

**BASIC DESIGN REPORT**  
**ON**  
**THE FISHERY DEVELOPMENT PROGRAM**  
**IN**  
**THE DEMOCRATIC REPUBLIC OF THE SUDAN**

**JANUARY 1980**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

**SDS**  
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**JANUARY 1980**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

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## PREFACE

Upon the request of the Government of the Democratic Republic of the Sudan, the Government of Japan has decided to carry out a basic design study concerning the fishing boats, equipment, and facilities to be donated for the fishery development programme of the Sudan under our grant-aid with non-reimbursible funds, and the Japan International Cooperation Agency (JICA) conducted the study.


JICA dispatched to the Sudan from November 22 to November 29, 1979, a study team headed by Mr. Kazuo Takayama, fishing boat inspector, Fisheries Agency, Ministry of Agriculture, Forestry & Fisheries.

The field survey was carried out smoothly and successfully with the extensive cooperation of the ministry and other public organizations of the Sudan.

The present report is based on the findings of the survey and on the analyses made upon its return to Japan. I hope this report will contribute to the fisheries development and to the strengthening of the friendly relations between our two countries.

I express my heartfelt appreciation to the government and people concerned of the Sudan for their close cooperation extended to the study team.

January, 1980



Keisuke Arita,

President,

Japan International Cooperation Agency



## SUMMARY

The Government of the Sudan is positively accelerating the promotion of fresh-water fisheries as a means to improve the nation's food situation. Although the domestic demand for fish is fairly large, the supply of fish is only about 2/5 of the demand, indicating a marked imbalance in the supply-demand situation, and the prices of fish are reportedly twice more than those of animal meat.

The fishing grounds have not been developed in the Red Sea and have mainly been located in Lake Nubia and the Nile. It is estimated that the national has fishing resources of over 100,000 tons a year. But the hauls at present from those inland waters hardly exceed 1/4 of the resources, thus leaving more room to expand the fish catches. The fact is, however, that the shortage of various materials for fishing including fishing boats, has hampered the development of fishing, and the Sudan has called on UNDP, FAO, the People's Republic of China, and other nations for funds, equipment, and materials.

With this background, the Sudan called Japan for assistance requesting materials and equipment to promote its fresh-water fisheries in accordance with a grant aid cooperation system.

Based on these requests, this survey aimed at probing into technical and economic adaptability and feasibility as to the items stated above, at appraising the whole aspect of the plan including the effects of the offer, and at drawing up the optimum plan necessary for Japan to extend cooperation in terms of grant aid.

The survey team consulted with competent government officials of the Sudan and the Embassy of Japan in Sudan, etc., for one week from November 23 to 29, 1979. Following these consultation, the survey team made on-the-spot surveys on fishing grounds, fish markets, shipyards, and other facilities along Lake Nubia and the White Nile where proposed materials and mechanical equipment are expected to be used. The survey team held talks on the basis of the request from the Government of the Sudan. As a result of several consultations, the survey team has approved the necessity and adequacy to provide small-size fishing boats, fishing nets, fishing gear, machine tools, and other tools, and the Government of the Sudan has agreed to the above as shown in the following.

(1) Fishing boat

|                                  |          |
|----------------------------------|----------|
| 6M type small fishing boat ..... | 26 units |
| (outboard engine)                |          |
| 6M type small fishing boat ..... | 4 units  |
| (inboard engine)                 |          |



- 7.6M type small fishing boat ..... 26 units  
(outboard engine)
- 7.6M type small fishing boat ..... 7 units  
(inboard engine)
- (2) Fishing nets
  - Nylon fishing nets, nylon twine,  
plastic floats, nylon rope, etc.
- (3) Echo sounder ..... 25 sets
- (4) Fish trays
  - Plastic fish trays ..... 1,000 sets
  - Aluminium fish trays ..... 500 sets
- (5) Stationary machinery, drawing office,  
hand tools, etc.
- (6) Engine
  - Outboard engine ..... 24 sets
  - Inboard engine ..... 14 sets
- (7) Insulated trucks (5 tons type) ..... 3 sets
- (8) Technical guidance

The survey team conducted the basic design on the above in consideration to her request, the environmental conditions of fishing grounds, the technical levels, the state of maintenance and control, and the like, and, in addition, also on the thorough technical guidance for handling and operating, and spare parts for about 2-3 years.

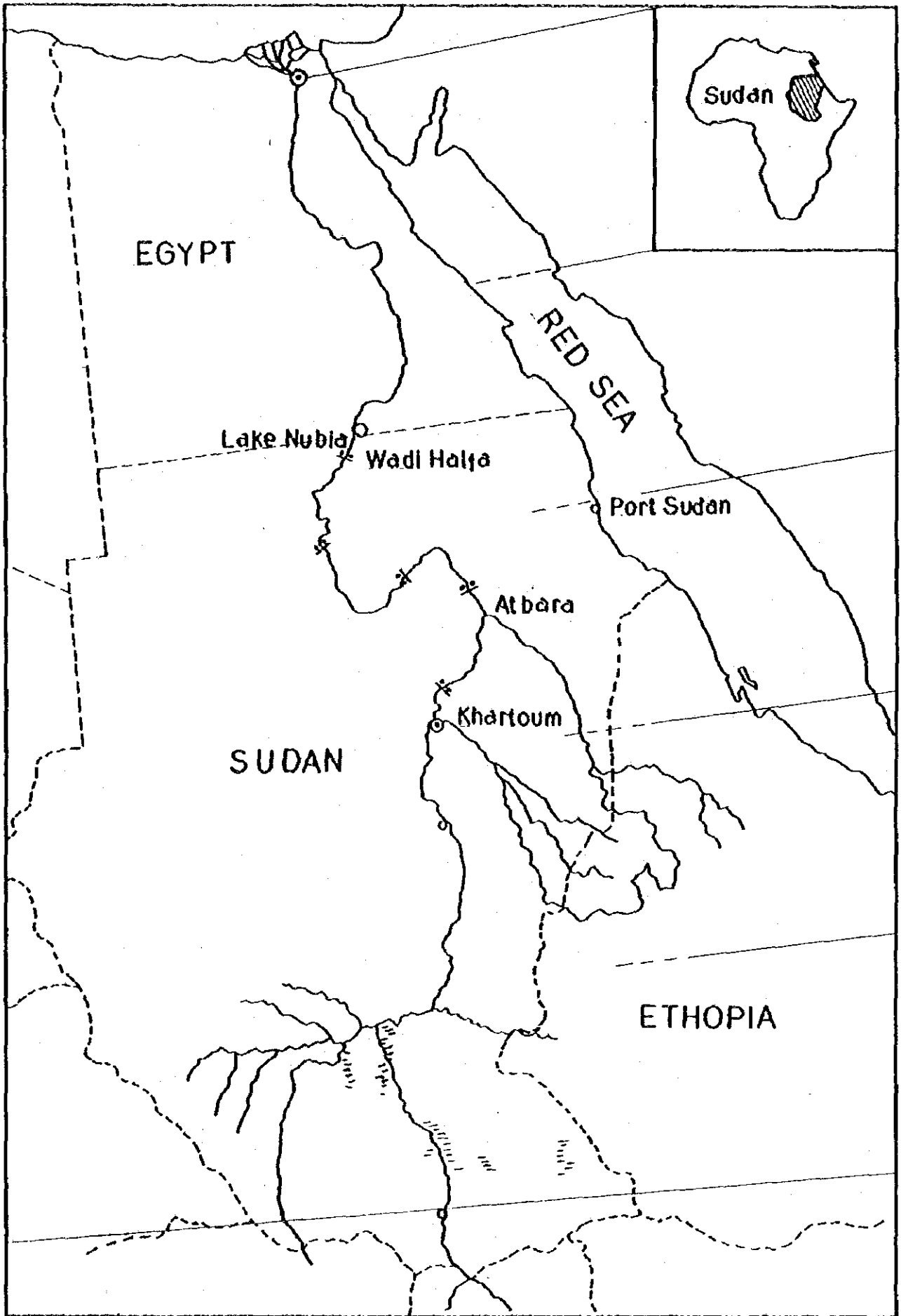
The materials and equipment shall be exclusively maintained and operated in the inland waters of fishing grounds in Lake Nubia and other rivers efficiently and adequately by

the Animal Production Public Corporation (APPC), one of the Government agencies, which will contribute to the promotion of fishery in the Sudan.

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## Chapter 1 Purposes and Details of the Survey

### 1-1 Purposes

In order to accelerate its fishing industry development program, the Democratic Republic of the Sudan approached Japan with a request regarding a grant for materials, mechanical equipment and facilities necessary for the development of fisheries.

In response to this request, the Japan International Cooperation Agency carried out on-the-spot surveys to collect various data and information indispensable for a basic plan to realize an eventual offer of mechanical equipment and materials to the fishing industry as requested by the Democratic Republic of the Sudan and also to consult with competent Government authorities over the matter.

### 1-2 Composition of Survey Team

The Survey Team, led by Mr. Kazuo Takayama, Fishing Boats Inspector, Fishing Boats Div., Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, and composed of the below-mentioned persons, was dispatched to the Sudan for one week from November 23 to 29, 1979.

Mr. Kazuo TAKAYAMA (Leader)

Fishing Boats Inspector

Fishing Boats Div.

Fisheries Agency

Ministry of Agriculture, Forestry & Fisheries

Mr. Yoshihisa KONDO, M.B.A

Councillor

Development Survey Div.

Social Development Cooperation Dept.

Japan International Cooperation Agency

Mr. Hitoshi TAMAKI

Engineer

Ocean Development Dept.

World Ocean System Inc.

Dr. Akio KOYAMA

Marine Biologist

Ocean Development Dept.

World Ocean System Inc.

Mr. Seiji KIKUCHI

Ocean Development Dept.

World Ocean System Inc.



## Chapter 2 Outline of Contents of Requests

### 2-1 Background and Details of Requests

It is a fact that the fishing grounds have been left undeveloped in the Red Sea and fishing has mainly been carried out on a small scale on Lake Nubia and the Nile which runs through the country of the Sudan. It is estimated that inland waters including the River Nile have potential fishing resource over 100,000 tons a year. But the total catch of fish is registered at only about 26,000 tons a year in Sudan. On the other hand, although the coastal fishing resources, are now estimated at about 4,000 tons a year in the Red Sea, only 500 tons of fish are caught at present. Neither coastal fishing nor ocean-going fishing is carried out in Sudan.

In spite of the strong national demand for fish as a source of protein, the fish supply is few to the contrary. The fact is that the fish supply hasn't been satisfied enough to meet the national demand since the fish meat price is two times and more than the animal meat, that is, 1.3 kg per head as the annual domestic fish consumption, namely, 10 kg lower than the mean average in the world. It is said that the demand of fish represents 25 tons per day, while the supply only meets

10 tons per day to the city of Khartoum.

As stated above, it can be hardly said that the fishing industry has well been developed as a whole in the Democratic Republic of the Sudan. The several reasons that can be pointed out, are that there prevails a vocational prejudice against fishery among the inhabitants who imply it less valued in the northern district and who are mainly Arabic as called Nubram, that fishery is an occupation mainly covered by the western and southern emigrant negro labourers who are called Nilotic people, and that fishermen are mostly too poor to purchase fishing boats, fishing gear, and fishing materials as a leading reason. Therefore, nothing can help them but lose an intention to work in fishery.

With the background of the above, the Government of the Sudan asked for assistance in terms of funds and materials for the development of the nation's fishing industry from such the U.N. as UNDP and FAO and also from various foreign countries. She conducts vocational training programs for fishermen (fishing gear, fishing methods, shipbuilding, operation of ships, processing, management, etc.) under the guidance of the Government. In addition, the Government has positively exerted to develop the undeveloped fishing resources and increase production in order to improve the nation's food situa-

tion. As a part of this scheme, the Government has established the Animal Production Public Corporation (APPC) for the uniform supervision and management of the national fishing industry under the guidance of the Government.

The materials and equipment are scheduled to be granted by the Government of Japan on the bases of the fore-mentioned background and the history. Fishing boats, part of fishing gear like fishing nets and fish trays, are scheduled to be granted by the Government of Japan to Wadi Halfa (Lake Nubia) in the northern district, and fishing boats, fishing nets, fishing trays, wood working machines, and machine tools, to Al Shagara (the White Nile) in the middle of Ju Jula district, so that the APPC shall manage, operate, and sublet them for training fishermen.

The fishing materials and equipment are requested by the Government of the Sudan to the Government of Japan as follows:

- (1) Though fishing boats and others were granted by the People's Republic of China to the Government of the Sudan for the fishing development in Lake Nubia, net-fishing boats are requested as the sub-main assistance (20 FRP boats with outboat motors and 20, with inboard motors)

- (2) Gill nets (170-200 mm) with appropriate meshes for catching *Lates Nilotica*.
- (3) Echo sounders (for spotting fish in Lake Nubia).
- (4) 1,000 pieces of plastic fish trays for transporting from Lake Nubia to Khartoum and 500 aluminum trays for frozen fish (71.5 x 49.5 x 22 cm).
- (5) Motor tools, such as, motor drills, welding machines, band saws, etc. for the dockyards of wooden fishing boats, and other machine tools.
- (6) Drawing instruments for designing fishing boats.
- (7) Outboard and inboard motors of 5-33 hp.

## 2-2 Progress of Consultations with the Government of Sudan

The survey team visited the Sudan Fisheries Administration, Ministry of Agriculture, Food of Natural Resources, briefed the Director of the Bureau and other officials on the purpose of the survey, the schedule and various rules and regulations of the grant aid cooperation system of the Government of Japan, and discussed the contents of the request for assistance from the Sudan side under Sudan's fisheries development program with officials of the APPC which is in direct charge of the program.

The list of the consultations is as follows:

- (1) The survey team explained the outline of its plan (Table 1) concerning the contents, quantity, use, etc. of the materials and mechanical equipment (4 categories of fishing boats, engines, fishing gear, and tools) on the basis of the original Sudan's request. Although no special objection was raised by the Sudan authorities and the APPC against the team's plan, an additional draft request (Table 2) was presented including the suggestions of the survey team, for the estimated amount had not been satisfied.
- (2) On the thorough consultations with officials concerned in Japan, the survey team explained the original and additional plans to officials of the Government of the Sudan, and conducted the actual survey at the site.
- (3) The items and quantities of the fishing materials and equipment which two parties have finally agreed, are shown in Table 3.

Table 1 Sudanese Original Request

1. Fishing Boats (purpose = for fishing with seine nets)

1) FRP small fishing boats with suitable outboard

Engines 20 units

|                |                |
|----------------|----------------|
| Type           | Open deck type |
| Length overall | abt. 7.60 m    |
| Width overall  | abt. 1.87 m    |
| Depth          | abt. 0.75 m    |
| Weight         | abt. 420 kg    |

2) FRP small fishing boats with suitable outboard

Engines 20 units

|                |                |
|----------------|----------------|
| Type           | Open deck type |
| Length overall | abt. 6.00 m    |
| Width overall  | abt. 1.45 m    |
| Depth          | abt. 0.56 m    |
| Weight         | abt. 250 kg    |

2. Fishing Nets

1) Nylon fishing nets, natural colour, medium twist

single knot with double selvage on top and bottom.

| <u>No. of<br/>fleets</u> | <u>Thickness<br/>of twin</u> | <u>Mesh size<br/>Str</u> | <u>Depth in<br/>Meshes</u> | <u>Length in<br/>Metres</u> |
|--------------------------|------------------------------|--------------------------|----------------------------|-----------------------------|
| 800                      | 210/D/12                     | 170m. ms                 | 50                         | 100                         |
| 800                      | 210/D/15                     | 180m. ms                 | 50                         | 100                         |
| 500                      | 210/D/18                     | 190m. ms                 | 50                         | 100                         |
| 500                      | 210/D/21                     | 200m. ms                 | 50                         | 100                         |

2) Nylon twine, natural colour, medium twist

|         |          |
|---------|----------|
| 100 lbs | 210/D/12 |
| 100 lbs | 210/D/15 |
| 100 lbs | 210/D/18 |
| 100 lbs | 210/D/21 |

- 3) Plastic floats of brown colour and cylindrical shape 3,000 (Three thousand) floats 85m/m x 140m/m high, eye 16m/ms.
3. Echo Sounder (for spotting fish in Lake Nubia)
4. Fish Trays
  - 1) Plastic fish trays 1,000 (One thousand)
  - 2) Aluminium fish trays 500 (Five hundred)
5. Stationary Machinery
  - 1) One resawing machine (break-down saw) suitable for sawing unprepared logs (about 400 mm in dia) of our local hard timber in the boat building workshop, 240 V.
  - 2) One light duty band saw, with tilting frame saw, 240 V
  - 3) One spindle moulder, with both square cutters blocks and fresh spindle - 240 V
  - 4) Two - chain/cutting length, 350 mm, 450 mm, or more, 240 V gasoline engine.
  - 5) Two jig saws - 240 V
6. Drawing Office
  - 1) One blue printing machine, for drawings in midium size standard sheets - 240 V





2) Belt sanders

| <u>Q'ty</u> | <u>Item</u>  |
|-------------|--------------|
| 2           | Armature Ass |
| 2           | Field        |

3) Hand planners

| <u>Q'ty</u> | <u>Item</u> |
|-------------|-------------|
| 4           | Armature    |
| 4           | Field       |
| 8           | Poly V-belt |

4) Circular saws

| <u>Q'ty</u> | <u>Item</u> |
|-------------|-------------|
| 2           | Armature    |
| 2           | Field       |

Table 2 Additional Request

1. Fishing Boats

1) FRP small fishing boat with suitable outboard  
engine 6 units

Type Open deck type  
Length overall abt. 7.60 m

2) FRP small fishing boat with suitable outboard  
engine 6 units

Type Open deck type  
Length overall abt. 6.00 m

3) FRP small fishing boat with suitable inboard  
engine 4 units

Type Open deck type  
Length overall abt. 6.00 m

4) FRP small fishing boat with suitable inboard  
engine 7 units

Type Open deck type  
Length overall abt. 7.11 m

2. Blueprint copymachine 2 units

3. Engines

1) Outboard engines

12 Hp. (12 sets), 15 Hp. (7 sets), 25 Hp. (2 sets)

2) Inboard engines

12 Hp. (2 sets), 20 Hp. (2 sets), 33 Hp. (7 sets)

4. Insulated trucks 3 sets

Type 5 tons

5. Fishing Nets

1) Nylon net

| Thickness of Fishing Twine | Mesh size Str. | Depth of net (meshes) | Length (metre) | Number of Pieces |
|----------------------------|----------------|-----------------------|----------------|------------------|
| 210/D/4                    | 4              | 50                    | 100            | 1000             |
| 210/D/6                    | 11             | 30                    | 100            | 750              |
| 210/D/9                    | 13             | 28                    | 100            | 500              |
| 210/D/12                   | 15             | 25                    | 100            | 500              |

2) Fishing Twines

|         |        |                |
|---------|--------|----------------|
| 500 lb  | 210/4  | Natural colour |
| 500 lb  | 210/6  | "              |
| 500 lb  | 210/9  | "              |
| 500 lb  | 210/12 | "              |
| 1000 lb | 210/15 | "              |
| 1000 lb | 210/21 | "              |
| 1000 lb | 210/36 | "              |
| 1000 lb | 210/60 | "              |
| 1000 lb | 210/72 | "              |

3) Nylon ropes

1000 pieces - length 200m - dia. 6mm

4) Floots

2000 pieces

6. Technical guidance (offered by manufacturing companies for a short terms)

Regarding a list of equipment as requested, it'll be changeable a few corresponding to the unknown factors, particularly, the prices on the above at the time of purchase.

Table 3 Items and Quantities of the Materials and Mechanical Equipments Finally Agreed

1. Fishing Boat (for fishing with seine nets)

1) FRP small fishing boat with suitable outboard

engine 26 units

Type Open deck type

Length overall abt. 7.60 m

2) FRP small fishing boat with suitable outboard

engine 26 units

Type Open deck type

Length overall abt. 6.00 m

3) FRP small fishing boat with suitable inboard

engine 4 units

Type Open deck type

Length overall abt. 6.00 m

4) FRP small fishing boat with suitable inboard

engine 7 units

Type Open deck type

Length overall abt. 7.11 m

2. Fishing Nets

1) Nylon fishing nets, natural colour, medium twist single knot with double selvage on top and bottom.

| <u>No. of fleets</u> | <u>Thickness of twin</u> | <u>Mesh size Str</u> | <u>Depth in Meshes</u> | <u>Length in Metres</u> |
|----------------------|--------------------------|----------------------|------------------------|-------------------------|
| 1000                 | 210/D/4                  | 100m. ms             | 50                     | 100                     |
| 800                  | 210/D/12                 | 170m. ms             | 50                     | 100                     |

|     |          |          |    |     |
|-----|----------|----------|----|-----|
| 800 | 210/D/15 | 180m. ms | 50 | 100 |
| 500 | 210/D/18 | 190m. ms | 50 | 100 |
| 500 | 210/D/21 | 200m. ms | 50 | 100 |
| 750 | 210/D/6  | 280m. ms | 30 | 100 |
| 500 | 210/D/9  | 330m. ms | 28 | 100 |
| 500 | 210/D/12 | 380m. ms | 25 | 100 |

2) Nylon twine, natural colour, medium twist

|          |          |
|----------|----------|
| 500 lbs  | 210/D/4  |
| 500 lbs  | 210/D/6  |
| 500 lbs  | 210/D/9  |
| 600 lbs  | 210/D/12 |
| 1100 lbs | 210/D/15 |
| 100 lbs  | 210/D/18 |
| 1100 lbs | 210/D/21 |
| 1000 lbs | 210/D/36 |
| 1000 lbs | 210/D/60 |
| 1000 lbs | 210/D/72 |

3) Plastic floats of brown colour and cylindrical shape  
5,000 (Five thousand) floats 85 m/m x 140 m/m high,  
eye 16 m/ms.

4) Nylon ropes

1,000 pieces - length 200 m - dia. 6 m/m

3. Echo Sounder (for spotting fish in Lake Nubia)

4. Fish Trays

1) Plastic fish trays 1,000 (One thousand)

2) Aluminium fish trays 500 (Five hundred)

## 5. Stationary Machinery

- 1) One resawing machine (Break-down saw) suitable for sawing unprepared logs (about 400 mm in dia.) of our local hard timber in the boat building workshop, 240 V.
- 2) One light duty band saw, with tilting frame saw, 240 V
- 3) One spindle moulder, with both square cutters blocks and fresh spindle - 240 V
- 4) Two - chain/cutting length, 350 mm, 450 mm, or more, 240 V gasoline engine
- 5) Two jig saws - 240 V

## 6. Drawing Office

- 1) Three blue printing machine, for drawings in midium size standard sheets - 240 V
- 2) Two set, plastic strips used for drawing longitudinal curved lines of boats.
- 3) Two Drawing Office sharpeners (pencils)

## 7. Engines

### 1) Outboard engines

5 HP (1 set), 12 HP (12 sets), 15 HP (8 sets),  
25 HP (3 sets)

### 2) Inboard engines

12 HP (3 sets), 20 HP (3 sets), 25 HP (7 sets),  
33 HP (1 set)

8. Equipment for motor installation and repair Suitable for the above-mentioned engines.

- 1) General tools (spanners, drivers, hammers etc.)
- 2) Special tools (gear puller, bearing puller, liner puller, fly wheel puller, etc.)
- 3) Measuring instruments (vernier calipers micrometer, gauges, testers)

9. Insulated trucks 3 sets

Type 5 tons

10. Hand tools

- 1) 100 files 75 m/m (YA SU RI)
- 2) 100 files 100 m/m (YA SU RI)
- 3) 10 steel measure (MA GA RI GA NE)
- 4) 10 staffing chisel (MA KI HA DA NOMI)
- 5) 10 nail measure 180 m/m (KU GI SA SI)

11. Spare parts

1) Disc sander

| <u>Q'ty</u> | <u>Item</u>                 |
|-------------|-----------------------------|
| 10          | Rubber pad wire cup brushes |

2) Belt sander

| <u>Q'ty</u> | <u>Item</u> |
|-------------|-------------|
| 2           | Armature ss |
| 2           | Field       |

3) Hand planner

| <u>Q'ty</u> | <u>Item</u> |
|-------------|-------------|
| 4           | Armature    |



|   |             |
|---|-------------|
| 4 | Field       |
| 8 | Poly V-belt |

4) Circular saw

| <u>Q'ty</u> | <u>Item</u> |
|-------------|-------------|
| 2           | Armature    |
| 2           | Field       |

12. Technical guidance (offered by manufacturing companies for a short terms)

Regarding a list of equipment as requested, it'll be changeable a few corresponding to the unknown factors, particularly, the prices on the above at the time of purchase.

## Chapter 3 Basic Design

### 3-1 Keynotes

In making a basic design for the fishing materials and equipment, the keynotes are as follows:

- (1) The materials and equipment shall be selected in such a manner not only to contribute to the promotion of fishing industry in the Democratic Republic of the Sudan but also to help fishermen train.
- (2) In determining the quantity and the specifications of the materials and equipment, it is fully adaptable to fit the local environments of fishing grounds, fishermen's technical level, and the maintenance and control system.
- (3) Finished goods shall be mainly mobilized as many as possible so as not to create troubles for the local works of installation and assembly.
- (4) The materials and equipment shall be selected so as to maintain, inspect, and repair easily.
- (5) The sufficient quantities of spare parts shall be included for 2-3 years.
- (6) The types of machines shall be selected to minimize the running costs as much as possible like fuel expenses.

- (7) The expenses on local training for handling, repairing, etc. of the materials and mechanical equipment shall be included in advance.

### 3-2 Mechanical Equipment

The materials and equipment were listed up in accordance with the quantities and the specifications. The following points were worth examining in designing the basic design for the materials and equipment.

- (1) Small-size Fishing Boats

The small-size fishing boats with both out-board and inboard engines shall be easy to maintain and operate and all the engines be manually ignited. Regarding fishing boats with inboard engines, the medium-speed diesel engines shall be durable and easy to overhaul.

- (2) Fishing Gear & Nets

The fishing nets which can be durable for a long time, shall be selected on the basis of a request from the APPC, the Government of the Sudan in addition to the supplies of semi-manufactured goods of texture for nets, twines, ropes, and others.

Fish finders shall be battery-operated, and easy to mount, operate, and maintain. In addition,

spare parts for motors, fuses, neon tubes, etc. shall be provided enough for three years.

Fish trays which are light and yet strong, shall be made of plastic for transporting and of aluminum for freezing fresh fish.

(3) Machine Tools and Tools

As wooden fishing boats are mostly built with hand tools in Sudan, a great deal of labour and time are required for building even a simple boat, so that they aren't so highly graded generally.

Therefore, the period of building a wooden boat shall be much curtailed and the quality'll be highly leveled up to meet the fishing purpose if the requested machine tools and hand tools are mobilized, such as, power-operated circular saws, band saws, spindle moulders, jig saws, and power-driven chain saws. Furthermore, the simple operation, maintenance, and repair, shall be the criteria of selecting the machine tools, hand tools, and drawing instruments together with spare parts.

Regarding the spare parts, they shall be exclusively supplied for the existing machine tools and hand tools which were made by the Makita Electric Machinery Manufacturing Co., Ltd.

(4) Engines

The inboard and outboard engines shall be mounted on wooden and steel boats to be locally built in the future, the outboard engines of which shall be selected to maintain and operate easily.

As for inboard engines, the multi-purpose four cycle diesel engines shall be provided in addition to propellers, propeller shafts, and stern tubes in order to minimize the burden to be levied on the Government of the Sudan, and be of the medium speed type and durable for a long time.

(5) Insulated Trucks for Transporting Fresh Fish

In response to a strong request of the Government of the Sudan (APPC) for the insulated trucks which shall be mobilized to transport fresh fish in ice, the team shall select them durable for the long-term preservation of fresh fish, the outer cover of which shall be light and made of anti-corrosive coated aluminum, the inner walls, be of the well qualified adiabatic, and the mechanism and the tires, be durable in a long service life together with the spare parts for three years.

### 3-2-1 Small-sized Fishing Boats

#### 1) Small-size boats 26 boats

|                  |  |
|------------------|--|
| Type             | Open deck type   |
| Material of hull | F.R.P. (Fiberglass reinforced plastic)   |
| Hull dimensions  | Overall length : about 7.5 m<br>Overall width : about 2.0 m<br>Depth : about 0.8 m |
| Type of engine   | Outboard type, 2-stroke engine   |
| Maximum output   | about 40 HP x 5500 rpm   |
| Starting method  | Manual starting type   |
| Fuel oil         | Mixing gasoline  |
| Fuel tank        | Capacity of about 25 liters  |

#### 2) Small-size boats 26 boats

|                  |  |
|------------------|--|
| Type             | Open deck type   |
| Material of hull | F.R.P. (Fiberglass reinforced plastic)   |
| Hull dimensions  | Overall length : about 6.0 m<br>Overall width : about 1.6 m<br>Depth : about 0.7 m |
| Type of engine   | Outboard type, 2-stroke engine   |
| Maximum output   | about 25 HP x 5500 rpm   |
| Starting method  | Manual starting type   |
| Fuel oil         | Mixing gasoline  |
| Fuel tank        | Capacity of about 25 liters  |

3) Small-size boats

4 boats

|                  |  |
|------------------|--|
| Type             | Deck type  |
| Material of hull | F.R.P. (Fiberglass reinforced plastic)   |
| Hull dimensions  | Overall length : about 6.5 m<br>Overall width : about 1.8 m<br>Depth : about 0.8 m |
| Type of engine   | 4-stroke diesel engine   |
| Rated output     | about 10 HP x 2400-2900 rpm  |
| Starting method  | Manual starting type   |
| Cooling system   | Fresh water  |
| Fuel oil         | Light oil  |
| Fuel tank        | about 80 liters  |

4) Small-size boats

7 boats

|                  |  |
|------------------|--|
| Type             | Deck type  |
| Material of hull | F.R.P. (Fiberglass reinforced Plastic)   |
| Hull dimensions  | Overall length : about 7.1 m<br>Overall width : about 1.8 m<br>Depth : about 0.9 m |
| Ice hold         | about 0.8 m <sup>3</sup>   |
| Fish hold        | about 1.5 m <sup>3</sup>   |
| Type of engine   | 4-stroke diesel engine   |
| Rated output     | about 20 HP x 2600-2900 rpm  |
| Starting method  | Manual starting system   |
| Cooling system   | Fresh water  |
| Fuel oil         | Light oil  |
| Fuel tank        | about 80 liters  |

### 3-2-2 Fishing Gear

#### 1) Fishing nets

Nylon shall be used for a net material in the blue or brown and the net shall be a single English knot with the double selvage, one each at the upper and the lower.

| <u>Thickness</u> | <u>Mesh size</u><br>(m.ms) | <u>Depth of net</u><br>(meshed) | <u>Length</u><br>(m) | <u>Quantity</u><br>(pieces) |
|------------------|----------------------------|---------------------------------|----------------------|-----------------------------|
| 210/D/ 4         | 100                        | 50                              | 100                  | 1000                        |
| 210/D/12         | 170                        | 50                              | 100                  | 800                         |
| 210/D/15         | 180                        | 50                              | 100                  | 800                         |
| 210/D/18         | 190                        | 50                              | 100                  | 500                         |
| 210/D/21         | 200                        | 50                              | 100                  | 500                         |
| 210/D/16         | 110                        | 30                              | 100                  | 750                         |
| 210/D/ 9         | 130                        | 28                              | 100                  | 500                         |
| 210/D/12         | 150                        | 25                              | 100                  | 500                         |

#### 2) Twine

The material for twine shall be nylon, in its original color, and be medium-twined.

| <u>Thickness</u> | <u>Quantity (lbs)</u> |
|------------------|-----------------------|
| 210/D/ 4         | 500                   |
| 210/D/ 6         | 500                   |
| 210/D/ 9         | 500                   |
| 210/D/12         | 600                   |
| 210/D/15         | 1,100                 |
| 210/D/18         | 100                   |
| 210/D/21         | 1,100                 |
| 210/D/36         | 1,000                 |
| 210/D/60         | 1,000                 |
| 210/D/72         | 1,000                 |



3) Plastic floats 5,000 pcs.

Color Brown  
Diameter 85  $\phi$  mm  
Length 140 mm  
Hole diameter 16  $\phi$  mm

4) Nylon ropes 1,000 pcs.

Diameter 6  $\phi$  mm x 200 m

5) Echo sounders (with batteries) 25 sets

Measuring depth about 0 - 160 m  
Frequency 200 KHZ  
Output about 20 W

6) Fish trays

Plastic tray (Capacity: about 25 liters) 1,000 pcs.  
Aluminum tray ( " " " ) 500 pcs.

### 3-2-3 Machine Tools, Tools, Drawing Instruments etc.

1) Machine tools

a) Electric disk saw 1 set

Outer diameter of disc saw about 1200  $\phi$  mm

Max. sawing diameter about 400  $\phi$  mm

Table dimensions about 1300 mm x 1300 mm

Electric motor 7.5 KW x 240V x 50 HZ

b) Electric band saw 1 set

Band saw blade about 75mm wide x 4200mm long

Max. sawing thickness about 375 mm

Upper and lower pulley diameters about 600  $\phi$  mm

Table dimensions about 640mm x 700mm

Electric motor 3.7 KW x 240V x 50 HZ

c) Spindle molder 1 set

Type 4-side molder block cutter type

Electric motor 2.2 KW x 240V x 50 HZ

d) Chain saw

Type Driven by gasoline engine

Size and number of pieces 350mm x 1 piece 1 set

450mm x 1 " 1 set

e) Jig saw 2 sets

Type Portable type

Electric motor 140 W x 240V x 50 HZ

## 2) Drawing instrument

a) Copying machine 3 sets

Type Wet type

Copying width about 65 cm

Paper feeding speed about 50-660 m/h

Light source Fluorescent light

UVF 420 Model 80 W 4 pieces

Power source AC 240 V/100V single phase  
(with transformer)

Size about H350 x W980 x D690

Spare parts for 3 years' use

b) Batten 2 sets

Material : Plastic

Use : for the use of vessel curve at the time  
of ship designing

c) Drawing pencil sharpener: Manual type 2 sets

3) Tools

a) Setting file for saw ( 75 mm) 100 pcs.

b) " (100 mm) 100 pcs.

c) Metal measure 10 pcs.

d) Chisel 10 pcs.

e) Nail fastener (180 mm) 10 pcs.

4) Spare parts

a) Spare parts for electric desk sander: MAKITA Model 9205

Ruber pad 10 pcs.

Wire brush 10 pcs.

b) Spare parts for electric belt sander: MAKITA Model 9401

Armature 10 pcs.

Field 10 pcs.

c) Spare parts for electric hand planer: MAKITA Model 1804N

Armature 4 pcs.

Field 4 pcs.

Polyvinyl V belt 8 pcs.

c) Spare parts for electric rotary saw : MAKITA Model 5601N

Armature 2 pcs.

Field 2 pcs.

5) Necessary Tools for Electric Machines and Engine

|                         |                |
|-------------------------|----------------|
| a) Ordinary tool        | 1 complete set |
| b) Special tool         | 1 "            |
| c) Measuring instrument | 1 "            |

3-2-4 Engines

1) Outboard engine

|                 |                              |  |         |
|-----------------|------------------------------|--|---------|
| Type            | 2-stroke engine              |  |         |
| Starting method | Manual starting type         |  |         |
| Fuel oil        | Mixing gasoline or kerosine  |  |         |
| a) Max. output  | about 5 HP x 5500 rpm engine |  | 1 set   |
| b) " "          | about 12 HP x " "            |  | 12 sets |
| c) " "          | about 15 HP x " "            |  | 8 sets  |
| d) " "          | about 25 HP x " "            |  | 3 sets  |

2) Inboard engine

|                 |                              |  |        |
|-----------------|------------------------------|--|--------|
| Type            | 4-stroke diesel engine       |  |        |
| Starting method | Manual starting type         |  |        |
| Fuel oil        | Light oil                    |  |        |
| a) Rated output | approx. 12HP x 2400-2900 rpm |  | 3 sets |
| b) " "          | approx. 20HP x 2600-2900 rpm |  | 3 sets |
| c) " "          | approx. 25HP x 2000-2400 rpm |  | 7 sets |
| d) " "          | approx. 33HP x 2200-2900 rpm |  | 1 set  |

3-2-5 Insulated Trucks for Transport  
of Fresh Fish

3 sets

Principal items

|                |                |
|----------------|----------------|
| Overall length | approx. 7.80 m |
| Overall width  | " 2.50 m       |
| Overall height | " 3.60 m       |

Weight

|                         |                           |
|-------------------------|---------------------------|
| Insulated truck         | approx. 5,300 kg          |
| Loadage                 | " 5,000 kg                |
| Loading capacity (Max.) | approx. 22 m <sup>3</sup> |
| Engine (Max.)           | approx. 140 HP x 3200 rpm |
| Speed (Max.)            | approx. 90 km/h           |

Material of insulation

|                       |                      |
|-----------------------|----------------------|
| Outer walls and floor | Aluminum plate       |
| Insulation            | Foaming polyurethane |
| Spare parts           | for 3 years' use     |

3-2-6 Technical Guidance

On-the-spot guidance will be required for a short time on the handling of small-size fishing boats, fishing nets, inboard engine, outboard engine, etc.

### 3-3 Rough Calculation of Cost of Machine Parts

In adding up the costs of materials and equipment in accordance with this basic design plan, the following conditions were taken into account.

- 1) The estimated prices shall be calculated on the CIF-Port Sudan basis as of January 1980.
- 2) For importing the materials and equipment, customs duties and all other taxes and charges shall be exempted in Sudan.

The roughly calculated costs of materials and equipment for the basic design plan are as shown in the following Table:

(Unit: 1000 Yen)

| Item                            | Description                                     | Q'ty        | Price | Amount   |
|---------------------------------|---|-------------|-------|----------|
| 1. FRP small fishing boat       |   |             |       | (78,924) |
| 1) FRP small fishing boat       | Open deck type<br>Length overall<br>abt. 8.00 m |             |       | 27,210   |
| Hull                            |   | 26<br>units | 738   | 19,188   |
| Engine                          | Outboard engine 40HP                            | 26<br>sets  | 252   | 6,552    |
| Spare parts                     |   | 1 set       | -     | 1,470    |
| 2) FRP small fishing boat       | Open deck type<br>Length overall<br>abt. 6.00 m |             |       | 16,184   |
| Hull                            |   | 26<br>units | 406   | 10,556   |
| Engine                          | Outboard engine 25HP                            | 26<br>sets  | 183   | 4,758    |
| Spare parts                     |   | 1 set       |       | 870      |
| 3) FRP small fishing boat       | Deck type<br>Length overall<br>abt. 6.00 m      |             |       | 9,700    |
| Hull                            |   | 4<br>units  | 1,525 | 6,100    |
| Engine                          | Inboard engine                                  | 4<br>sets   | 720   | 2,880    |
| Stern arrangement & accessories |   | 4<br>sets   | 60    | 240      |
| Spare parts                     |   | 1 set       | -     | 480      |
| 4) FRP small fishing boat       | Deck type<br>Length overall<br>abt. 7.00 m      |             |       | 25,830   |
| Hull                            |   | 7<br>units  | 2,720 | 19,040   |
| Engine                          | Inboard engine                                  | 7<br>sets   | 720   | 5,040    |
| Stern arrangement & accessories |   | 7<br>sets   | 70    | 490      |
| Spare parts                     |   | 1 set       | -     | 1,260    |

| Item                  | Description                 | Q'ty            | Price | Amount   |
|-----------------------|-----------------------------|-----------------|-------|----------|
| 2. Fishing gear & net |                             |                 |       | (72,240) |
| 1) Nylon fishing nets |                             |                 |       | 44,250   |
|                       | 210d/12x170mmx50MDx<br>100m | 800<br>fleets   | 9     | 7,200    |
|                       | 15x180mmx50MDx<br>100m      | 800<br>"        | 11    | 8,800    |
|                       | 18x190mmx50MDx<br>100mm     | 500<br>"        | 13    | 6,500    |
|                       | 21x200mmx50MDx<br>100mm     | 500<br>"        | 15    | 7,500    |
|                       | 4x4 inchx50MD<br>x100m      | 1,000<br>"      | 4     | 4,000    |
|                       | 6x11 x30MD<br>x100m         | 750<br>"        | 5     | 3,750    |
|                       | 9x13 x28MD<br>x100m         | 500<br>"        | 6     | 3,000    |
|                       | 12x15 x25MD<br>x100m        | 500<br>"        | 7     | 3,500    |
| 2) Nylon twine        |                             |                 |       | 6,290    |
|                       | 210d/4                      | 500<br>lbs      | 0.85  | 425      |
|                       | 6                           | 500<br>"        | 0.85  | 425      |
|                       | 9                           | 500<br>"        | 0.85  | 425      |
|                       | 12                          | 600<br>"        | 0.85  | 510      |
|                       | 15                          | 1,100<br>"      | 0.85  | 935      |
|                       | 18                          | 100<br>"        | 0.85  | 85       |
|                       | 21                          | 1,100<br>"      | 0.85  | 935      |
|                       | 36                          | 1,000<br>"      | 0.85  | 850      |
|                       | 60                          | 1,000<br>"      | 0.85  | 850      |
|                       | 72                          | 1,000<br>"      | 0.85  | 850      |
| 3) Nylon ropes        | 6mm x 200m                  | 1,000<br>pieces | 6.3   | 6,300    |



| Item  | Description                                       | Q'ty         | Price | Amount         |
|---|---|--------------|-------|----------------|
| 4) Plastic floats                                   | 85x126x16mm                                       | 5,000 floats | 0.38  | 1,900          |
| 5) Echo sounder body                                | Including paper, Fuse, neon tube Motor (3 years). | 25 sets      | 180   | 6,700<br>4,500 |
| Battery   | 12V x 200A  | 25 sets      | 88    | 2,200          |
| 6) Fish Tray  |   |              |       | 6,800          |
| Aluminium fish Trays                                |   | 500 pieces   | 7     | 3,500          |
| Plastic fish Trays                                  |   | 1,000 pieces | 3.3   | 3,300          |
| 3. Stationary Machinery, hand tool & drawing office |   |              |       | (6,986)        |
| 1) Stationary Machinery                             |   |              |       | 4,260          |
| Band saw  |   | 1 set        | 1,200 | 1,200          |
| Circular saw  |   | 1 set        | 1,500 | 1,500          |
| Jig saw   |   | 2 sets       | 50    | 100            |
| Chain saw   | 350mm   | 1 sets       | 190   | 190            |
| Chain saw   | 450mm   | 1 set        | 270   | 270            |
| Spindle moulder                                     |   | 1 set        | 1,000 | 1,000          |
| 2) Hand tool spare Parts (No. 1)                    |   |              |       | 161            |
| Disc sander   | Rubber pad  | 10           | 1.2   | 12             |
|   | Wire cup brush                                    | 10           | 4.8   | 48             |
| Belt sander   | Armature ass                                      | 2            | 8     | 16             |
|   | Field   | 2            | 2.5   | 5              |
| Hand planner  | Armature  | 4            | 7.5   | 30             |
|   | Field   | 4            | 3     | 12             |
|   | Poly V-belt                                       | 8            | 2     | 16             |

| Item                  | Description     | Q'ty    | Price | Amount   |
|-----------------------|-----------------|---------|-------|----------|
| Circular saw          | Armature        | 2       | 7     | 14       |
|                       | Field           | 2       | 4     | 8        |
| 3) Hand tool (No.2)   |                 |         |       | 115      |
| Files                 | 75mm            | 100     | 0.44  | 44       |
|                       | 100mm           | 100     | 0.5   | 50       |
| Steel measure         |                 | 10      | 1     | 10       |
| Staffing chisel       |                 | 10      | 0.7   | 7        |
| Nail measure          | 180mm           | 10      | 0.4   | 4        |
| 4) Drawing office     |                 |         |       | 2,450    |
| Blue printing machine |                 | 3 sets  | 600   | 1,800    |
| Spare (4 years)       | Paper, etc.     | 1 set   | -     | 600      |
| Plastic batten        |                 | 2 sets  | 20    | 40       |
| Sharpener (pencils)   |                 | 2 sets  | 5     | 10       |
| 4. Engine             |                 |         |       | (16,300) |
| 1) Outboard engine    |                 |         |       | 4,800    |
|                       | 5HP             | 1 set   | 120   | 120      |
|                       | 12HP            | 12 sets | 150   | 1,800    |
|                       | 15HP            | 8 sets  | 180   | 1,440    |
|                       | 25HP            | 3 sets  | 210   | 630      |
| Spare parts           |                 | 1 set   | -     | 810      |
| 2) Inboard engine     |                 |         |       | 11,500   |
|                       | 12HP Engine     | 3 sets  | 345   | 1,035    |
|                       | Stern equipment | 3 sets  | 60    | 180      |
|                       | Accessories     | 3 sets  | 22    | 66       |
|                       | 20HP Engine     | 3 sets  | 520   | 1,560    |
|                       | Stern equipment | 3 sets  | 80    | 240      |
|                       | Accessories     | 3 sets  | 24    | 72       |
|                       | 25HP Engine     | 7 sets  | 700   | 4,900    |
|                       | Stern equipment | 7 sets  | 90    | 630      |
|                       | Accessories     | 7 sets  | 25    | 175      |

| Item                     | Description          | Q'ty   | Price | Amount    |
|--------------------------|----------------------|--------|-------|-----------|
|                          | 33HP Engine          | 1 set  | 700   | 700       |
|                          | Stern equip-<br>ment | 1 set  | 115   | 115       |
|                          | Accessories          | 1 set  | 27    | 27        |
| Spare parts              |                      | 1 set  | -     | 1,800     |
| 5. Insulated truck       |                      |        |       | (21,150)  |
|                          | 5 ton Type           | 3 sets | 6,200 | 18,600    |
| Spare parts              | 3 years              | 3 sets | 850   | 2,550     |
| 6. Technical<br>guidance |                      |        |       | (4,400)   |
| Total                    |                      |        |       | (200,000) |

#### Chapter 4 Feasibility of the Present Program

The actual control of the fishing materials and equipment to be granted in accordance with the present program rests with the Animal Production Public Corporation (APPC) supervised by the Government of the Sudan. Some of the fishing boats, fishing nets, and fish trays shall be used for fishing in Wadi Halfa (Lake Nubia) in the northern part of the Sudan facing the Egyptian border, where the development of fishing is now on the way to promote, and the remaining fishing boats, fishing nets, fish trays, and woodworking machines as well as machine tools shall be used at the White Nile, in the central part of the country.

The APPC, established in 1925, is a subordinate agency of the Ministry of Agriculture, Food, and Natural Resources, and takes in charge of the administration of the nation's stock raising and fishing industries. At present, a 6-year project is being promoted by this agency to establish fishing camps at 10 places in the country, three of which have already opened at three places. This agency also supervises any development programs for the nation's fishing industry.

The APPC manages and controls Lake Nubia where it has the surface area of 1,000 km<sup>2</sup> and the max. depth of 40 m (they say, the mean average of 20 m deep). According to a survey carried out by the FAO, the potential output of fish catch is estimated at 51 kgs per hectare, and 5,100 tons

per year in total. About 180-200 government officials engage in fishing on Lake Nubia and 120 fishermen out of the total.

The fishing boats and fishing nets out of the fishing materials and equipment to be granted, shall be managed and controlled by the APPC, and enable them to increase the quantity of fish catches, and the fish finders shall be utilized for surveying the fishing grounds and the actual fishing activities in Lake Nubia.

Besides, regarding the aids from foreign countries, the APPC, the Government of the Sudan has received the large quantities of equipment and facilities, namely, a fish processing plant consisting of ice-making and freezing units with power and water supplies near Lake Nubia, 35 two ton fishing boats, and 5 ten ton fishing boats, and has operated them without any problems, so that the APPC will make the efficient use of the fishing materials and equipment to be granted from Japan.

Part of the fishing boats and fishing nets to be granted, are expected to be used at the government-operated fishing center and in the Gebel Aulia Dam where it is located near the city of Khartoum, so that it is convenient to transport fish catches from the site to the city. In other words, it is one of the emphasized fishing grounds where the Government aims at promoting fishing industry. The Gebel Aulia Dam has the large water surface area of 3 mil. m<sup>2</sup>, the depth of

15-20 m, and the storage capacity of about one mil. millilitres.

Fishing in Lake Nubia is conducted by non-self-propelling boats except two steel boats owned by the Government and 7 privately owned wooden boats by theirs utilizing grill nets. The kinds of fish are Kasu (with sharp teeth like sharks' and about 20-25 m long) and Bicawara (about 22-25 cm long). Therefore, the fishing resources have left them untouched. The fish catches will be increased a lot if the fishing boats with engines are granted together with fishing nets to fit to the fishery. And if the fish catches are transported to the city of Khartoum within a shortest possible time and with a high degree of freshness, the prevailing unbalance of the supply and demand of fish will be improved much and stabilized the fish market price in the city. Insulated trucks are used for transporting these fresh fish catches.

On the other hand, engines, wood working tools, hand tools, and drawing instruments to be granted, shall be used at a shipyard in the White Nile district. At present, about 3 mm thick steel boats are built by rivetting plates in the Democratic Republic of the Sudan, while wooden boats are built with the less undeveloped hand tools, so that the above grant will owe her much to improve the shipbuilding techniques.

The fishing materials and equipment to be granted this time, constitute fishing boats, fishing nets, engines, hand tools, insulated trucks, and spare parts, which will be utilized for both fishing and training fishermen in a long run, not only in the fishing grounds, the shipbuilding yards, the fishing institutes, and the like, but also in the related fishing enterprises under the smooth management and control of the Government, and which will be very appropriate and reasonable to fit the present needs of the Government of the Sudan.

## Chapter 5 Views and Recommendation of Survey team

Fishing activities in the Sudan depends much on fresh water fishery in the Nile, in which *Lates nilotica*, *Tilapia nilotica*, and *Alesfes* are the main target games of fish catches, being large and expensive fish, mainly living in the reservoir of a dam barriered at the point of the Nile.

In hopes of improving the nation's food situation, the Democratic Republic of the Sudan has recently launched the development of the untouched marine resources in a nation-wide scale and the Government-supervised APPC has initiated as an implementation organization for promoting fishery industry and training fishermen.

On the other hand, the Government of the Sudan has requested the foreign aids of funds, materials, and equipment from the UNDP, the FAO, the People's Republic of China, and other countries corresponding to the aggregated fiscal and financial state and the undeveloped departments of various fishing industries, its related ones, and education in the Sudan.

The offer of technical assistance from Japan this time, will certainly meet her expectation in response to a request from the Government of the Sudan. In drafting the basic design for the materials and equipment to be granted, the survey team has considered much to select them to fit the local needs as close as possible as mentioned in the previous



Chapters, to operate and repair easily with the least possible troubles of management and control, to bear a long-term service, and to contribute to the promotion of fishing industry.

Though the technical services were included as much as possible upon granting the fishing materials and equipment, it is advisable not only to grant them but also to extend the most efficient technical assistance to the Democratic Republic of the Sudan so as to invite the improvement of fishing techniques by dispatching the experts, seniors and juniors, and receiving counterparts and participants in considerations to the promotion of fishing industry in Sudan on the basis of a long-term technical cooperation plan.



## DRAWING LIST

- FIG. 1 8 M TYPE FRP SMALL FISHING BOAT (OUTBOARD ENGINE)
- FIG. 2 6 M TYPE FRP SMALL FISHING BOAT (OUTBOARD ENGINE)
- FIG. 3 6 M TYPE FRP SMALL FISHING BOAT (INBOARD ENGINE)
- FIG. 4 7 M TYPE FRP SMALL FISHING BOAT (INBOARD ENGINE)
- FIG. 5 INSULATED TRUCK (5 TON TYPE)

| PRINCIPAL PARTICULARS |                          |
|-----------------------|--------------------------|
| OVER ALL LENGTH       | abt. 7 <sup>m</sup> ,500 |
| OVER ALL BREADTH      | abt. 2 <sup>m</sup> ,000 |
| DEPTH                 | abt. 0,800               |
| MAIN ENGINE           | abt. 40HP x 5,500 rPm    |

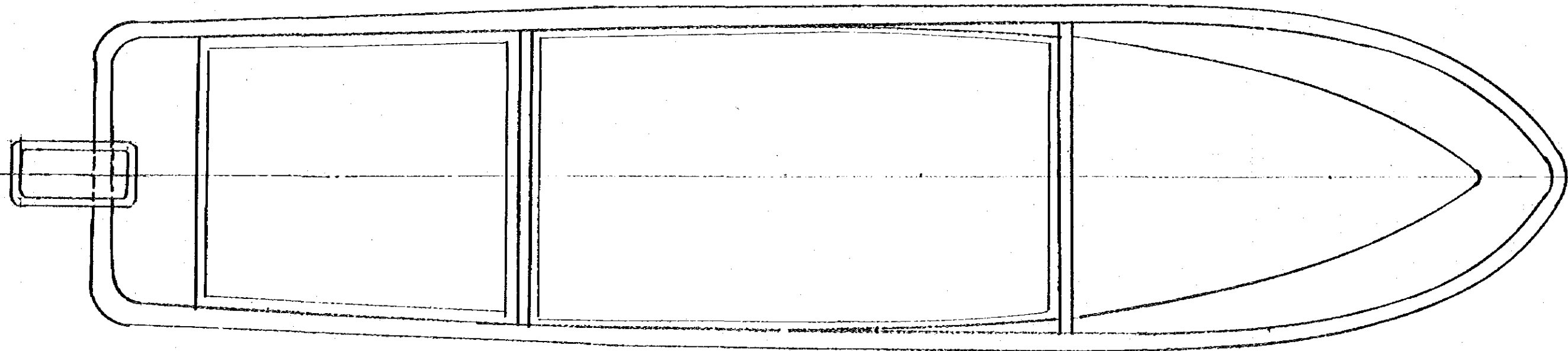
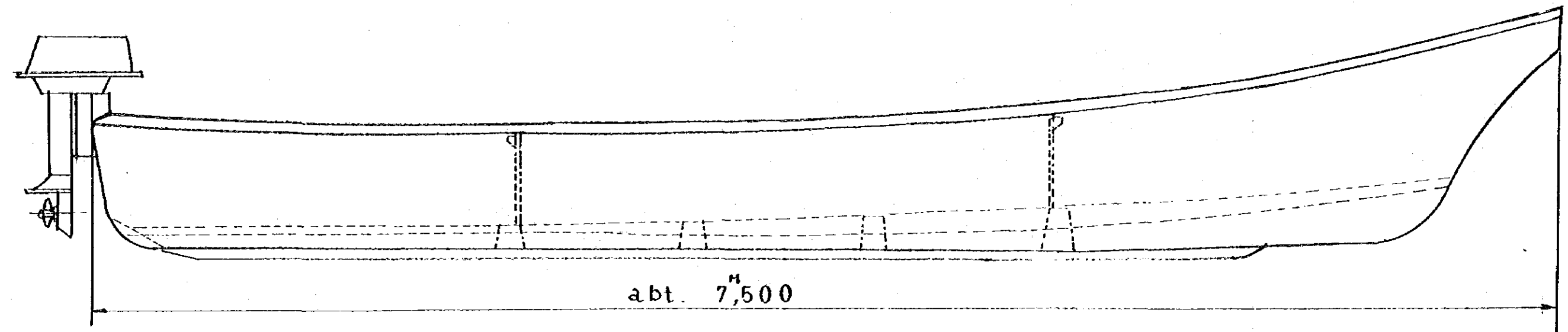


FIG. 1 8 M TYPE FRP SMALL FISHING BOAT (OUTBOARD ENGINE)

F.R.P FISH BOAT ( OUTBOARD TYPE )  
 JAPAN INTERNATIONAL COOPERATION AGENCY

| PRINCIPAL PARTICULARS |                                     |
|-----------------------|-------------------------------------|
| OVER ALL LENGTH       | abt. 6'000                          |
| OVER ALL BREADTH      | abt. 1'600                          |
| DEPTH                 | abt. 0'700                          |
| MAIN ENGINE           | abt. 25 <sup>HP</sup> x 5500 r.p.m. |

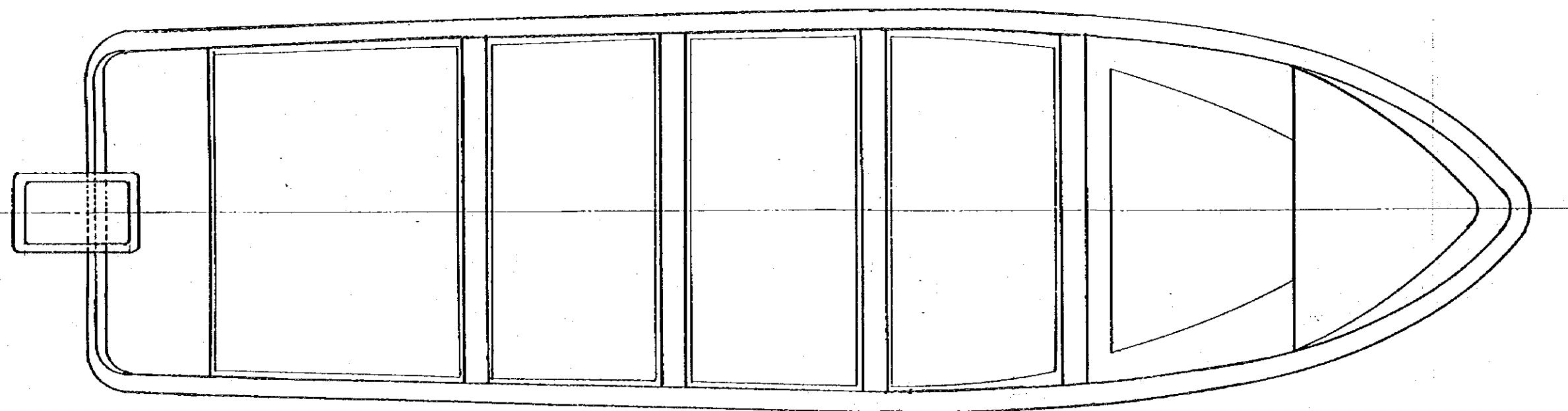
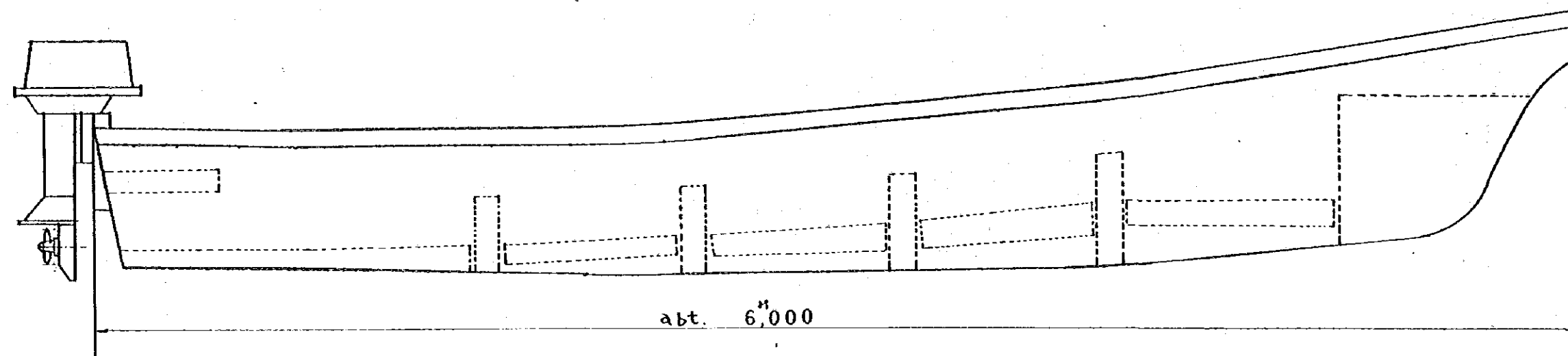
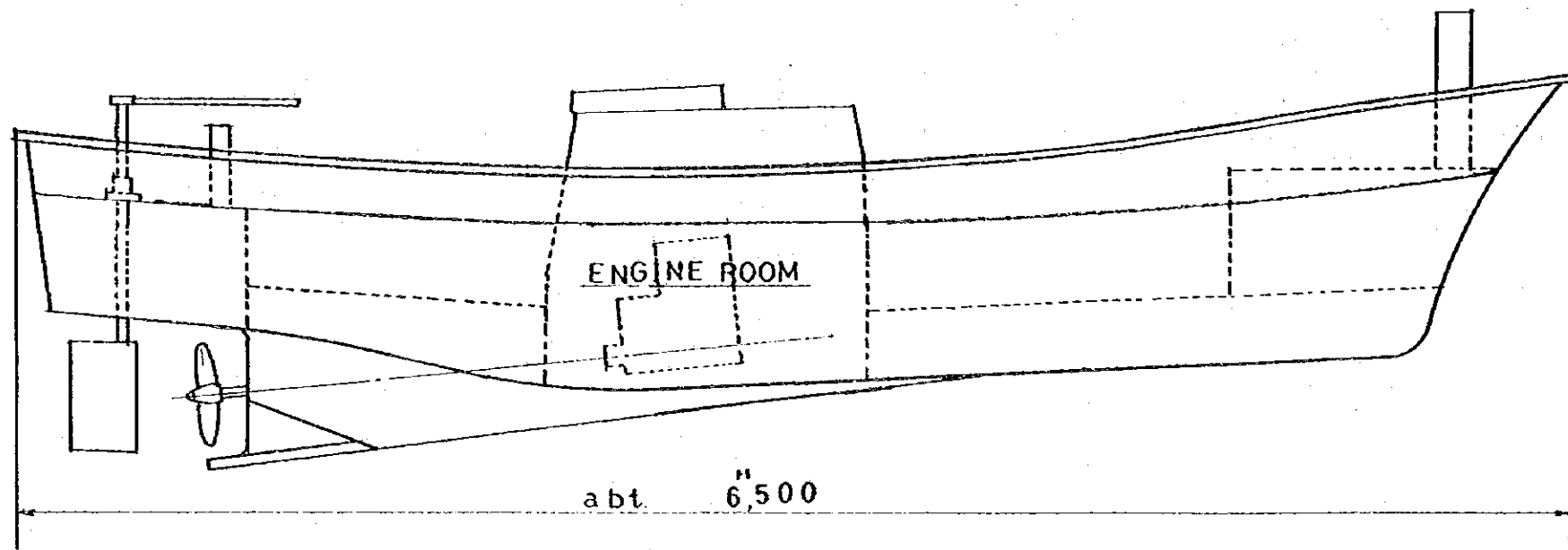


FIG. 2 6 M TYPE FRP SMALL FISHING BOAT (OUTBOARD ENGINE)

F.R.P FISH BOAT (OUTBOARD TYPE)  
 JAPAN INTERNATIONAL COOPERATION AGENCY



| PRINCIPAL PARTICULARS |   |
|-----------------------|---|
| OVER ALL LENGTH       | abt 6,500   |
| OVER ALL BREADTH      | abt. 1,800  |
| DEPTH                 | abt. 0,800  |
| MAIN ENGINE           | abt. 10 <sup>HP</sup> x 2,400 x 2,900 <sup>mm</sup> |

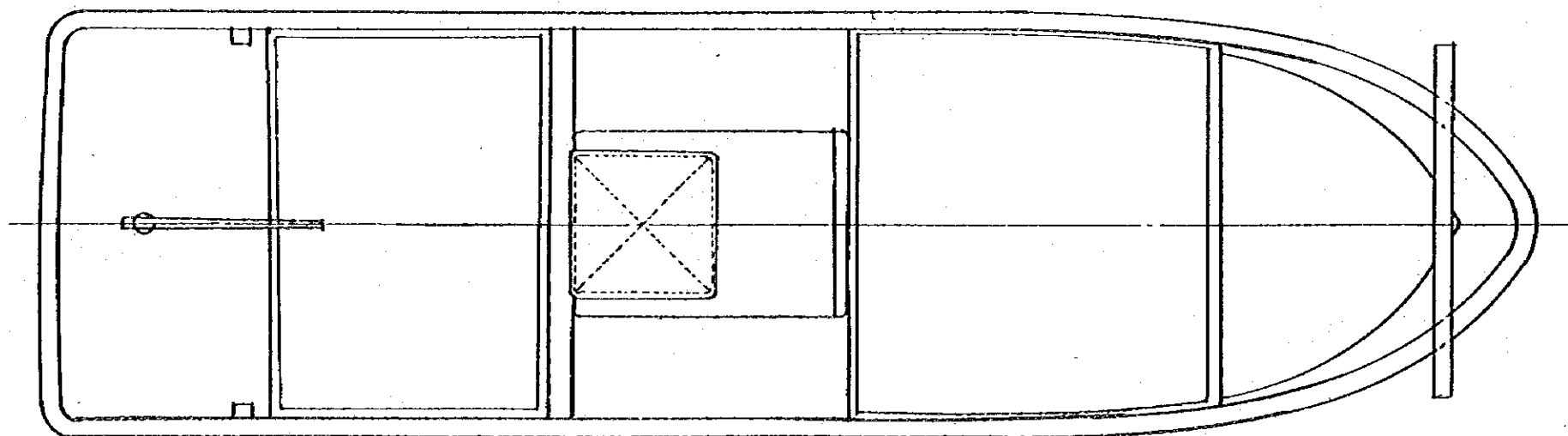


FIG. 3 6 M TYPE FRP SMALL FISHING BOAT (INBOARD ENGINE)

FRP FISH BOAT (INBOARD TYPE)  
 JAPAN INTERNATIONAL COOPERATION AGENCY

| PRINCIPAL PARTICULARS |  |
|-----------------------|--|
| OVER ALL LENGTH       | abt. 7 <sup>m</sup> .100                       |
| OVER ALL BREADTH      | abt. 1 <sup>m</sup> .800                       |
| DEPTH                 | abt. 0 <sup>m</sup> .900                       |
| MAIN ENGINE           | abt. 20 <sup>HP</sup> x2600~2900 <sup>MM</sup> |

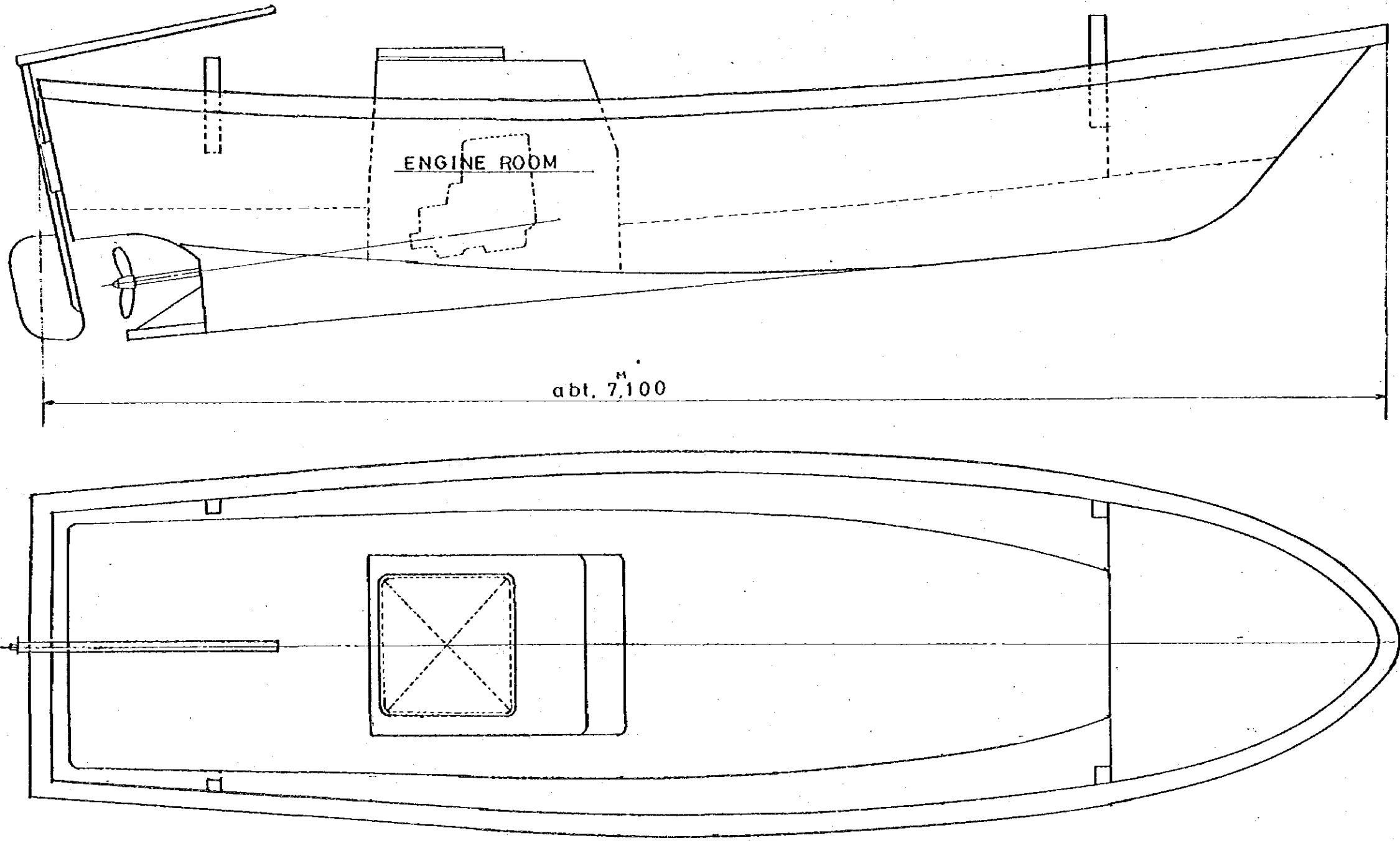


FIG. 4 7 M TYPE FRP SMALL FISHING BOAT (INBOARD ENGINE)

FRP FISH BOAT ( INBOARD TYPE )  
 JAPAN INTERNATIONAL COOPERATION AGENCY

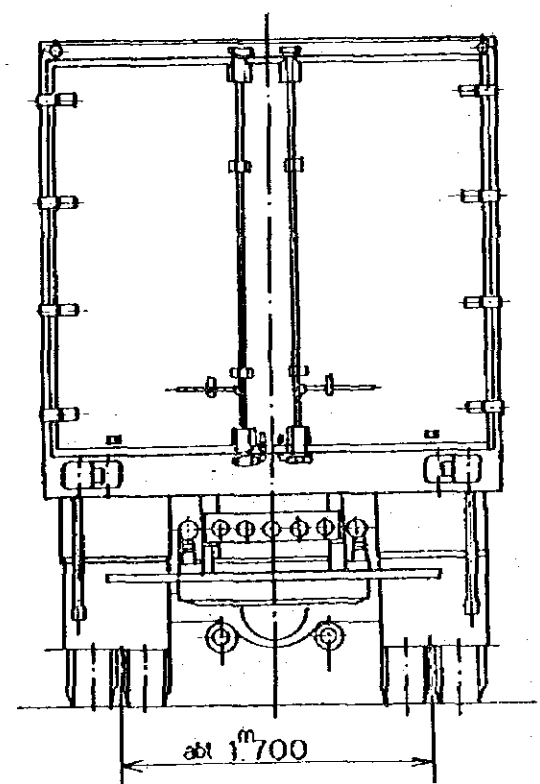
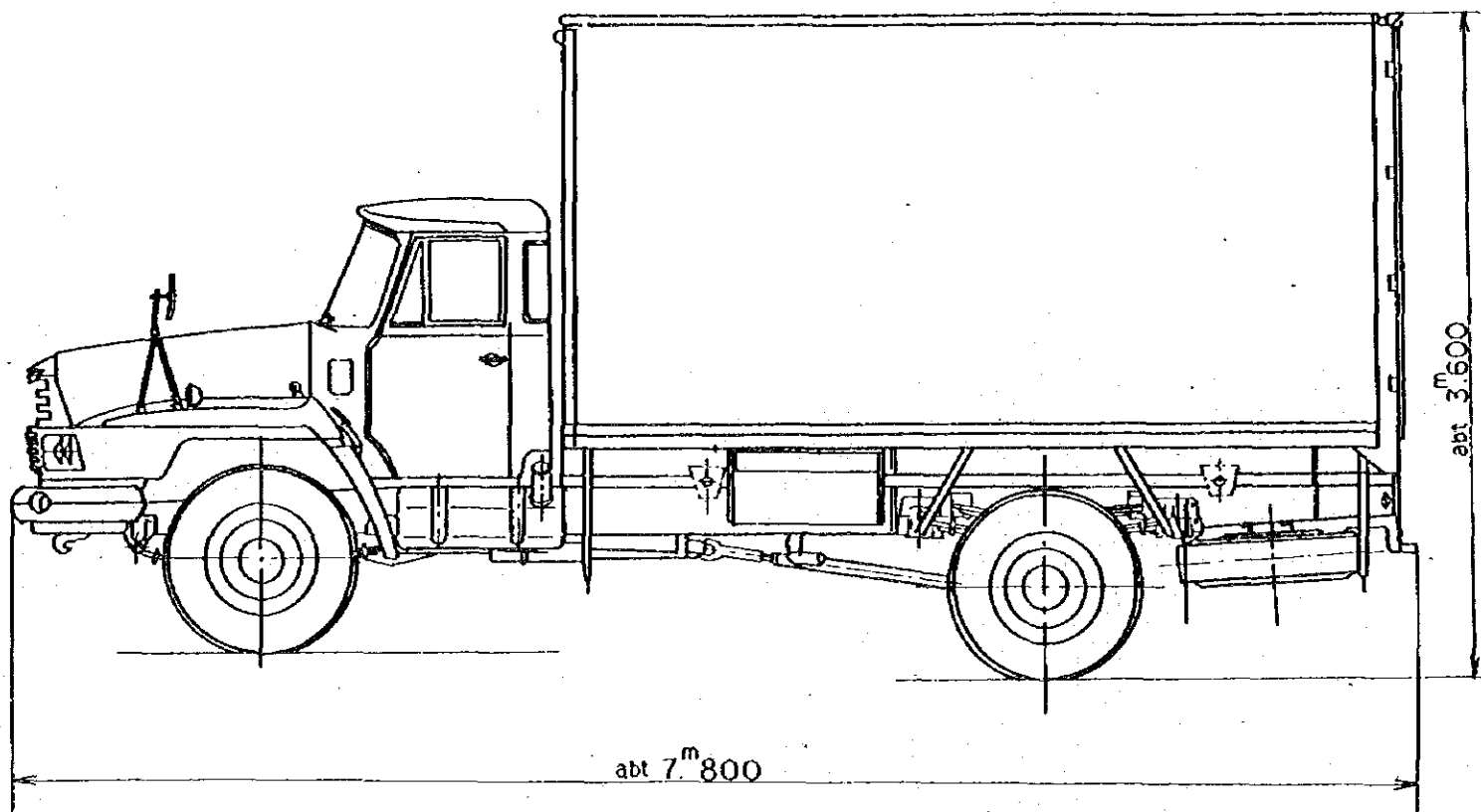
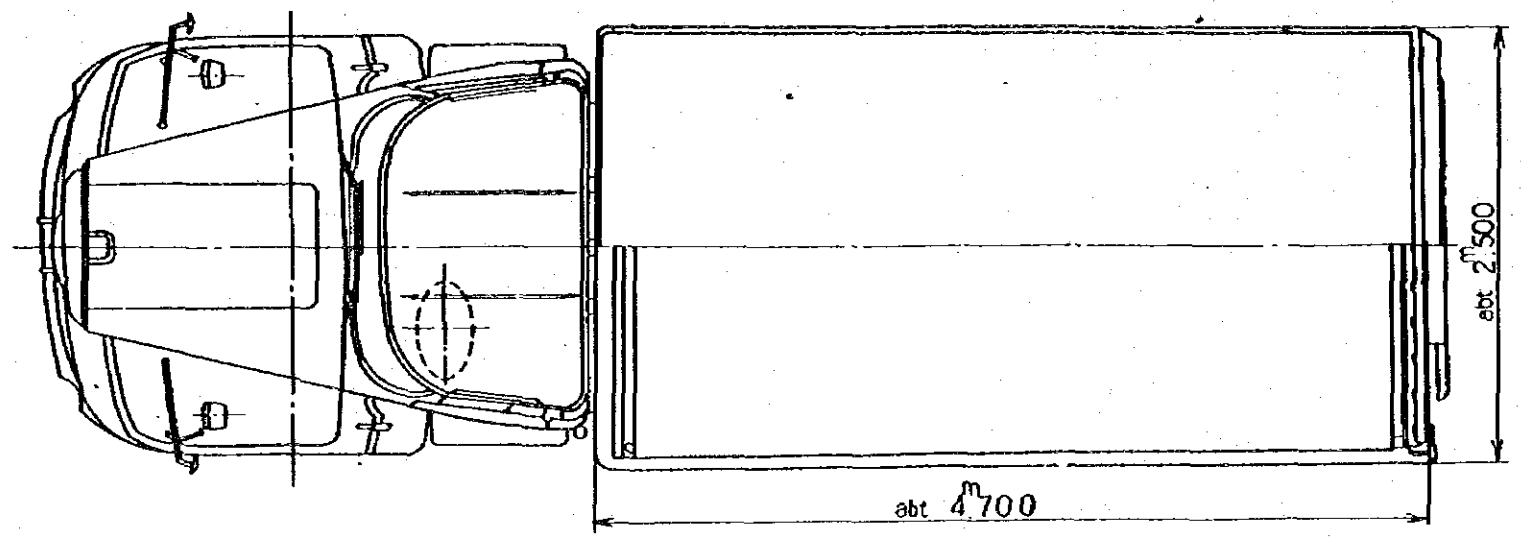


FIG. 5 INSULATED TRUCK (5 TON TYPE)

5<sup>T</sup> INSULATED TRUCK  
JAPAN INTERNATIONAL COOPERATION AGENCY







JICA