composed of the following works:

(1) Outline of Project

1) Aerial photographing (a scale of 1/30,000) of the area of about 15,000Km^2, mainly plane parts, along the Cagayan Valley basin above 16°30' N. Lat. and between Long. 121°E and 122°E.

2) Orthophotomaps for major cities and development areas, covering about 300Km^2, within the area.

3) 1/25,000 topographic maps for the area of about 11,000Km^2.

(2) Work Plan

1) Aerial Photographing
Photographing is made a scale of 1/30,000 to photograph the entire project area with precise wide angle cameras.

2) Control Point Survey
Additional prinaly control points are established by BCGS by means of satellite Doppler system.
Forty-nine control points are newly established and permanent monuments are made.

3) Levelling
Existing first order bench marks are recovered by BCGS and the Japanese team carries out second

and third order levelling required for following aerial triangulation and topographic mapping.

4) Field Identification
Topographic data related to land classification and vegetation are confirmed using aerial photographs for the area for which topographic maps are made.
Administrative boundary and geographical names are surveyed by BCGS.

5) Aerial Triangulation
Using stereocomparator and computer, aerial triangulation is conducted to mapping area by means of analytical method. Adjustment is performed through block adjustment.

6) Plotting and Compilation
A precise stereo plotting instrument is used for plotting. Contour intervals are 10 meters at a scale of 1/25,000 and 5-meter and 2.5-meter supplementary contour lines are added when necessary. Neat lines are 7.5' x 7.5'. Plotting area covers about 11,000Km^2 with about 70 plotting sheets.

7) Field Completion
In order to confirm contents of compiled sheets and to up date them for changes after field identification survey, field completion is done. Field completion and verification on administrative boundary and geographical names are done by BCGS.

8) Orthophotomaps

A total of 12 sheets are made at four areas (6 sheets at Tuguegarao, 4 sheets at Ilagan, 1 sheet at Gonzaga, 1 sheet at Port Irene) over the total area of 300Km^2 within the topographic mapping area. Neat lines are 5Km x 5Km and the Philippine Plane Coordinate System Zone III is used for projection.

9) Drafting

On the basis of complied sheets, drawing is performed on stable polyester base by means of scribing. Marginal information and symbols are as determined upon consultation on the basis of BCGS specifications.

10) Printing

Using what have been drawn, five-color offset printing is performed by means of photo-mechanical processing. Tone and printing paper are as determined upon consulation on the basis of BCGS specifications.

(3) Detailed Five-Year Plan

1) First Year(1978 F/Y)

a. Aerial photographing operation
About 15,000Km^2 (1/30,000)

2) Second Year(1979 F/Y)

a. Control point survey
49 points (4 points at JMR points)

b. Satellite(JMR) geodetic control points 13 points (done by the Philippine side)

c. Pricking
58 points (45 control points, 13 JMR points)

d. First order levelling (restoration)
457.1Km (done by the Philippine side)

3) Third Year(1980)

a. Photographic treatment

b. Levelling
about 1,000Km

c. Field reconaissance survey
about 11,000Km^2

4) Fourth Year(1981 F/Y)

a. Aerial triangulation
about 1,100 model

b. Plotting and Compilation
about 11,000Km^2

c. Orthophotomap
about 300Km^2, 12 sheets (1/10,000)

d. Supplementary survey
about 11,000Km^2

5) Fifth Year(1982 F/Y)

a. Drawing
about 11,000Km^2, about 70 sheets

b. Printing (1/25,000 topographic maps)
about 11,000Km^2, about 70 sheets

c. Preparation of reports and turn-over of
results to the government of the Philippines

PROGRAM & ACHIEVEMENT

WORK ITEMS	PROGRAM	ACHIEVEMENT	PROPORTION OF ACHIEVEMENT	REMARKS
AERIAL PHOTOGRAPHY	15,000 km	15,000 km	100%	Scale 1/30,000
GEODETIC CONTROL SURVEY	45 points	45 points	100%	
JMR OBSERVATION	13 points	13 points	100%	Conducted by BCGS
STATION TIED TO JMR STATION	4 points	4 points	100%	
OBSERVATION OF ASTRONOMIC AZIMUTH	------	3 points	100%	To improve accuracy
PRICKING OF GEODETIC CONTROL STATIONS	45 points	45 points	100%	
PRICKING OF JMR STATIONS	13 points	13 points	100%	
SIGNAL TARGET FOR LEVELING	------	30 points	100%	To improve accuracy
FIRST-ORDER LEVELING	457.1 km	457.1 km	100%	Conducted by BCGS
LEVELING(DIRECT)	1,000 km	1,000 km	100%	
LEVELING(INDIRECT)	------	80 km	100%	
LEVELING (RIVER CROSSING)	------	6 points	100%	
PRICKING OF EXISTING BENCH MARKS	------	457 km	100%	
PRICKING OF VERTICAL CONTROL STATIONS	------	100 points	100%	20 points established anew
AERIAL TRIANGULATION	1,100 models	1,151 models	100%	Overlapping orthophoto mapping area
FIELD IDENTIFICATION	11,000 km	11,200 km	100%	
STEREO PLOTTING	11,000 km	11,200 km	100%	Scale 1/25,000
COMPILATION	11,000 km	11,200 km	100%	72 sheets
FIELD COMPLETION SURVEY	11,000 km	11,200 km	100%	
ORTHOPHOTO MAPPING	300 km	300 km	100%	12 sheets 1/10,000
MAP DRAFTING	11,000 km	11,200 km	100%	72 sheets 1/25,000
MAP PRINTING	70 sheets X 1,000 pcs.	70 sheets X 1,000 pcs.	100%	5 colors

2-2 Plan and Achievements

The plan and achievements in the mapping project are as shown in the table. The achievement rate is determined to be 100% in view of no great changes and better definition of planned quantity in the achievements.

2-3 Technical Advisor

During the field operation, the following persons were sent to the Philippines for consultation with the Government o f the Philippines, supervising operation and guidance.

First Year:	Minoru Tajima	Planning Director, Geographical Survey Institute, Ministry of Construction
"	Takeshi Hirai	Head Planning and Coordinating Div., Planning Department, Geographical Survey Institute, Ministry of Construction
Second Year:	Yukio Kitani	Head Survey Guidance Div., Planning Department, Geographical Survey Institute, Ministry of Construction
"	Kenichi Shirai	Planning and Coordinating Assistant Manager, Geographical Survey Institute, Ministry of Construction
Third Year:	Taketsune Hosono	Research Staff, Geodetic Department, Geographical Survey Institute, Ministry of Construction

Third and Fourth Years	:	Akira Yaguchi Research Staff, Topographic Division, Geographical Survey Institute, Ministry of Construction
Fourth Year:		Ryō Saita
"		Staff, Survey Guidance Div., Planning Department, Geographic Survey Institute, Ministry of Construction
Second and Third Years	:	Hiroshi Kimura First Development Survey Division, Social Development Cooperation Department, Japan International Cooperation Agency
Second Year:		Hideki Murayama First Development Survey Division, Social Development Cooperation Department, Japan International Cooperation Agency
Third Year	:	Manabu Aiba Second Training Division, Training Affairs Department, Japan International Cooperation Agency
Fourth Year:		Fuminori Nofuku Training Division, Hachioji International Training Center, Japan International Cooperation Agency
"		Haruo Wada Training Division, Hachioji International Training Center, Japan International Cooperation Agency

2-4 Outline of Annual Project

2-4-1 First Year(1978 F/Y)

(1) Survey Team

Photographing	1 Supervisor
Photo Processing	1 Supervising and Q.C.

(2) Period of Operation

From February 15 to May 18, 1979

(3) Contents of Operation

Aerial photographing

Planned ..... 15,000Km^2

Done ..... 15,000Km^2

2-4-2 Second Year(1979 F/Y)

(1) Survey Team

Leader	1	Overall project management
Deputy Leader	1	Survey in general
Staff Coordinator	1	Operation coordination
Staff Mechanic	1	Vehicles maintenance
Surveyor	15	Control point survey
Total	19	

(2) On-Site Operation Period

From November 29 to December 16, 1979 for preparation

From January 7 to May 28, 1980 for on-site operation

(3) Contents of Operation

	Planned	Done
Control point survey	45 points	45 points
Control point pricking	45	45
JMR point pricking	13	13
Astronomic azimuth observation	-	3
Differential levelling from a bench mark to a triangulation station	-	4

2-4-3 Third Year(1980)

(1) Survey Team

Leader	1	Overall project management
Deputy Leader	1	Survey in general
Staff Coordinator	1	Operation coordination
Staff Mechanic	1	Vehicle maintenance
Surveyor	7	Reconaissance survey
Surveyor	8	Levelling
Total	19	

(2) Field Operation Period

From December 1, 1980 to April 21, 1981

(3) Contents of Operation

	Planned	Done
Direct levelling	460Km (duplicate line) 340Km (single line)	460Km (duplicate line) 340Km (single line)
Indirect levelling	80Km	80Km
Over-river levelling	6 points	6 points
Field reconaissance survey	11,200Km^2	11,200Km^2
Bench mark pricking	457Km (existing first order bench mark), 100 points (20 new points)	457Km (existing first order bench mark), 100 points (20 new points)
Monumentation	20 points	20 points

2-4-4 Third Year Work in Japan(1980 F/Y)

(1) Period of Operation

From October 11 to December 13, 1980

(2) Contents of Operation

Uncontrolled mosaic photograph	192 pieces
Contact photograph	2,701 "
Positive film	1,240 "
Positive film for orthophoto	66 "
Double-enlarged photograph	82 "

2-4-5 Fourth Year(1981 F/Y)

(1) Survey Team

Leader	1	Overall project management
Deputy Leader	1	Survey in general
Staff Coordinator	1	Operation coordination
Staff Mechanic	1	Vehicle maintenance
Surveyor	11	Field operation
Cartographer	1	Consultation on cartography
Total	16	

(2) Field Operation Period

From January 4 to March 4, 1982

(3) Contents of Operation (supplementary survey)

	Planned	Done
Planimetric Accuracy check survey	4 sites	4 sites
Height Accuracy check survey	4 "	4 "
Secular change revision	Whole area	Whole area
Verification for annotation and planimetric feature	Whole area	Whole area
Operation to confirm questionable matters at the time of compilation	Whole area	Whole area

2-4-6 Fourth Year Work in Japan(1981 F/Y)

(1) Contents of Operation

Aerial triangulation	1,151 models (about 15,000Km^2)
Plotting	72 sheets (11,200Km^2), 1/25,000
Compilation	72 sheets (11,200Km^2), 1/25,000
Orthophotomap	12 sheets (300Km^2), 1/10,000

(2) Period of Operation

From June 1 to December 25, 1981

2-4-7 Fifth Year Work in Japan(1982 F/Y)

"Map Symbols and Map Symbols Application" for 1/25,000 topographic maps is prepared. For details, the both parties agreed upon consultation as shown in Attached Tables (Annexes I and II).

In developing map symbols, special attention has been paid so that uniform operation will be possible in field reconaissance, plotting and compilation, taking into consideration conditions in the Philippines.

In the process, views of the BCGS were reflected to a considerable extent as it was expected that the BCGS will produce base maps themselves in the near future.

In discussing map symbols and their application, the Survey Team selected two typical sample sheets in the area, prepared color printing composite positives and presented them to the BCGS. Details were discussed on the basis of these sample printing.

In carrying out this year's operation, further examination was made to develop detailed manuals as "Specification and Standard Rules for Application of Map Symbols." to get understanding of surveyors and cartographer, and to unify their thinking.

(1) Outline of Works

1) Contents of Works

Item	Plan	Done	Achievement rate	Remarks
Scribing	72 sheets	72 sheets	100%	1/25,000 scribing
Printing	72 sheets x 1,000	72 sheets x 1,000	100%	1/25,000 five-color printing

2) Period of Operation

From June to December, 1982 for scribing

From November, 1982 to February, 1983 for printing

3) Major Equipment and Apparatuses

Photo-lettering machine
Precision duplicator
Offset printing machine for maps
Scribing tool set including light table
Electron photo-lettering machine
Large vacuum printer
Suspended large reproduction camera
Automatic developer for plate making
Twelvemo map proofreader
Full automatic large rotary press

(2) Characteristics of Topographic Map Symbols

The 1/25,000 topographic map symbols were determined upon consultation with BCGS on the basis of the amendment proposal made by the UNDP experts, as stated earlier. While these symbols make it possible to get better printing in appearance and quality in comparison with topographic maps of other countries, they make scribing more complex.

These map symbols have been developed, reflecting

desires of users in the Philippines including government agencies and private users and taking into consideration technical capacity of the Philippines. The following aspects may be pointed out as characteristics of these map symbols:

1) Five-color printing for easy reading.
2) Artificial cultural objects are indicated by different colors.
3) Objects in the water or to go under water during the high tide are indicated by blue color.
4) Objects related to ground reliefs are indicated by brown color.
5) Annotation related to water part are indicated by blue italics.
6) Three levels of blue color (30%, 20%, 10%) are used.
7) Seven thickness of lines (0.1, 0.15, 0.2, 0.25, 0.3, 0.4, 0.6mm) are used.
8) Red screen is overlapped for Regional boundaries.
9) Barangay boundaries are not shown.
10) Line thickness and color to indicate roads are related to road surface condition and road administration. Therefore, their importance is reflected.
11) National and provincial roads are marked with symbols.
12) In order to clearly show land use condition, vegetation symbols and screens are used concurrently, and delineate line is omitted.
13) For dense built-up area, red scrrens(20%) are used.

14) Public buildings, land mark objects are indicated by symbols.

15) As for water area, isobathymetric lines and depth values are shown down to the depth of 200 meters.

16) Geographic names are indicated by different sizes according to importance.

17) Fixed geographical names are indicated by upright characters and line-shape objects, i.e., river, and mountaines by italics.

18) Supplementary contour lines (2.5-meter intervals) are used for only very flat topography.

19) Spot elevations and their values and contour values are indicated by brown italics.

20) Maps may be used both as topographic maps and land use maps.

(3) Execution of Operation

(3)-1 Topographic map scribing

1) Outline

On the basis of the 1/25,000 topographic map symbols, scribing sheets were prepared in necessary numbers for color separations.

2) Materials used

As basic materials, polyester base scribing sheets which are more than 0.12mm thick and whose elasticity rate is less than 0.05% under the conditions of normal temperature and humidity were used. Yellow scribing bases were used to clearly show lines.

3) Specifications

Neat line size:		7.5' x 7.5'
Scale	:	1/25,000
Contour line interval	:	10 meters for intermediate contour lines, 5 meters for half interval contour lines, 2.5 meters for quarter interval contour lines
Isobathymetric line:		20 meters down to the depth of 200 meters
Amount of Work:		72 sheets, five-color separation

4) Color separation plates

Black:

Scribing plate ... roads and related things, buildings, boundary line, neat lines, grid reference lines, artificial objects.

Marginal information annotation plate ... annotations (excluding water-related things, elevation values), symbols.

Blue:

Scribing plate ... coasts, rivers, lakes, ponds, isobathymetric lines.

Annotation plate . those related to water.

Mask plate ... water surface, mangrove, nipa, fish farming ponds.

Mask plate ... swamp.

Mask plate ... tidal flat

Mask plate ... reef.

Mask plate ... broadleaf forest.

Mask plate ... rice field

Mask plate ... broadleaf and shrub mixed forest.

Green:

Mask plate ... broadleaf forest, mixed forest, mangrove shrub.

Mask plate ... nipa.

Mask plate ... grass field.

Mask plate ... coconut.

Mask plate ... rice field

Mask plate ... cultivated land.

Mask plate ... orchard.

Red plate:

Scribing plate ... roads, light houses.

Mask plate ... Regional boundaries, built up area.

Brown plate:

Scribing plate ... roads, cliffs, slopes, lavas, craters, dunes, contour lines.

Annotation plate ... spot elevation values, contour values.

Mask plate ... lavas, bare rocks.

Mask plate ... mud

Mask plate ... sand, dunes.

5) Execution and flow chart

Scribing work was divided into scribing, mask, positive, negative, marginal information annotation plates, paying special attention to fitting adjoining sheets and to omission of lines, symbols and others. (Refer to Attached Table 1.)
For indexing of plates, punching system were applied and supplemented by index marks were placed at the four corners and upper and bottom middles of plates for plate making and printing.
Neat line tolerance on four sides were less than 0.2mm.
Names of the sheet and sheet numbers were as determined by the BCGS as National Map Series. (Refer to Attached Table 2.)

6) Forming on scribing plate

Stereo compilation manuscripts were direct printed by photo-processing means onto the scribing plate.

7) Scribing Works

Scribing plates were divided into black, blue, red and brown plates on which planimetric and topographic details were scribed according to the map symbols and map symbols application regulations.
Color matching was strictly inspected on the light table.

8) Mask plate

As mask plate materials, daylight (photo sensitive) peel coat and peel coat was used.

WORK FLOW FOR SCRIBING