

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE IMPROVEMENT OF BROADCASTING EQUIPMENT
FOR
THE NATIONAL BROADCASTING CORPORATION
IN
THE INDEPENDENT STATE OF PAPUA NEW GUINEA**

March, 2003

***Japan International Cooperation Agency
NHK Integrated Technology Inc.***

PREFACE

In response to a request from the Government of the Independent State of Papua New Guinea, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Broadcasting Equipment for the National Broadcasting Corporation in Papua New Guinea and entrusted the study to the Japan International Cooperation Agency (JICA).

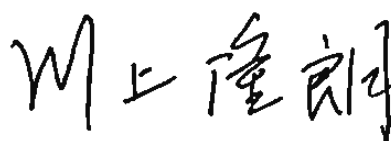
JICA sent to Papua New Guinea a study team from October 23rd to November 17th, 2002.

The team held discussions with the officials concerned of the Government of Papua New Guinea, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Papua New Guinea in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Independent State of Papua New Guinea for their close cooperation extended to the teams.

March 2003



Takao Kawakami
President

Japan International Cooperation Agency

March 2003

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of Broadcasting Equipment for the National Broadcasting Corporation in the Independent State of Papua New Guinea.

This study was conducted by NHK Integrated Technology Inc., under a contract to JICA, during the period from October 2002 to February 2003. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Papua New Guinea and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

大塚 裕 昭

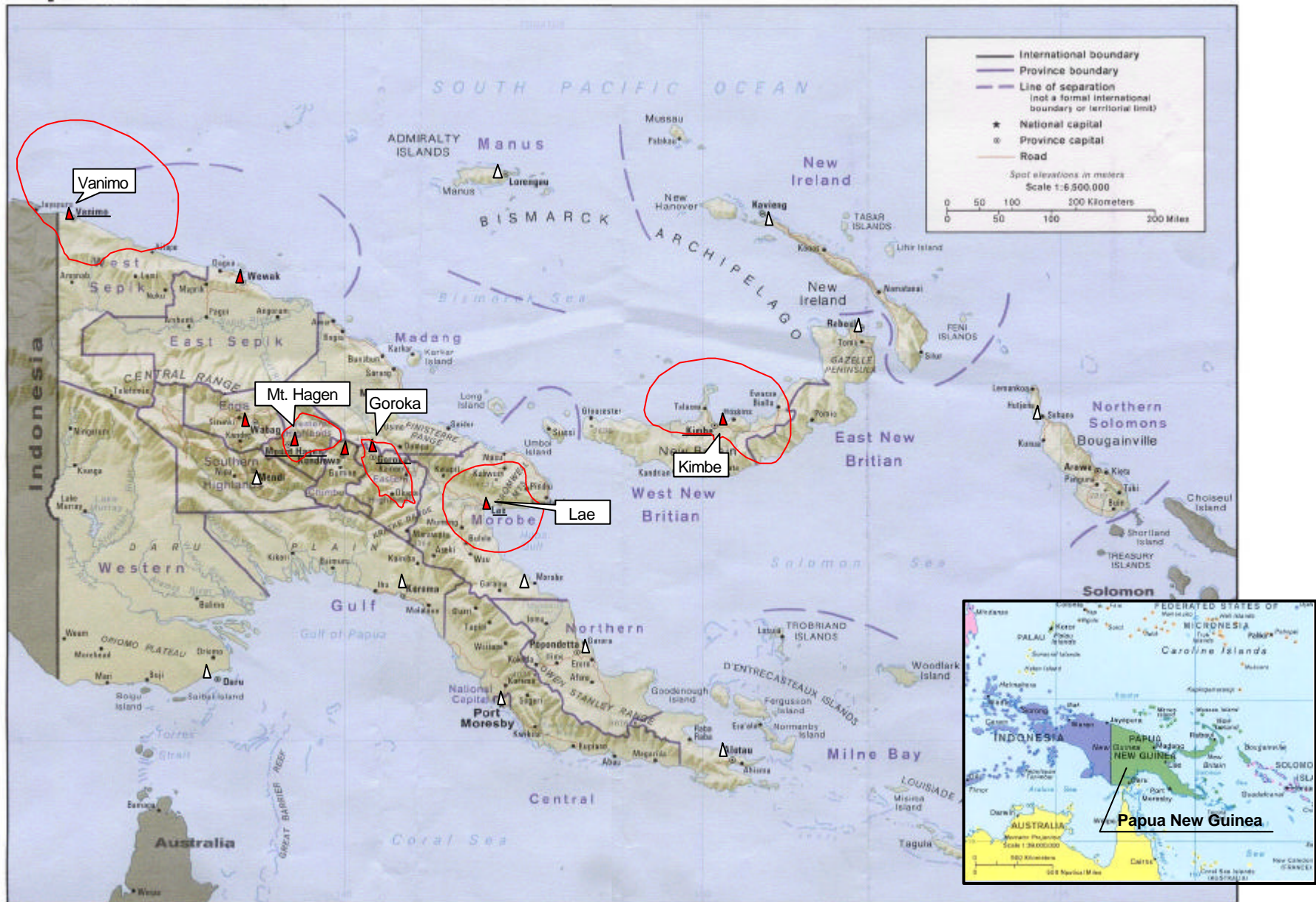
Hiroaki OTSUKA

Project manager,

Basic design study team on

The Project for Improvement of Broadcasting
Equipment for The National Broadcasting Corporation
in Papua New Guinea

NHK Integrated Technology Inc.



Site Location of NBC Kundu Services



Perspective of Medium Wave Transmitting Station



Perspective of FM Wave Transmitting Station

List of Figures and Tables

Fig. 2-1	Project Outline Drawing	
Fig. 2-2	Mt. Hagen FM Radio Station	Site Layout of FM Transmitting Station
Fig. 2-3	Mt. Hagen FM Radio Station	Block Diagram of Program Production System
Fig. 2-4	Mt. Hagen FM Radio Station	Block Diagram of Network Studio
Fig. 2-5	Mt. Hagen FM Radio Station	Equipment Layout of Network Studio
Fig. 2-6	Mt. Hagen FM Radio Station	Block Diagram of FM Transmitting Station
Fig. 2-7	Mt. Hagen FM Radio Station	General View of FM Transmitting Antenna
Fig. 2-8	Mt. Hagen FM Radio Station	Schematic Diagram of FM Power Supply System
Fig. 2-9	Mt. Hagen FM Radio Station	Equipment Layout of FM Transmitter Room
Fig. 2-10	Mt. Hagen FM Radio Station	General View of FM Transmitting Tower
Fig. 2-11	Lae MF Radio Station	Site Layout of MF Transmitting Station
Fig. 2-12	Lae MF Radio Station	Block Diagram of Program Production System
Fig. 2-13	Lae MF Radio Station	Block Diagram of MF Transmitting Station
Fig. 2-14	Lae MF Radio Station	General View of MF Transmitting Antenna
Fig. 2-15	Lae MF Radio Station	Schematic Diagram of MF Power Supply System
Fig. 2-16	Lae MF Radio Station	Equipment Layout of MF Transmitter Shelter
Fig. 2-17	Lae MF Radio Station	Equipment Layout of MF Transmitter Shelter (Section)
Fig. 2-18	Kimbe MF Radio Station	Site Layout of MF Transmitting Station
Fig. 2-19	Kimbe MF Radio Station	Block Diagram of Program Production System
Fig. 2-20	Kimbe MF Radio Station	Block Diagram of MF Transmitting Station
Fig. 2-21	Kimbe MF Radio Station	General View of MF Transmitting Antenna
Fig. 2-22	Kimbe MF Radio Station	Schematic Diagram of MF Power Supply System
Fig. 2-23	Kimbe MF Radio Station	Equipment Layout of MF Transmitter Shelter
Fig. 2-24	Kimbe MF Radio Station	Equipment Layout of MF Transmitter Shelter (Section)
Fig. 2-25	Vanimo MF Radio Station	Site Layout of MF Transmitting Station
Fig. 2-26	Vanimo MF Radio Station	Block Diagram of Program Production System
Fig. 2-27	Vanimo MF Radio Station	Block Diagram of Network Studio
Fig. 2-28	Vanimo MF Radio Station	Equipment Layout of Network Studio
Fig. 2-29	Vanimo MF Radio Station	Block Diagram of MF Transmitting Station
Fig. 2-30	Vanimo MF Radio Station	General View of MF Transmitting Antenna
Fig. 2-31	Vanimo MF Radio Station	Schematic Diagram of MF Power Supply System
Fig. 2-32	Vanimo MF Radio Station	Equipment Layout of MF Transmitter Shelter

Fig. 2-33	Vanimo MF Radio Station	Equipment Layout of MF Transmitter Shelter (Section)
Fig. 2-34	Goroka FM Radio Station	Site Layout of FM Transmitting Station
Fig. 2-35	Goroka FM Radio Station	Block Diagram of Program Production System
Fig. 2-36	Goroka FM Radio Station	Block Diagram of Network Studio
Fig. 2-37	Goroka FM Radio Station	Equipment Layout of Network Studio
Fig. 2-38	Goroka FM Radio Station	Block Diagram of FM Transmitting Station
Fig. 2-39	Goroka FM Radio Station	General View of FM Transmitting Antenna
Fig. 2-40	Goroka FM Radio Station	Schematic Diagram of FM Power Supply System
Fig. 2-41	Goroka FM Radio Station	Equipment Layout of FM Transmitter Shelter
Fig. 2-42	Goroka FM Radio Station	Equipment Layout of FM Transmitter Shelter (Section)
Fig. 2-43	Goroka FM Radio Station	General View of FM Transmitting Tower
Fig. 2-44	Kainantu FM Relay Station	Site Layout of FM Relay Station
Fig. 2-45	Kainantu FM Relay Station	Block Diagram of FM Relay Station
Fig. 2-46	Kainantu FM Relay Station	General View of FM Transmitting Antenna
Fig. 2-47	Kainantu FM Relay Station	Equipment Layout

Table 1-1	Mining industry and Population density of each province
Table 1-2	Major Issues in PNG
Table 2-1	Study Summary Sheet
Table 2-2	Mt. Hagen FM Station Equipment
Table 2-3	Lae MF Station Equipment
Table 2-4	Kimbe MF Station Equipment
Table 2-5	Vanimo MF Station Equipment
Table 2-6	Goroka FM Station Equipment
Table 2-7	Major Undertaking of Each Government
Table 2-8	Work Implementation Schedule

Abbreviations

A/C	: Air Conditioner	HYB	: Telephone Pick-up
ADA	: Audio Distortion Amplifier	ICAO	: International Civil Aviation Organization
AM	: Amplitude Modulation	ITF	: Isolation Transformer
ATT	: Attenuator	LA	: Line Amplifier
ATU	: Antenna Tuning Unit	LIM	: Limiting Amplifier
AVR	: Automatic Voltage Regulator	LM	: Level Meter
CCT	: Compact Cassette Tape Recorder/Reproducer	LT	: Line Transformer
CDP	: Compact Disc Player	M	: Microphone
CDR	: Compact Disc Recorder/Reproducer	MCR	: Master Control Room
CL	: Clock	MF	: Medium Frequency
COS	: Change Over Switch	MOD	: Modulator
DAT	: Digital Audio Tape Recorder/Reproducer	OV	: Over Voltage Relay
DET	: Detector	PA	: Power Amplifier
DHY	: Dehydrator	PANGTEL	: PNG Telecommunication Authority
D/L	: Dummy Load	PDB	: Power Distribution Board
DV	: Input Divider	PIE	: Program Input & Monitoring Equipment
E/G	: Engine Generator	PS	: Power Supply
EQ	: Line Equalizer	RX	: Receiver
FL	: Fluorescent Light	SP	: Speaker
FM	: Frequency Modulation	TEL	: Telephone
FU	: Cough Box	TX	: Transmitter
HF	: High Frequency (Short Wave)		

SUMMARY

Papua New Guinea (PNG) is situated in the Southern Hemisphere just under the equator at Lat. 0~12° S. and Long. 141~160° E, is an island nation composed of the eastern half of New Guinea, New Britain, New Island, Bougainville and islands in the surrounding areas.

It has a population of 5,190,000 (2000) and covers an area of 460,000 km² (roughly 1.25 times the size of Japan). PNG assumed autonomy in 1973 and attained independence in September 1975, thereby ending a United Nations trusteeship under the administration of Australia.

Broadcasting in PNG was started at Port Moresby in 1934 when the country was still a trusteeship under the administration of Australia. Currently the National Broadcasting Corporation (NBC) operates the radio broadcasting consisting of regional broadcasting stations in each of the country's 19 provinces, which conducts MF Karai broadcasting and HF Kundu broadcasting. Whereas the Karai broadcasting are conducted in English over the whole nation, Kundu broadcasting are conducted in the official language of Pigeon English and local dialects for each provinces.

PNG has raised the following targets in its latest Medium Term Development Strategy 1997~2002: 1) primary health, 2) primary education, 3) maintenance of infrastructure, 4) opportunity for private sector, and 5) law and order, and the aim of Kundu broadcasting is to provide necessary information in local languages for improving the standard of living, education, health and agriculture, etc. in line with the above targets for local inhabitants in the areas.

Japan's Grant Aid in 1989, the procurement and supply of equipment of HF broadcasting facilities in 17 provinces, was successful in stimulating education and enlightenment among local inhabitants. However, it passed 13 years since this project completed, and it has become difficult to sustain these facilities and equipment because maintenance parts are either no longer available on markets or they have become so hard to find that prices have jumped and costs are too expensive. Moreover, deterioration of equipment has meant that transmission output power and service areas of Kundu broadcasting have fallen rapidly. Broadcasting conditions are currently so poor that only around 10~30% of the population can receive broadcasting even in the nighttime when condition for signal propagation is good.

On the other hand, in the broadcasting situation in PNG, many FM private radio stations were opened following the revision to the Broadcasting Law in 1995, and NBC was confronted with high quality broadcasting competition with these entrants to the broadcasting sector. Because the audio quality of FM broadcasting has more superiority rather than HF broadcastings, Private broadcaster

took many audiences from NBC. In the result, Kundu broadcasting is not able to fulfill its primary purposes of explaining government policies and promoting education and enlightenment because of the decline of audience rating.

In order to recover such a situation, and also taking into consideration the decision adopted by the International Telecommunication Union (ITU) to suspend present HF broadcasting by 2015, the Government of PNG has requested the Government of Japan to provide the grant aid cooperation to replace HF transmitters with MF transmitters at eight Kundu broadcasting stations that have reached the renewal stage.

In response to the request, Japan International Cooperation Agency (JICA) sent the Basic Design Study Team to PNG from October 23 to November 17, 2002 to verify viability of this project. As a result of the Study, it was deemed that implementation of the project at three of eight candidate sites are difficult concerning to land acquisition and securing of maintenance costs, etc., . Consequently, the numbers of sites were finally decided to five sites. The results of analysis in Japan were compiled into the Basic Design draft Report. And the team came back to PNG from February 16 to 27, 2003 to explain PNG officials in detail of the basic design, and agreement was made concerning the contents of the project.

Important consideration for the basic design was studied as follows:

In addition to the original request, MF, FM broadcasting system should also be considered in selecting the optimum system for each target province.

There was overlapping service areas with adjacent provinces in the conventional HF Kundu broadcasting system, therefore, the minimum necessary service areas should be secured in this project.

Concerning studio equipment, the minimum number of necessary equipment should be included into the Project for improvement of a program quality.

Outline of the Project

Broadcasting Station	Outline of Facilities and Equipment (including procurement and installation)
Mt. Hagen (West Highlands Province)	<ul style="list-style-type: none"> • FM transmitting equipment (3 kW transmitter, 60 m steel tower, antenna, power supply) • Basic studio equipment
Lae (Morobe Province)	<ul style="list-style-type: none"> • MF transmitting equipment (10 kW transmitter, 80 m transmitting antenna, transmitter shelter, power supply) • Recorder/player

Broadcasting Station	Outline of Facilities and Equipment (including procurement and installation)
Kimbe (West New Britain Province)	<ul style="list-style-type: none"> • MF transmitting equipment (10 kW transmitter, 80 m transmitting antenna, transmitter shelter, power supply) • Recorder/player
Vanimo (West Sepik Province)	<ul style="list-style-type: none"> • MF transmitting equipment (10 kW transmitter, 80 m transmitting antenna, transmitter shelter, power supply) • Basic studio equipment
Goroka (East Highland Province)	<ul style="list-style-type: none"> • FM transmitting equipment (3 kW transmitter, 60m steel tower, antenna, transmitter shelter, power supply) • 100 W relay transmitting facilities (Kainantu) • Basic studio equipment

To implement this project as Japan's grant aid, total project term will be approximately 15 months (4 months for implementation design, 11 months for equipment procurement and installation.). Project cost to be borne by PNG side is estimated as 495,000kina (15,300 thousands Yen).

This project is expected to bring following effects directly:

- 1) Expansion of population coverage in target provinces
The average population coverage of the five target stations will increase from 20% to 83%, and the benefiting population will be up from 326,000 to 1,360,000.
- 2) Enlargement of Broadcasting cover area
Broadcasting cover area will be enlarged to 32,000 km² from 12,000 k m² now.
- 3) Improvement on a broadcasting sound quality
Broadcasting sound quality will be improved by introduction of FM and MF broadcasting as well as setup of basic studio equipment. And it is expected that a number of radio listeners will be increased in addition to substantial program contents.

The following are effects that may accrue indirectly:

- 1) Improvement of living environment
Local communications by broadcasting will be restored, information on administrative services will become available, and living environments will be improved.
- 2) Promotion and stimulation of enlightenment activities
Government enlightenment activities will become available, so peoples can understand well situation and circumstances in the field of education, health and agriculture, etc..

3) Introduction of broadcast education for primary schools using local language

Since school attendant rate is relative low in PNG, broadcasting education using radio will be possible for a low grade class of elementary school in cooperation with the Education Media Programs.

More than 1.3 million people in 5 provinces are beneficiaries of this project. The project will be expected to contribute to improvement of their basic human needs. Moreover, technical levels and human resources necessary for operation and maintenance of the facilities has been secured based on past their efforts to maintain conventional equipment.

Finally, budget for operation and maintenance continuously supported by provincial governments after completion of the project should be ensured.

CONTENTS

Preface	
Letter of Transmittal	
Location Map of the Project Sites	
Perspective	
List of Figures and Tables	
Abbreviations	
Summary	
Chapter 1	Background of the Project1
1-1	Background of the Request.....1
1-1-1	Issues and Countermeasures During Implementation of the Radio Broadcasting Station Improvement Projects in 1986/87.....3
1-2	Contents of the Project.....4
1-3	Study on the Project.....6
Chapter 2	Contents of the Project7
2-1	Basic Concept of the Project.....7
2-2	Basic Design of the Requested Japanese Assistance.....9
2-2-1	Design Policy.....9
2-2-2	Basic Plan.....19
2-2-2-1	Equipment Plan.....19
2-2-2-2	Basic Plan of Equipment for Each Station21
2-2-3	Basic Design Drawing38
2-2-4	Implementation Plan.....92
2-2-4-1	Implementation Policy.....92
2-2-4-2	Implementation Conditions93
2-2-4-3	Scope of Works94
2-2-4-4	Consultant's Supervision.....94
2-2-4-5	Quality Control Plan.....96
2-2-4-6	Procurement Plan.....98
2-2-4-7	Implementation Schedule99

2-3	Obligations of Recipient Country.....	101
2-4	Project Operation Plan	104
2-4-1	Operation and Maintenance for Kundu Broadcasting Stations	104
2-4-2	Operation and Maintenance Cost	105
Chapter 3	Project Evaluation and Recommendations	107
3-1	Project Effects.....	107
3-2	Recommendations	108

Appendices

1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Discussions
5. Cost Estimation Borne by Papua New Guinea
6. Estimation Service Area Map