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# THE PROJECT FOR IMPROVEMENT OF EQUIPMENT FOR DEMINING ACTIVITIES IN THE KINGDOM OF CAMBODIA

JANUARY, 1999

JAPAN INTERNATIONAL COOPERATION AGENCY

| C R O |
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| CR(1) |
| 99-114 |

# PREFACE

In response to a request from the Government of the Kingdom of Cambodia , the Government of Japan decided to conduct a basic design study on the Project for Improvement of Equipment for Demining Activities and entrusted the Japan International Cooperation Agency ( JICA ) to conduct the study with the assistance of the Japan International Cooperation System ( JICS ).

JICA sent to the Kingdom of Cambodia a study team from December 6th to December 24th ,1998.

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 Kingcom of Cambodia for their close cooperation extended to the team.

January 1999

Kimio Fujita
President
Japan International Cooperation Agency

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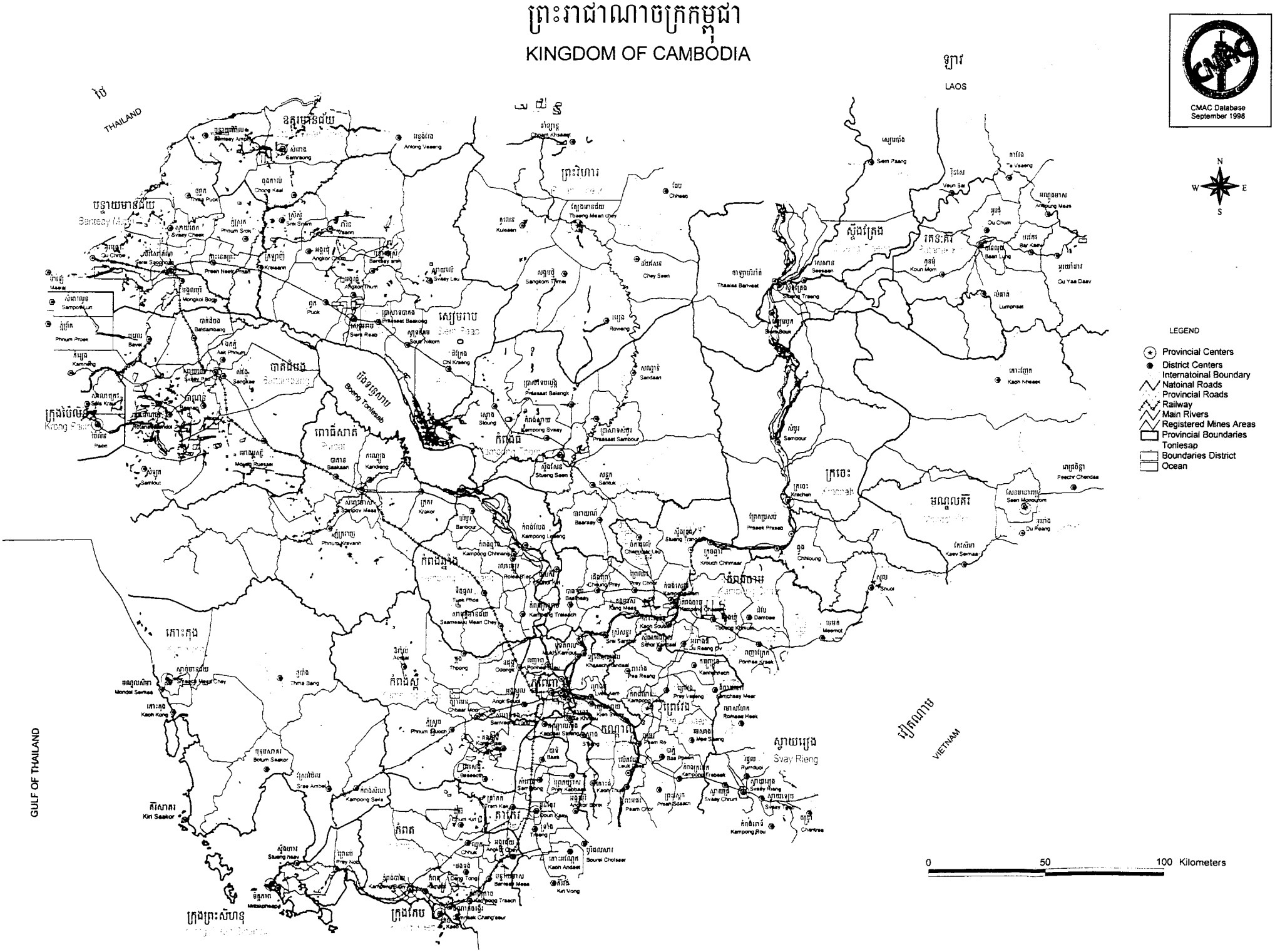
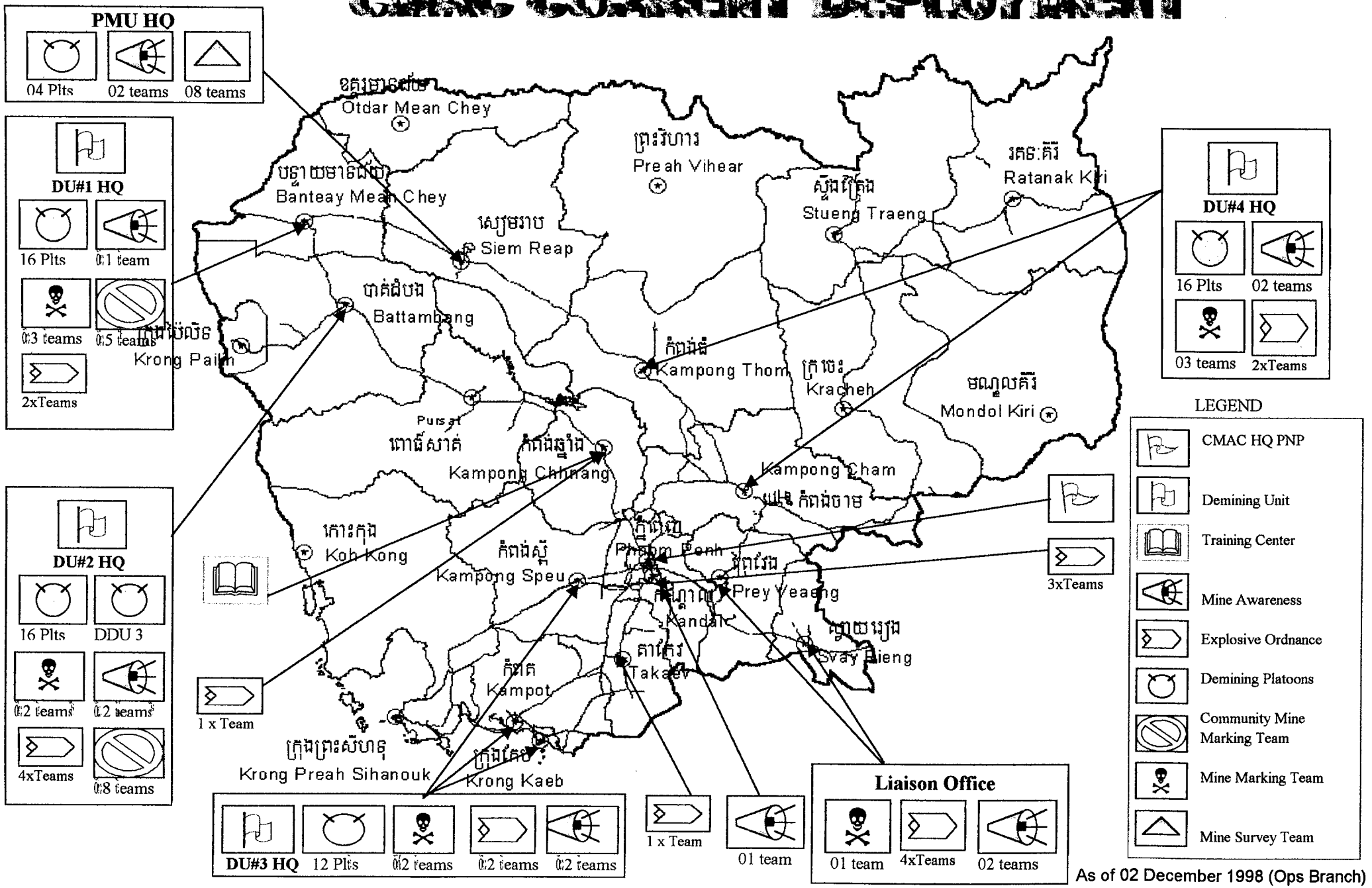


# CMAC CURRENT DEPLOYMENT




As of 02 December 1998 (Ops Branch)

# Chapter 1 Background of the Project

**The Kingdom of Cambodia (hereinafter referred to as Cambodia) achieved independence from France in November 1949 in the aftermath of World War II. Following this, internal conflict and political turmoil continued for more than 20 years as the country found itself caught up in the East-West Cold War, the standoff between China and the Soviet Union, and the war in Vietnam, etc.**

**Based on the Cambodia Peace Accord, which was signed in Paris in October 1991, the United Nations Transition Authority in Cambodia (hereinafter referred to as UNTAC) commenced operations in March 1992, and Cambodia embarked on national reconstruction under support from the international community. Since Cambodia has traditionally been an agricultural country and more than 80% of the population are engaged in agriculture. UNTAC, in 1993, started work on the return of approximately 350,000 refugees who had evacuated to areas near the Thailand border, and devoted all its efforts to first securing the social livelihood of returning farmers. However, it is said that between 4-6 million land mines (United Nations estimate) planted during the conflict still exist in regional areas excluding the capital, Phnom Penh, and anti-personnel land mines and Unexploded Ordnance(hereinafter referred to as UXO) are causing repeated harm to returning farmers and inhabitants in rural areas. Since the land mine strike rate (United Nations data from 1997) in Cambodia is one out of every 236 inhabitants, which is higher than the rate seen in other countries troubled by land mines(one out of 470 in Angola, one out of 862 in Mozambique). For the Royal Government of Cambodia the cleaning up of land mines and UXO is an issue that demands immediate attention.**

**It was against this background that the Royal Government of Cambodia requested the Government of Japan to provide grant aid for the Project for Improvement of Equipment for Demining Activities.**

# Chapter 2 Contents of the Project

## 2-1 Objectives of the Project

**The CAMBODIAN MINE ACTION CENTRE(hereinafter referred to as CMAC) Five Years Plan aims to support the implementation of demining activities based on cooperation with UNDP. Within this plan, the Project is intended to supply equipment necessary for the promotion of future CMAC demining activities, with a view to maintaining and improving the current activity capability.**

## 2-2 Basic Concept of the Project

**The equipment requested by the Royal Government of Cambodia, as is shown in Table 1, is the equipment planned for renewal in 1999 and part of the equipment planned for renewal in 2000 under the CMAC Five Year Plan. The basic concept of the Project is to procure the required types and quantities of equipment based on the items and quantities for supply in 1999 as given in the supply list of the CMAC Five Year Plan.**

## 2-3 Basic Design

### 2-3-1 Design Concept

**Since road conditions in Cambodia are appalling (only 7.5% of the arterial road network is paved as of 1998). Moreover, demining sites are located far from arterial roads and can only be reached by unpaved roads which deteriorate badly in the rainy and dry seasons, four-wheel-drive vehicles shall be adopted concerning the vehicular equipment. Furthermore, since the climate in Cambodia is hot and humid and it is important under such conditions to give consideration to the maintenance and temperature control of equipment, it has been decided to procure an air conditioner for the data base room at headquarters of the CMAC, where computers are installed.**

**Concerning the operation and maintenance capacity of the implementing agency, United Nations experts are dispatched to numerous areas of CMAC and capability is high. Moreover, concerning the CMAC activities budget, since this is provided from the UNDP trust fund that is funded by donor nations, there is thought to be no problem**

**regarding the operation and maintenance of Project equipment. Concerning the types and quantities of equipment, these shall basically be determined based on the items and quantities, that are scheduled to be procured in 1999 under the CMAC Five Years Plan (1999-2000).**

## 2-3-2 Basic Design

**(1) Brush Cutters**

**CMAC has so far carried out vegetation cutting, which actually accounts for 70% of demining work, using manual labor, however, it has requested four brush cutters with a view to improving the efficiency of vegetation cutting. The brush cutters in question are made by Komatsu and Hitachi Construction Machinery Co., Ltd. and are based on crawler-type hydraulic excavators. In selecting the brush cutters, it is first necessary for equipment safety to be confirmed in experiments on CMAC sites which entail LM explosions, and for equipment to be selected from items that have completed such testing prior to the start of the procurement procedure. Moreover, an Equipment Statement of Operational Requirement: SOR #1099 Brush Cutters for CMAC, has been completed and will be used as the standard for equipment selection. Concerning the number of brush cutters, one has been selected for each land mine removal site in the 1999 portion of the five year plan, i.e. four brush cutters in total.**

**(2) Metal Detectors**

**CMAC has until now used metal detectors made by Siebel Co. However, as a result of performance tests that were carried out on various metal detectors from 1996, it was found that the F1A4 metal detector made by Minelab Co. offers excellent detection performance in laterite soil, which makes up approximately 30% of all soil in Cambodia.**

**Accordingly, Minelab Co. metal detectors were introduced following the implementation of improvements in line with conditions of use in Cambodia. CMAC currently possesses approximately 1,100 Siebel Co. metal detectors and 1,200 Minelab Co. metal detectors (including broken down machines), however, it plans to make all metal detectors Minelab Co. products over the next five years. The Project will entail the procurement of 200 such detectors which are intended for supply under this plan in 1999.**

**(2) Vehicles**

**Three types of vehicles have been requested: pickup trucks, ambulances, and people carriers. The basic design concerning each type of vehicle is given below.**

**1) Pickup Trucks**

**Pickup trucks are essential for transporting materials and people on sites, and approximately 170 such vehicles are assigned to the headquarters and each land mine removal site, etc. CMAC plans to carry out the renewal of vehicles over the next five years, and the Project shall entail the procurement of 11 pickup trucks to replace extremely deteriorated vehicles.**

**2) Ambulances**

**It is compulsory for one ambulance to be assigned to each land mine removal branch site, however, only 13 ambulances are in use at the 18 sites currently in operation. Other vehicles are used in place of ambulances on sites which do not possess ambulances. Over the next five years it is planned to supply an additional 34 ambulances and to assign three or four to each major land mine removal site (branch sites No. 1 and No. 2). The Project will entail the procurement of eight ambulances as the 1999 portion of this plan.**

**3) People Carriers**

**In order to strengthen survey department vehicles for carrying personnel required to implement the National Level 1 Survey, which is to be implemented in earnest in 1999 throughout the country including areas which have so far been inaccessible due to safety problems, 13 people carriers have been requested. Since these vehicles will need to carry surveying equipment and recording equipment, etc. in addition to personnel, station wagon-type vehicles are appropriate. A total of 13 such vehicles, consisting of three vehicles for the headquarters, two vehicles each for the four land mine removal sites, and two vehicles for the Project Managing Unit, shall be procured under the Project.**

**(4) Telecommunications Equipment**

**The radios used by CMAC are American military specification durable types passed down by UNTAC, but these present problems in terms of compatibility with repeaters, call functions with specific stations, and data communication functions, etc. Since problems may also exist in the case of Japanese radios, the Project radios shall be procured locally. Concerning the types and quantity of radios, the 1999 portion of the**

**five year plan shall be procured. Table 5 shows the radio procurement plan.**

**Table 5 Radio Procurement Plan**

| Type | Currency Band | Places of Use | Quantity |
|---|---|---|---|
| HF mobile | 125 W, with cell call | For land mine removal branch sites | 59 |
| HF base station | 125 W, with cell call | For communication between land mine removal branches and removal sites | 10 |
| VHF portable | 136-174MHz, 5W | Land mine removal branches | 30 |
| VHF base station | 136-174MHz, 5W | Land mine removal branches | 15 |

**Source: CMAC interview, December 1998**

### (5) Computers, etc.

#### 1) Computers

**The networking of computers is an issue that faces CMAC in the future. In the current situation, where no network has yet been established, one printer is required for every one or two computers in each department. Table 5 shows the procurement plan for the 48 computers which have been requested under the Project.**

**Table 5 Breakdown of Computers, etc. to be Procured**

| | Place of Use | | For Replacement | Additional | Purpose of Use |
|---|---|---|---|---|---|
| 1 | Headquarters | General Affairs Dept. | 10 | - | For data preparation in the equipment maintenance department |
| | | LM and UXO Department | 6 | 2 | For preparation of minefield data bases |
| 2 | Demining sites | | - | 24 | New introduction for input of detailed minefield information and equipment maintenance information, etc. |
| 3 | Training centers | | - | 6 | New introduction for preparing teaching materials and translating, etc. |
| Subtotals | | | 16 | 32 | |
| Total | | | 48 | | |

**Source: CMAC interview, December 1998**

#### 2) Printers

**Printers have been requested for each section at headquarters, whereas scanners and plotters have been requested as additional equipment for expanding minefield, data base and map preparation work, etc. The following 49 items of equipment shall be supplied to headquarters.**

| | | |
|---|---|---|
| **A4 printer** | **40 units** | **For use by headquarters staff** |
| **A2 color printer** | **4 units** | **For data base use** |
| **A3 scanner** | **3 units** | **For data base use** |
| **A0 scanner** | **1 unit** | **For data base use** |
| **A0 plotter** | **1 unit** | **For data base use** |
| **Total** | **49 units** | |

**(6) Other Equipment**

**Other equipment consists of items that are required for the activities of each land mine removal branch and site. In view of electric power conditions in Cambodia, private generators are used to provide power at most CMAC land mine removal sites including the headquarters building. It is planned to use the 2.8 KVA generators as power sources for television sets and videos, etc. (used for educational purposes), and the other generators as main power sources at the headquarters, sites and training center. Table 6 shows the items, models and quantities that are to be procured.**

**Table 6 Other Equipment Procurement Plan**

| Item | Model | Quantity | Remarks |
|---|---|---|---|
| **Generator 1.** | **2.8KVA** | **6** | **1 for headquarters, 1 for the PR and enlightenment teams at each land mine removal branch, and 1 for the PMU. To be used as power sources for PR activities equipment.** |
| **Generator 2.** | **5KVA** | **5** | **1 for headquarters, and 1 for each land mine removal branch. To be used as site power sources.** |
| **Generator 3.** | **20KVA** | **2** | **1 each for the community marking teams in land mine removal branches No. 1 and No. 2. To be used as power sources for activities equipment.** |
| **Generator 4.** | **1,000KVA** | **3** | **1 for headquarters, and 2 for the training center. To be used as main power sources for facilities.** |
| **Television set** | **29 inch** | **14** | **2 for headquarters, 2 for the training center, and 2 for the PR and enlightenment teams at each land mine removal branch. To be used for training and PR activities.** |
| **Video deck** | **Multi system** | **11** | **1 for the training center, and 2 for the PR and enlightenment teams at each land mine removal branch. To be used for training and PR activities.** |
| **OHP** | **PC & Video compatible type** | **5** | **1 for the training center, and 1 for each land mine removal branch. To be used for PR activities and training.** |
| **Air conditioner** | | **5** | **5 for the data base room at headquarters. For temperature control.** |
| **Binoculars** | | **8** | **2 for each land mine removal branch. For monitoring the land mine removal sites.** |
| **Oscilloscope** | **Digital 300 MHZ** | **4** | **1 for each land mine removal branch. For maintenance of metal detectors.** |

| | | | |
|---|---|---|---|
| **Facsimile** | **Compatible for use in Cambodia** | **3** | **2 for headquarters, and 1 for the training center. For improvement of work communications.** |
| **Refrigerator** | **200-250 liters** | **5** | **1 for headquarters, and 4 for the land mine removal branches. For preservation of emergency medical supplies.** |

**Source: CMAC interview, December 1998**

## 2-3-3 Procurement of Third Country Products

**Table 7 shows the third country products that are included in the Project equipment. The Remarks column shows the range of supply sources.**

**Table 7 List of Third Country Products**

| No. | Item | Reason | Remarks |
|---|---|---|---|
| 1 | Metal detector | Minelab Co. products have been designated by CMAC | Australia |
| 2 | HF portable radio | Japanese products do not satisfy the contents of the request. | OECD |
| 3 | HF base station radio | Japanese products do not satisfy the contents of the request. | OECD |
| 4 | VHF portable radio | Japanese products do not satisfy the contents of the request. | OECD |
| 5 | VHF base station radio | Japanese products do not satisfy the contents of the request. | OECD |
| 6 | A4 printer | Products for export are not produced in Japan. | OECD, Malaysia, Singapore, Thailand |
| 7 | A3 printer | Products for export are not produced in Japan. | OECD, Malaysia, Singapore, Thailand |
| 8 | A4 scanner | Products for export are not produced in Japan. | OECD, Malaysia, Singapore, Thailand |
| 9 | A0 scanner | Products for export are not produced in Japan. | OECD, Malaysia, Singapore, Thailand |
| 10 | A0 plotter | Products for export are not produced in Japan. | OECD, Malaysia, Singapore, Thailand |

**Source: CMAC interview, December 1998**

### (1) Examination Concerning Designation of the Brand of Metal Detectors

**Concerning metal detectors, CMAC in the request designated the F1A4 metal detector made by Minelab Co. in Australia, since this was the only model to gain approval in the site tests that it independently carried out.**

#### 1) Current Situation Regarding Metal Detectors in CMAC

**Following its establishment in 1992, CMAC used metal detectors made by Siebel Co.**

**which were handed down by the United Nations. However, since these metal detectors did not give sufficient detection capability in laterite soil, CMAC carried out testing of various metal detector models. In 1997 CMAC adopted the F1A4 metal detector made by Minelab Co. since this was found to possess excellent detection capacity in laterite soil, and it decided to replace all metal detectors with the F1A4 model. Since that time, CMAC has advanced introduction of the F1A4 metal detector and it currently possesses more than 1,100 of these models, accounting for approximately half the metal detectors in its ownership.**

**2) Types of Metal Detector**

**Metal detectors designed to find land mines are not manufactured in Japan (the Type-89 detector used by the self defense forces consists of a metal detector combined with an underground radar). However, numerous metal detectors are made in foreign countries: for example, NATO uses metal detectors made by Siebel Co. in Austria and Evinger Co. in Germany, etc.**

**3) Selection and Management of Metal Detectors in CMAC**

**CMAC makes it a basic policy for the following reasons to use one type of metal detector - the type that is best suited to conditions in Cambodia. Since metal detectors are used every day on site by CMAC's 2,000 or more mine removal staff in work that is directly hazardous to human life, CMAC prepares detailed operator standards according to the characteristics of the metal detectors and only assigns removal staff who have undergone sufficient training based on these standards. Thus, detailed operator standards are required for each specific metal detector model, and only personnel skilled in each model are allowed to work on sites. Accordingly, adopting numerous models would not only create difficulties in terms of equipment maintenance, it may also lead to major problems concerning staff training plans and work safety itself. With a view to selecting the optimum metal detector model, CMAC implements site tests in accordance with performance requirements that it has prepared itself. Test items range widely from detection capacity, durability and operability to ease of maintenance, etc., but particular emphasis is given to detection capability in laterite soil, which accounts for roughly one-third of all soil in Cambodia. This is because, since laterite contains a lot of iron oxide, it is very common for metal detectors to react to the soil itself and for detection work to be hindered as a result.**

**4) Views Concerning the Appropriateness of Brand Designation by CMAC**

**CMAC is currently advancing a plan to introduce only F1A4 metal detectors made by Minelab Co. as the model most suited to the conditions of use in Cambodia. Therefore, if a model other than the F1A4 were to be procured at the present point in time, this would be beyond the scope of consideration as a practical model if it has not undergone testing by CMAC, or it would necessarily be an inferior model to the F1A4 if it has already undergone the said testing. In any case, the selected model would be inappropriate. Furthermore, since the selection of a model other than the F1A4 would entail the complete revision of mine removal staff training plans, etc. and would also have an impact on work safety, this would not be appropriate in terms of metal detector operation either. Accordingly, it is deemed that, for the purposes of the Project, it is appropriate for CMAC to designate the brand of the targeted metal detectors as the F1A4 model made by Minelab Co.**

**(2) Examination Concerning Third Country Procurement of Radios and Computers, etc.**

**1) Short Wave Radios**

**CMAC is requesting that base station and portable short wave radios be procured from a third country. Due to the poorly developed state of the telephone network in Cambodia, CMAC relies on short wave radios to carry out medium and long distance communications between headquarters, branches, site offices, and survey teams, etc., and it uses more than 150 short wave radios, including equipment that was inherited from the United Nations, for this purpose. The radios currently being used by CMAC possess a specific station call function known as cell call system, whereby one can ring up another person's radio by inputting his number (in the same way as a telephone). This function can be said to be indispensable for achieving mutual communications between specific persons using 100 stations or more. Accordingly, it is essential for the Project equipment to be compatible with the cell call system currently used by CMAC. However, since it has been found that Japanese short wave radios fitted with the above function do not exist (except for shipping radios), the request for third country procurement is deemed to be appropriate.**

**2) Ultrashort Wave Radio**

**CMAC uses handy and vehicular ultrashort wave radios to carry out short distance**

**communications between land mine removal sites, survey teams and branches, etc. Since these ultrashort wave radios are used under harsh site conditions (high temperature and humidity, rainfall, shocks, etc.), models that satisfy American military standards (MIL standards) with respect to durability are used. Since ultrashort wave radios are the only means of communication on removal sites, great importance is attached to the reliability of this equipment under difficult conditions. Accordingly, it is essential for the ultrashort wave radios that are to be procured under the Project to also possess durability that is compliant with American military standards. There is one Japanese manufacturer of ultrashort wave radios which makes radios compliant with American military standards, however, it has not yet been confirmed whether the frequency band of these radios corresponds to the bands used by CMAC. Furthermore, even if the frequency band is satisfactory, there is concern that sufficient competition will not be secured when dealing with a single company. Accordingly, concerning the ultrashort wave radios, too, the request for third country procurement is again deemed to be appropriate.**

**3) Computers, Printers and Plotters**

**Concerning these items of OA equipment, there are numerous products made by Japanese manufacturers. However, in recent years, since OA makers have spread their production plants throughout the world, with respect to so-called export specification products (English specifications), there is a very high possibility that even the products of Japanese makers are made overseas. Therefore, since there is thought to be a very high possibility that competition will be restrained if OA equipment for the Project is limited to Japanese products only, the request for third country procurement is again deemed to be appropriate.**

**Table 8 Equipment List**

| No. | Equipment | Specifications | Quantity |
|---|---|---|---|
| 1 | Brush cutter | Weight 10-15 t | 4 units |
| 2 | Metal detector and attachments | Multi-period sensing | 200 units |
| 3 | UPS (unmanned power source) | Output capacity: 1000 VA, backup time: 5 minutes minimum | 5units |
| 4 | Electric water pump | Centrifugal type, capacity: 100 l/min | 2 units |
| 5 | Generator (2.8 KVA) | Single phase 2.5 KW minimum, fuel: gasoline | 6 units |
| 6 | Generator (5 KVA) | Single phase 5 KW minimum, fuel: diesel | 5 units |
| 7 | Generator (20 KVA) | Single phase 20 KW minimum, fuel: diesel | 2 units |
| 8 | Generator (100 KVA) | Single phase 100 KW minimum, fuel: diesel | 3 units |

| | | | |
|---|---|---|---|
| 9 | Mower | Back-carried type, engine output: 30 cc | 3 units |
| 10 | Binoculars | Magnification: x7, objective lens effective diameter: 50 mm, waterproof | 8 units |
| 11 | 20 foot container | 20 feet, side open type | 2 units |
| 12 | 6 foot container | 6 feet x 4 feet, side open type | 20 units |
| 13 | Water trailer | Tank capacity: roughly 1000 liters, low speed specifications | 15 units |
| 14 | Refrigerator | Door, capacity: roughly 200 liters, fleon-free | 5 units |
| 15 | Lap top computer | | 15 units |
| 16 | Desk top computer | | 30 units |
| 17 | Desk top computer | | 3 units |
| 18 | Facsimile | | 3 units |
| 19 | Video cassette deck | S-VHS recording and playing, multi system | 11 units |
| 20 | Television set | 29 inch, multi system | 14 units |
| 21 | OHP projector | Projection range: 1-4.5 m, magnification: roughly 3-10 times | 5 units |
| 22 | Pickup truck | Double cabin, 4-wheel-drive | 11 units |
| 23 | Ambulance | 4-wheel-drive | 8 units |
| 24 | People carrier | 4-wheel-drive, long body | 13 units |
| 25 | Spare parts for pickup truck | | 1 set |
| 26 | Spare parts for ambulance | | 1 set |
| 27 | Short wave base station and attachments | Max. 400 channels, 2-26.5 Mhz | 10 units |
| 28 | Ultrashort wave radio (handy type) | Frequency: 146-172 Mhz, channels: 16 minimum | 15 units |
| 29 | Ultrashort wave base station (durable type) | Frequency: 146-172 Mhz, channels: 80 minimum | 10 units |
| 30 | Solar panel | | 20 units |
| 31 | Ultrashort wave base station | Frequency: 136-174 Mhz, channels: 80 minimum | 10 units |
| 32 | Short wave mobile station and attachments | 15 channels, 2.25-30 Mhz, with 2 transceivers | 59 units |
| 33 | Ultrashort wave radio (handy type) | Frequency: 136-174 Mhz, channels: 20 minimum | 10 units |
| 34 | Copier | Size: A4, table-top type | 6 units |
| 35 | Copier | Size: A3, console type | 2 units |
| 36 | Printer | Size: A4 | 40 units |
| 37 | Printer | Size: A4 | 4 units |
| 38 | Scanner | Size: A4 | 3 units |
| 39 | Scanner | Size: A0 | 1 unit |
| 40 | Plotter | Size: A0 | 1 unit |
| 41 | Air conditioner | | 5 units |
| 42 | Cathode-ray oscilloscope | Digital type, frequency band: DC 200 Mhz | 4 units |

**Source: Extract from the Minutes signed on December 10, 1998**

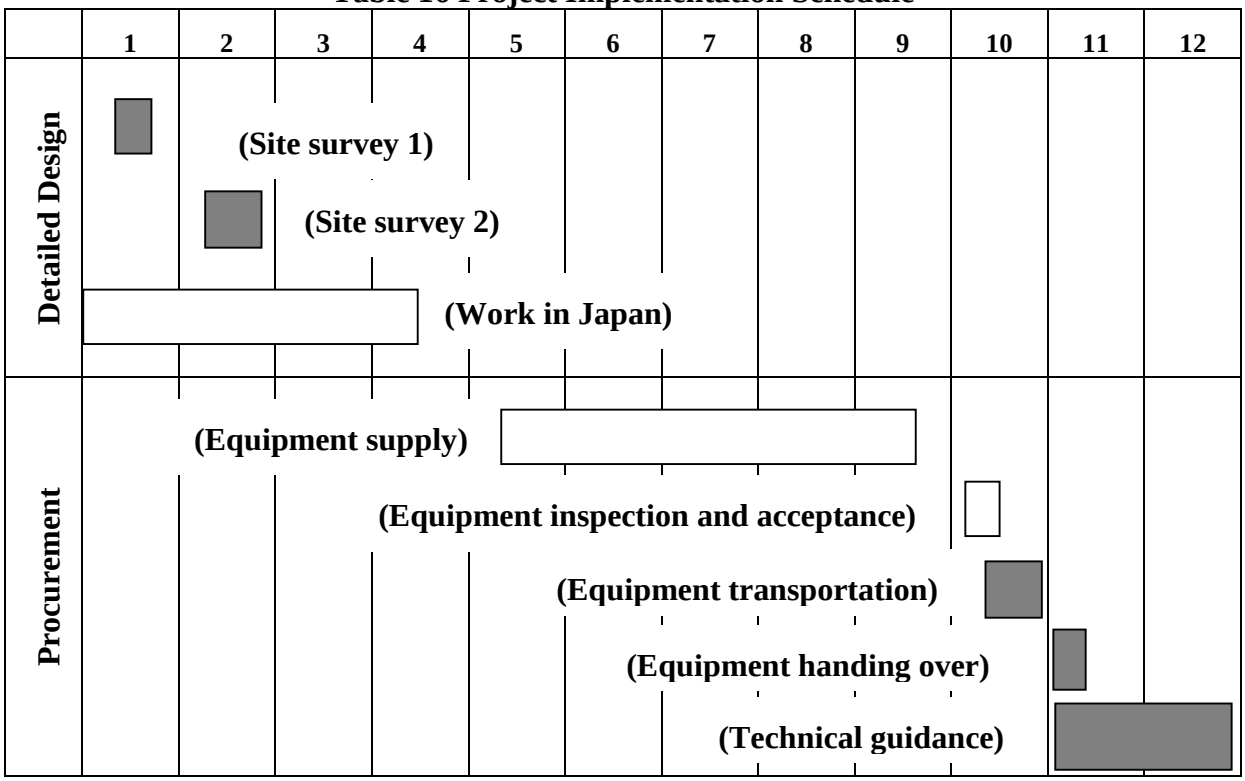
# Chapter 3 Implementation Plan

## 3-1 Implementation Schedule

### 3-1-1 Implementation Schedule

**Table 16 shows the implementation schedule for the Project.**

**Table 16 Project Implementation Schedule**




**Overseas work**

**Site survey 1: Consultant contract**

**Site survey 2: Tender explanation, equipment detailed design**

**Technical guidance: Guidance on operation and maintenance of brush cutters**

**Work in Japan**

**Work in Japan: Request of estimates, advertisement of tender, sale of tender documents, staging of tender meeting, contract**

## 3-1-2 Obligations of Recipient Country

**Cambodia shall bear any steps that are required to implement the Project under the grant aid scheme of the Government of Japan. The necessary steps are as given below.**

**(1) To bear the costs of inland transportation to each site following customs clearance.**

**(2) To bear costs arising from bank work based on the banking agreement.**

**(3) To deal with taxes and execute customs clearance procedures for imported Project equipment.**

**(4) To permit the entry to Cambodia and stay therein of Japanese nationals concerned with Project implementation.**

**(5) To organize and select staff for the agency responsible for Project implementation and the Project following implementation.**

**(6) To secure a budget for the agency responsible for Project implementation and the Project following implementation.**

**(7) To bear all costs not covered by the scope of the grant aid.**

## 3-2 Operation and Maintenance Plan

**The CMAC budget for the operation and maintenance of equipment and facilities (not including staff salaries) accounts for 3.59% of the overall budget. Between November 1993 and August 1998, total expenditure on this item amounted to US $ 1,070,000 (US $ 214,000 per year on average). Except for the Brush cutters, the equipment to be supplied under the Project consists of metal detectors, computers and other items which will not incur any major increase in operation and maintenance cost. For reference purposes, Table 18 gives a rough estimate of the annual operation and maintenance cost of Brush cutter.**

**Table 18**

**Rough Estimate of the Annual Operation and Maintenance Cost of a Brush Cutter**

| | Expenditure Item | Price, Quantity | Remarks |
|---|---|---|---|
| 1. | Fuel cost | | |
| | Hourly fuel consumption | 8 liters/hour | |
| | Monthly operating time | 160h | |
| | Unit cost of light oil | US $ 0.22/liter | Local price |
| | Annual fuel cost subtotal | US $ 3,379.2 | |
| 2. | Oil cost | | |
| | Hourly oil consumption | 0.2 liters/hour | |
| | Monthly operating time | 160h | |
| | Unit cost of oil | US $ 1.4/liter | |
| | Annual oil cost subtotal | US $ 268.8 | |
| 3. | Parts cost | | |
| | Filters | US $ 456 | Replacement every 300 hours |
| | Cutter-related expendable parts | US $ 12,480 | Two times per year |
| | Expendable and replacement parts cost subtotal | US $ 12,936 | |
| 4. | Total | US $ 16,548 | |

**Source: Maker information**

**As can be seen in Table 18 above, the annual operation and maintenance cost of a Brush cutter is approximately US $ 16,000, which would not place a major burden on the current equipment operation and maintenance budget of CMAC. Incidentally, CMAC plans to establish an additional brush cutting section when the Brush cutters are introduced. The organization chart of this section is shown in Figure 5 on the following page. The section personnel will consist of one section commander, seven Brush cutter operators, two maintenance and support staff, and one command vehicle driver, making 11 staff in all. It is scheduled for the personnel expenses, equipment purchase costs and other expenses incurred by this section to be appropriated in the budget for fiscal 2000. The work contents of the brush cutting section are described on the following page.**

**(1) Section Commander**

**The section commander is the person in charge of the vegetation cutting section. He will oversee the overall Brush cutter utilization plans on each demining site. One command vehicle shall be assigned for carrying out work communications.**

**(2) Brush Cutting Team**

**One vegetation cutting team, consisting of seven Brush cutter operators, will be assigned to each land mine removal branch. Over the next five years it is planned to**

**introduce five Brush cutters and assign two operators as rotating shift staff working exclusively on the removal of vegetation (shrubs, weeds, bamboo, bush).**

**(3) Maintenance and Support Team**

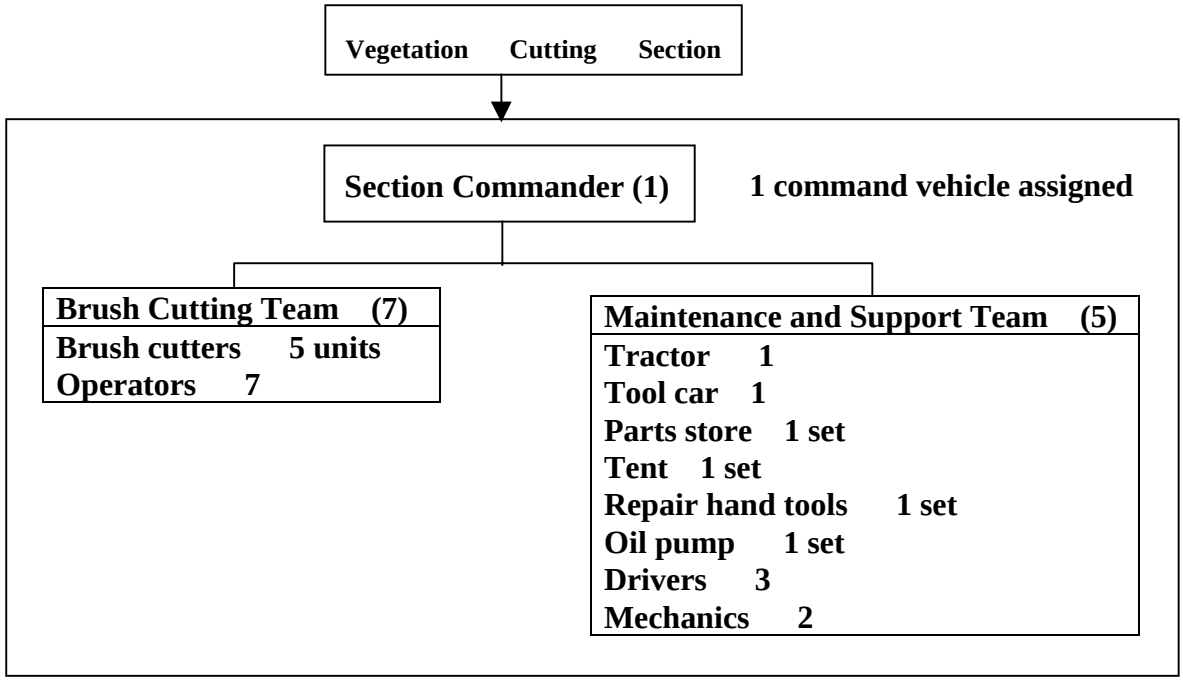
**The maintenance and support team will be in charge of the maintenance, inspection and repair, etc. of Brush cutters. The team shall consist of five members including drivers. The role of each vehicle is as given below:**

**1) Tractor: large trailer used for transporting Brush cutters**

**2) Tool car: medium truck carrying vehicle maintenance and repair tools, etc.**

**3) Parts store: room for storing parts including Brush cutter spare parts**

**4) Tent: simple tent for workers**




**Source: Extracted from CMAC data for March 1993 (SOR #1099)**

**Figures in brackets show number of personnel.**

**Figure 5 Organization Chart of the Brush Cutting Section**

# Chapter 4 Project Evaluation and Recommendation

## 4-1 Project Effect

**(1) Examination of Appropriateness**

**The Royal Government of Cambodia has compiled the 1996-2000 Socio-Economic Development Plan in which it aims to achieve economic recovery in the run-up to the 21st Century. Within this, the Public Investment Programme (PIP) has been formulated by the Council for Development of Cambodia (CDC), and development of rural villages is being advanced as a priority area. Since it is anticipated that the demining in rural areas via the Project will contribute to the said rural development and benefit people living on or below the poverty line in these areas, the Project is deemed to be compatible with the above superior plans.**

**(2) Examination of Social Needs**

**The Royal Government of Cambodia is striving to improve the situation through utilizing aid from international agencies and so on, however, there are no plans regarding the assistance that is required to renew deteriorated metal detectors and vehicles, etc. Moreover, there is no immediate prospect for the procurement of computers, etc., which are required for the preparation of land mine distribution maps (work that is carried out by the land mine and unexploded device disposal division of CMAC). The Project is intended to supply such equipment and is judged will prove effective in improving continued demining activities.**

**(3) Beneficial Effect**

**The various equipment to be introduced under the Project is support equipment for CMAC demining activities. The beneficial effects of this equipment supply are described in the following paragraphs.**

**1) Through the introduction of brush cutters, vegetation cutting work, which accounts for 70% of all site work, will be greatly reduced as shown in Table 19.**

**Table 19 Vegetation Cutting Work**

| Vegetation Work Area | Hourly Work Area | Remarks |
|---|---|---|
| One demining team (current system) | 71.4 m2 | One demining team consists of 29 members. |
| One brush cutter (future system) | 400-700 m2 | The driver of the Brush cutter shall be an experienced person. |

**Source: CMAC interview, December 1998**

**Note) The average area of land cleared by a demining team in one day (7 working hours) is 500 m2.**

**2) By distributing 200 Minelab Co. metal detectors (the type most suited to laterite soil) to the demining branches in the manner shown in Table 20, i.e. introducing 50 metal detectors to each branch, the ratio of Minelab Co. metal detectors will be raised to 49% in Branch No. 1, more than 50% in Branch Nos. 2 and 3, and 100% in Branch No. 4. This will lead to a major improvement in the safety and efficiency of mine detecting work.**

**Table 20 Plan for Introduction of New Minelab Metal Detectors**

| Demining Branches | | Number of Minelab Co. Units | Number of Siebel Co. Units | Minelab Co. Share |
|---|---|---|---|---|
| D/U. No.1 | Current system | 93 | 196 | 32% |
| | Future system | 143 | 146 | 49% |
| D/U. No.2 | Current system | 125 | 209 | 37% |
| | Future system | 175 | 159 | 52% |
| D/U. No.3 | Current system | 96 | 152 | 38% |
| | Future system | 146 | 102 | 58% |
| D/U. No.4 | Current system | 213 | 2 | 97% |
| | Future system | 263 | 0 | 100% |

**Source: CMAC interview, December 1998**

**3) Through bolstering means of communication and transportation, greater efficiency will be achieved not only in the land mine removal work, but all areas of activity relating to demining by the implementing agency, for example, minefield surveying work, and educational activities, etc.**

## 4-2 Recommendation

**In order to ensure the effective implementation of the Project, it is necessary to give consideration to the following points.**

**(1) CMAC needs to carry out ample discussions with government councils and steering committees in order to secure the operation and maintenance budget for Project equipment.**

**(2) Since other aid agencies and NGO, etc. are providing assistance in addition to Japan, it is necessary for CMAC to coordinate the contents of this cooperation and to make sure that the Project equipment is effectively utilized.**

**(3) Since the Project equipment will be distributed between the headquarters and the regional demining branches, it is necessary to strengthen the CMAC operation and maintenance setup for each type of equipment.**