4. BASIC DESIGN

4-1 Basic design policy

The basic design of the equipment and materials best suited for this project will be made in conformity with the undermentioned basic policy, based on results of analysis of information collected on the occasion of the field survey and other subsequent data.

(1) To take into consideration the technical level of the fishermen, as well as the technical backup capacity of the fisheries department.

(2) To take into consideration the kinds of fish, fishing method and fishing ground environment.

(3) To take into consideration the economic efficiency of the maintenance, operation and other costs.

(4) To select equipment and facilities with technical level similar to those ones being used at the present time.

(5) To take into consideration the stepped development in the future.

(6) To select equipment and facilities suiting the weather, sea and environmental conditions, as well as the public electricity situation.

(7) To take into consideration the capacity of the domestic transportation system of Vanuatu regarding the distribution of the equipment and facilities.

4-2 Basic factors to be used in the basic design and financial evaluation

The numeric figures obtained as a result of interviews held with personnel of the VFDP on the occasion of the field survey, and as a result of analyses of VFDP data are regarded as cardinal numbers, and they are used for the sake of basic design calculations, together with other planned values and forecasted values.

4-2-1 Main factors

(1) Annual fishery yield of the VFDP in 1984 : 96,318 kg

(2) Quantity of marine products supplied from VFDP to the Port Vila Fisheries Ltd., Natai Shop during the said period : 43,280 kg

(3) Percentage of (1) with regard to (2) : 45%

(4) Number of fishing units operating outboard engine fishing boats as of end of 1984 : 28

(5) Number of fishing units operating outboad engine fishing boats as of October 1985 : 53

(6) Increase in the number of fishing units from end of 1984 to October 1985 : 25

(7) Number of fishing units planned as of end of 1987 : 127

(8) Increase in the number of outboard engine fishing boats and inboard engine from end of 1984 to end of 1987 : 99 boats

(9) Number of areas of the country provided with fishing units, as of Octoer 1985 : 27 areas

(10) Number of medium- and large-scale fish marketing stations at the end of 1987 : 14 stations

- Existing stations (5) + Stations to be established anew (9) = 14 stations

(11) Number of outboard fishing boats that can use the fish marketing stations : 66 boats

- 127 boats x 14 stations/27 areas = 66 boats

The outboard fishing boats tend to concentrate in the medium- and large-scale fish marketing stations. However, expected number of the outboard engine fishing boats to use such fish marketing stations are estimated in low apllied with average number, using the fixed number of 27 areas in future.

(12) Expected average number of outboard engine fishing boats using each fish marketing stations : 4.7 boats

- 66 boats x 1/14 stations = 4.7 boats

(13) Average daily catach of each outboard engine fishing boat : 30 kg

(14) Average number of monthly working days of each outboard engine fishing boat : 7 days

(15) Average annual catch of each outboard fishing boat: 2,520 kg

- 30 kg x 7 days x 12 months = 2,520 kg

(16) Average number of monthly working days of outboard engine fishing boats that can use the fish marketing stations as like as ice-making machine : 15 - 19 days

It is presumed that these boats have more monthly working days because both the market and demand of marine products was expanded through the use of the fish marketing stations.

The basic design calculations are carried out by assuming that outboard engine fishing boats with access to the middle- and large-scale fish marketing stations have 14 monthly working days, i.e., twice the average.

The outboard engine fishing boats with access to the small-scale fish marketing stations increase a few monthly working days and no effect applied to the calculation for the basic design.

(17) Average annual catch by canoes under the VFDP : 659 kg

(18) The consumption of ice per kg of fresh fish is shown in the following.

- Quantity of ice used for processing and preservation of fresh fish at the Port Vila Fisheries Ltd. : 2/3 kg

- Quantity of ice used for fishing by the outboard engine fishing boats (using heat insulating fish boxes) : 0.5 kg

- Quantity of ice used by the existing association for transportation of fish (using heat insulating fish boxes) : 0.5 kg

- Quantity of ice used by the existing association for selling fresh fish in the villages (using heat in sulating fix boxes) : 0.25 kg

- Ice selling price at the existing association: 15 VT/kg

(19) Estimated annual output of marine products under the VFDP in 1987 : 512,118 kg

Assuming that the equipment and facilities to be distributed under the Project will start their operation

on 1st January in 1987, the project implementation year. The annual output of marine products is calculated in the following.

96,318kg*1 + 2,520kg*2 x 99boats*3 = 345,798kg*4 (1)
2,520 kg x 66 boats*5 = 166,320 kg*6 (2)
(1) + (2) 345,798kg + 166,320kg = 512,118 kg*7 (3)

Note:

*1 Annual output of marine products under the VFDP in 1984.

*2 Annual catch of each outboard engine fishing boat under the VFDP.

*3 Increase in the number of outboard engine and inboard engine fishing boats under the VFDP from the end of 1984 to the end of 1987.

*4 Annual output of marine products when the fish marketing stations are not used.

*5 Number of outboard fishing boats, out of the total (127 boats), that can make use of the large- and medium-scale marketing stations.

*6 Incremental annual output of marine products resulting from the increase in the number of annual operating days of outboard engine fishing boats, thanks to the utilization of the marketing stations.

*7 Annual output of marine products under the VFDP expected in 1987.

4-2-2 Subsidiary factor

(1) Cost of fishing gear consumed for catching 1 kg of marine products : Approx. 10 VT

(2) Cost of fuel consumed for catching 1 kg of marine products : Approx. 30 VT

(3) Daily consumption of gasoline for operating one outboard engine fishing boat : Approx. 22 liters

(4) Average fishermen boarding each outboard engine fishing boat : Approx. 3.5 persons

(5) Average income per fisherman resulting from the daily operation of the outboard engine fishing boat : Approx. 150 VT

The said income refer to fishing units reimbursing loans used for purchasing the fishing boat and outboard engine, and depreciating the said equipment as well.

(6) Average price of fish sold by fishermen under the VFDP to the existing association : Approx. 120 VT/kg

(7) Average price of fish sold by the existing association : Approx. 150 VT/kg

(8) Cost for transportation of fresh fish from the Remre fishing unit located in Port Orly to the airport : Approx. 8 VT/kg x 60 km

(9) Domestic airline freight of fresh fish

- From the central and south areas to the capital city "Port Vila" : 30 VT/kg

- From the north area to the capital city "Port Vila" : 60 VT/kv

Note: 1 VT = 1.988 Yen

4-3 Equipment and materials to be used for expansion of number of fishing units

4-3-1 Outboard engines

(1) Objective

These engines will be used in the fishing boats for new fishing units under this project. The outboard engines

will be distributed to the new fishermen of the VFDP in conformity with the method mentioned in the previous chapter.

(2) Conditions for selection

1) The outboard engines in question will be selected so as to be used in fishing boats similar to the displacement-type[*1] fishing boats with approximately 6 m in length being used at the present time under the VFDP.

2) The Fisheries department stipulates that fishing boats under the VFDP must possess one outboard engine for regular use and another one for emergency use, and the outboard engines in question should be selected accordingly.

3) The outboard engines should be selected in type and output similar to those ones being used at the persent time under the VFDP.

(3) Selection of the equipment

1) Engine

Wooden fishing boats with approximately 6 m in length being used under the VFDP at the present time are designed and built on the premise of using outboard engine. Therefore, outboard engines should be used for propulsion of such boats.

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*1 Boats with shape distinct from ordinary fishing boats normally used in Japan, with smaller length/widty ratio and width/depth radio. These boats have large inner volume compared with the length.

The aforementioned outboard engine fishing boats are engaged in hook and line fishing and trolling, and they do not require big-power outboard engines in view of their modus operation.

That being so, outboard engines with power similar to those ones being used popularly at the present time under the VFDP will be selected in this project as well.

2) Specifications

a) Regular outboard engine
Engine output: 25 HP
Fuel oil: Mixed gasoline and lubricant oil
Accessories & spare parts: 1 set

b) Emergency outboard engine
Engine output: 8 HP
Fuel oil: Mixed gasoline and lubricant oil
Accessories & spare parts: 1 set

3) Quantity

The quantity of outboard engines to be introduced under this project corresponds to 30 outboard fishing boats of the VFDP, as planned in Chapter 3.

- Regular outboard engines 30 units
- Emergency outboard engines 30 units

4-3-2 Inboard marine diesel engine

(1) Objective

These engines will be used as main propulsion machines of inboard engine fishing boats for new fishing units under this project. The marine diesel propulsion engines will

be installed in the fishing boats at the wooden boat shipyard in the Espiritu Santo Island and then the fishing boat will be alloted to the fishing units.

(2) Conditions for selection

1) These marine diesel propulsion engines should be selected so as to be used for 4 inboard engine fishing boats with 7 m overall length, 3 fishing boats of the same kind with 10 m overall length, and 2 boats with 12 m overall length, totalling 9 fishing boats.

2) Each inboard engine fishing boat will be equipped with one diesel propulsion engine.

3) The inboard diesel propulsion engines should be selected in type and power similar to those ones used in inboard diesel engine boats constructed or under construction in Vanuatu, and confirm that no overpowered engines are selected.

(3) Selection of the equipment

According to the existing plans, the fishing boats equipped with inboard diesel propulsion engines will have overall length of 7 meters, 10 meters and 12 meters, respectively, and therefore three distinct kinds of diesel propulsion engines will be examined for these fishing boats.

1) Engine output

It is confirmed that 7-meter class, 10-meter class and 12-meter class inboard diesel engine boats have approximately 8 knots speed*1 by using 3 district

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*1 One knot is a speed equivaloent to 1,852 meters per hour.

three class of diesel engines with 25 HP, 35 HP snd 45 HP respectively, examined by the speed-power curve*1.

Therefore, it is concluded that no over-powered inboard diesel propulsion engines are selected for each class of boat.

2) Specifications

a) Marine diesel propulsion engine for 7-meter class inboard engine fishing boat

- Engine output: Approximately 25 HP
- Speed reduction gear: Provided
- Ahead and astern clutch: Provided
- Accessories and spare parts: Propeller, propeller shaft, stern tube, etc., 1 set

b) Marine diesel propulsion engine for 10-meter class inboard engine fishing boat

- Engine output: Approximately 35 HP
- Speed reduction gear: Provided
- Ahead and astern clutch: Provided
- Accessories and spare parts: Propeller, propeller shaft, stern tube, etc., 1 set

c) Marine diesel propulsion engine for 12-meter class inboard engine fishing boat

- Engine output: Approximately 45 HP
- Speed reduction gear: Provided
- Ahead and astern clutch: Provided
- Accessories and spare parts: Propeller, propeller shaft, stern tube, etc., 1 set

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*1 Refer to the "Design Data" in the Appendix.

3) Quantity

Number of the diesel propulsion engines for the 4 fishing boats of 7-meter class, 3 boats of 10-meter class and 2 boats of 12-meter class are listed in the following.

- 25 HP-class main Diesel engine for ship propulsion: 4 units

- 35 HP-class main Diesel engine for ship propulsion: 3 units

- 45 HP-class main Diesel engine for ship propulsion: 2 units

4-3-3 Fishing gear and marine chandlery

(1) Objective

Fishing gear and marine chandlery will be distributed to the fishermen under the VFDP, through the Fisheries department head office and branch, as well as extension service offices and the like, so as to equip the fishing boats of fishing units to be established anew in 1987, the project implementation year, and to accomplish the target yields of the project.

(2) Conditions for selection

1) The fishing gear and marine chandlery under this project should be selected in models and types similar to those ones being used at the present time by fishermen of the VFDP.

2) The fishing gear such as angling and trolling which fishermen of the VFDP have sufficient assembly technique should be distriburted in the form of

materials. As for gill nets, completed products should be selected , because the assembling technique is not sufficiently diffused, but there is no problem in the repair technique.

(3) Selection of equipment and materials

1) Trolling gear
Various kinds of artificial baits for trolling lines, fishing hooks, stainless-steel wires, nylon lines swivels etc.

2) Angling gear
Various kinds of fishing hooks, nylon lines, lead wires, swivels, etc.

3) Gill net
Completed bottom gill nets with 100 meters in length and materials for repair. 1 set

4) Marine chandlery
Anchor and anchor-chain for small boats, ropes, buoys, small-sized fire extinguishers, life saving signal set for small boats, flashlight, rain gear, heat-insulating fish boxes, etc. 39 sets

(4) Quantity

The quantity of fishing gears should be provided with one year of use in 1987, the project implementation year, and the individual quantity of the various kinds of fishing gears will be determined proportionally by the past record of use. The quantity of marine chandlery will be calculated so as to cope with the needs of the 39 fishing boats of the fishing units to be established anew during the project implementation year.

The budgets of fishing gear and marine chandlery, etc.,

will be distributed as follows, based on the past record regarding their use.

- Fishing gear: 50%
  - Hook fishing gear 6%
  - Trolling line fishing gear 33%
  - Gill net and other fishing gear: 11%

- Marine chandlery
  Marine chandlery for 39 fishing boats, based on the past sales records.

4-4 Equipment and facilities to improve the fish marketing functions

4-4-1 Absorption-type refrigerators

(1) Objective

Refrigerators will be used at the small-scale fish marketing stations under this project. The absorption-type refrigerators will be distributed to the selected 8 stations in the project.

(2) Conditions for selection and design

1) The absorption-type refrigerators should be selected in similar to the heat-absorption type ones being used at the present time under the VFDP.

2) The refrigerators should be equipped with two gas cylinders, so as not to interrput the operation even when the fuel gas is being filled.

(3) Selection of the equipment

1) Capacity of the refrigerator

The refrigerator should have capacity sufficient to cope with two day catch by the outboard engine fishing boat. Therefore, the refrigerator capacity is calculated in the following.

- 30 kg x 2 days ÷ 0.375*1 ton/m^3 = 160 liters

2) Specifications and quantity

The specifications and the quantity are determined as follows.

- Type of refrigerator:	Absorption-type, vertical type with a full size door
- Capacity:	160 liters
- Type of fuel:	Petroleum gas
- No. of gas cylinders:	2 pcs.
- Accessories:	1 set
- Quantity:	8 complete sets

4-4-2 Small-sized block ice machine sets

(1) Objective

Ice machines should be used at the middle-scale fish marketing stations. The small sized block ice machine sets should be distributed to the selected 9 stations in this project.

One block ice machine set consists of the following equipment.

1) Block ice machine
2) Box freezer
3) Diesel engine generator
4) Large-sized & small-sized heat insulating fish boxes

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*1 Weight of fish which can be stored in 1 cubic meter volume.

(2) Conditions for design and selection

1) As things now stand, the VFDP is using block ice machines with approximately 300 kg daily capacity, and the machines should be designed in similar to the existing ones.

2) The small-sized box freezers should be selected suitable for storing ice and fresh fish.

3) The generators should have capacity conforming to the power consumption of the ice machines and freezers.

4) The heat insulating boxes should be selected suitable for ice storage, as well as preservation and marketing of fresh fish.

(3) Selection and basic design of equipment and facilities.

1) Small-sized block ice machine

a) Type

The principal types of small sized block ice machine are listed in the following.

Type of ice machine	Ice shape
1. Cube ice machine	Dice-shaped cube ice
2. Flake ice machine	Thin ice flakes
3. Plate ice machine	Plate-shaped ice pieces
4. Block ice machine	Ice block of approx. 25 kg

The types 1. to 3. can be operated with automatic equipment and are suited for continuous ice-making, but on the other hand their maintenance and repair is complicated. The block ice machine requires manpower for its operation, but on the other hand its maintenance

and repair is easy compared with the aforementioned types.

In this project, it is decided to adopt the block ice machine, by taking into consideration the ease of maintenance and repair as well as its record of use under the auspices of the VFDP, because they will be used in the villages.

b) Ice-making capacity

As mentioned in the previous chapter, the number of outboard engine fishing boats will increase to 127 at the end of 1987. Of that total, 66 fishing boats will have access to the existing medium- and large scale fish marketing stations and those ones to be established anew, mounting to 14 in total. It is estimated that each one of the said stations will be used by 4.7 fishing boats in average.

The quantity of ice to be purchased by these fishing boats per working day, and the quantity of ice required for fish marketing of the marine products caught by these boats are calculated in the following.

$$4.7 \text{ boats} \times 30\text{kg}^{*1} \times (0.5\text{kg}^{*2} + 0.5\text{kg}^{*3} + 0.25\text{kg}^{*4}) = 176 \text{ kg}$$

Note:

*1 Daily catch of each outboard engine fishing boat, estimated as a result of analysis of the relevant data.

*2 *3 *4 The consumption of ice is estimated to be as follows, as a result of interview survey.

- Quantity of ice used per kilogram of fresh fish (assuming the use of heat-insulating fish boxes for the totality of fresh fish)
  - For fishing: 0.5 kg
  - For transportation 0.5 kg
  - For sales in the villages: 0.25 kg

As can be seen, the ice machines are required to have daily ice-making capacity mounting to 176 kg.

c) Ice can and ice-making time

The ice-making boxes are assumed to have 25 kg capacity, which is the size normally used in small-sized ice machines. Furthermore, it is assumed that each ice-making cycle takes 12 hours, by taking into consideration the size, operation efficiency and operation convenience of the ice machine. Therefore, the Ice machines are required to have the undermentioned ice-making capacity, so as to make 176 kg of ice, which is the daily estimated requirement in this project, by using 25 kg ice-making boxes.

25 kg x 4 boxes x 2 times/24 hours = 200 kg/24hrs.

In view of the aforestated considerations, the ice machines to be introduced under this project should have 200 kg/24 hour ice-making capacity.

Appropriate measures, such as extending the ice machine operation day, etc., should be taken in medium-scale fish marketing stations used by more than 4.7 outboard fishing boats, so as to cope with the larger demand of ice.

d) Specifications

Type of the ice machine: Block ice machine
Quantity: 1 set
Capacity: 200 kg/24 hours
Refrigerating machine: 1,700 Kcal/h x 2.2 KW
Accessories & spare parts:
1 set of Ice-crusher, raw-water tank for ice-making, etc.

2) Box freezers

a) Capacity

The freezer store should have sufficient to store 2 day catch of 4.7 outboard fishing boats, besides the quantity of ice corresponding to 1 day of ice machine operation.

Therefore, the freezing store should have the undermentioned inner volume.

(4.7 fishing boats x 30kg x 2 ÷ 0.375 ton/m^{3*1})
+ (200kg ÷ 0.5 ton/m^{3*2}) ≈ 1,152 litres

Selecting appropriate models from among mass-produced box freezers in Japan and available on the domestic market, it is concluded that two units with 650 liter capacity will be required to provide tha said inner volume.

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*1 Weight of fresh fish which can be stored in 1 cubic meter volume (in the case of small-sized freezing store).

*2 Quantity of ice which can be stored in 1 cubic meter volume (in the case of small-sized ice store).

b) Cooling temperature of the box freezer

The cooling temperature of the box freezer is assumed to be - 15°C, by taking into consideration conditions for satisfactory ice storage, generator operation method, etc.

c) Specifications and quantity

- Type of the freezer: Box-shaped freezer with fully-opening upper lid.
- Quantity: One set consisting of 2 units
- Capacity: 650 liters
- Refrigerating machine: Hermetic type, 250 W
- Cooling temperature of box freezer: - 15°C

3) Generator

a) Generator capacity

The generator capacity is examined only in connection with the ice machine, which requires larger starting current, because there is no necessity of starting simultaneously the operation of the box freezer and ice machine.

The motor of the refrigerating machine for the ice machine has 2.2 KW power, and the starting current can be regarded as approximately 3 times the steady value. Therefore, the required generator capacity is 6.6 KW.

b) Specifications and quantity

- Generator type: Diesel engine driven generator
- Quantity: 1 unit
- Capacity: 8.5 KVA (6.8 KW) x 12 HP
- Voltages, frequency, and number of phases: 380 V/220 V x 50 Hz x 3 ø/1 ø
- Accessories & spare parts: 1 set

4) Heat insulating fish box

a) Specifications and quantity

- Type of heat-insulating fish box:
  Inner and outer surfaces made of hard plastic with a lid.
- Capacity: Approx. 160 liters and 80 litres
- Quantity: 1 set

(4) Quantity

The undermentioned euqipment and apparatuses compose one complete set.

- Small-sized block ice machine: Approx. 200 kg/24 hours	1 set
- Box freezer: Approx. 650 litres x 2 units	1 set
- Genarator: Approx. 8.5 KVA	1 unit
- Heat-insulating fix box Approx. 160 litres and 80 litres	1 set
- Quantity: 9 complete sets of the aforementioned items	

4-4-3 Outdoor type small-sized cold store

(1) Objective

Outdoor type small-sized cold store should be used to cope with the demand of ice of the fishing units under the VFDP, and the inceasing preservation of skipjack and tuna catch resulting from the implementation of this project.

The installation of cold store with ice-storage capacity will make it possible to cope with fluctuations in the ice demand, exercising as a consequance full capacity of the existing ice-making machines.

Furthermore, the cold store will be used for preserving skipjack and tuna, which are kinds of fish with growing demand and supply.

This cold store will be installed in the Santo Fish shop of the Port Vila Fisheries Ltd.

(2) Design Conditions

1) The cold store will be designed as outdoor facility, because there is no room for installing them inside the Santo Fish Shop.

2) The cold store should be provided with sufficient thickness of heat insulating material because the surface temperature of the store rises where installed outdoors, and furthermore the cold store should be provided with a prechamber, so as to prevent hot open air from getting directly into the freezing store.

3) Ice and fish should be stored sumultaneously in the freezing store.

4) The cold store volume should be calculated on the basis of one-week warehousing capacity, so as to cope with fluctuations in the daily demand of ice, which surpasses 200 kg, as well as fluctuations in the storage of skipjack and tuna caught by the fishing boats.

5) The cold store should be designed so as not to lower the inner temperature in excess, in order to prevent the necessity of installing large-sized and complicated refrigerating equipment.

6) The structure of the cold store should be sufficiently rigid, so as to cope with the exposure to the weather.

(3) Basic design of the equipment

1) Capacity

The cold store capacity is designed by regarding the ratio between the exepcted annual output of marine products of 1985 and the assumed annual output of 1987[*1], the project implementation year, as expected growth rate.

The expected annual output of marine products as of 1985, based on the number of outboard engine fishing boats existing at the time of the field survey carried out in October of that year, is calculated in the following.

96,318kg[*2] + 2,520kg[*3] + 25[*4] fishing boats[*5]
x 0.5 = 127,818kg[*7] (1)

2,520 x 12 fishing boats[*8] x 0.5[*6]
= 15,120kg[*9] (2)

(1) + (2) = 127,818kg + 15,120kg = 142,938kg[*10]

Therefore, the expected growth rate is calculated as follows.

512,118[*11] ÷ 142,938 = 3.58

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*1 Annual output of marine products calculated by assuming that the equipment and facilities to be distributed under the project will start operation on 1st January in 1987, the implementation year of this project.

*2 Overall annual output of marine products of the VFDP as of 1984.

*3 Average annual catch of each outboard engine fishing boat.

*4 Number of fishing units established anew from January to October 1985.

*5 Each one of the aforementioned fishing units operating one outboard engine fishing boat.

*6 The annual output of marine products of the fishing units established anew from January to October 1985 is assumed to be proportional to the period of time from the epoch of establishment and epoch of start of operation to the end of the year. For the sake of simplicity, the relevant calculations are carried out by assuming that the output of the said units is 1/2 of the average.

*7 Overall output of marine products as of 1985, calculated on the basis of the average annual output of the outboard engine fishing boats.

*8 Number of outboard engine fishing boats of the fishing units established anew in 1985 that have access to the fish marketing stations, and that satisfy conditions for increasing the number of annual working days and the annual output of marine products to twice as much as the average as a consequence of the market expansion.

*9 Annual output of marine products increased as a consequence of the condition in *8. (Refer to section 4-2-1(16) for further details).

*10 Annual output of marine products expected in 1985.

*11 Annual output of marine products assumed in 1987, the project implementation year. (Quoted from the main factor (19)).

The cold store capacity required in 1987, the project implementation year, is calculated by mutiplying the weekly ice selling quantity (500 kg) and the preserving quantities of skipjaok and tuna at the time of the survey (October 1985) with the expected growth rates.

$0.3\ t^{*1} \times 3{,}58^{*2} + 0.375^{*3}/m^3$
$= 2{,}864^{*4} m^3/week \qquad (1)$

$0.5\ t^{*5} \times 3{,}58 + 0.5\ t^{*6}/m^3$
$= 3.58^{*7} m^3/week \qquad (2)$

$(1) + (2) \quad (2.86\ m^3 + 3.58\ m^3) \times 0.6$
$= 10.7\ m^3/week$

Therefore, the required cold store capacity is 10.7 m^3.

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*1 Weekly arrival of skipjack and tuna at the time of the survey.

*2 Growth rate of 1987, based on data as of October 1985.

*3 Weight of fish which can be preserved in 1 cubic meter (in the case of small-sized cold store)

*4 Cold store capacity required for preserving skipjack and tuna.

*5 Weekly ice selling quantity at the time of the survey.

*6 Quantity of ice which can be stored in 1 cubic meter volume (in the case of small-sized cold store).

*7 Cold store capacity required for storing ice.

*8 Percentage of the inner volume of the cold store surrounded with heat insulating walls, which can be effectively used for storage purposes.

2) Cooling temperature of the cold store

The cold store is designed by taking into consideration cooling temperature of - 25°C, which can be efficiently attained with single-stage refrigerating compressor which do not require complicated system.

3) Specifications and quantities

- Type of cold store:
  Outdoor weatherproof type freezing store
- Quantity: 1 unit
- Cold store capacaity:
  Approx. 10.7 cubic meters
- Cooling temperature of the cold store:
  -25°C
- Prechamber: Provided
- Refrigerating machine:
  Approx. 5,800 Kcal/h x 5.5 KW
- Accessories & spare parts: 1 set

4-4-4 Outdoor type small-sized flake ice machine

(1) Objective

At the time of the survey, the 500 kg-capacity of the flake ice machine unit of the Natai Shop was practically even with the demand, with some sporadic shortage of ice to be sold. That being so, new flake ice machine unit will be installed so as to cope with the assumed output of marine products in 1987, the project implementation year.

The new ice machine unit will be installed at the Natai Shop of the Port Vila Fisheries Ltd.

(2) Design conditions

1) Flake ice is suited for processing and preservation of fresh fish, because of its strong cooling power. That being so, flake ice machine unit similar to those ones being used at the present time will be adopted in this project as well.

2) The ice-making capacity is determined on the basis of the daily arriving quantity of fresh fish.

3) This flake ice machnie unit will be designed as an outdoor type one, because there is no room for installing the ice-making machine unit in the Natai Shop.

4) The ice bin should be provided with sufficient thickness of heat-insulating material, because surface temperature of the bin raises where it is installed outdoors.

5) The ice-making machine unit should be designed so as not to fit cooling apparatus inside the ice bin, in order to prevent the complication of the system.

6) The ice-making machnie unit should have sufficiently rigid structure, so as to cope with the exposure to the weather.

(3) Basic design of the equipment

1) Ice-making capacity

The ice-making machine capacity should be designed so as to cope with the increasing quantity of ice required at the Port Vila Fishery Ltd. Natai Shop in 1987, the project implementation year.

The ice-making machine capacity should be designed on the basis of the assumed output of marine products as of 1987.

The expected increase in the daily quantity of marine products arriving at the Natai Shop in 1987, compared with the current state of things, and the quantity of ice required concurrently, are calculated in the followings.

(512,118kg*1 - 142,938kg*2) ÷ 12 months ÷ 21 days/month = 1,465kg*3/day

1,465kg x 0.45*4 x 2/3kg*5 x 2*6 = 879kg/day

The required daily ice-making capacity is 879 kg in view of the aforestated considerations. Two identical ice-making machnies with 500 kg/24-hour capacity will be installed in this project, by taking into consideration such factors as dispersion of risks due to malfunction of the ice-making machine,

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Note:

*1 Assumed annual output of marine products as of the project implementation year.

*2 Expected annual output of marine products as of 1985.

*3 Daily output of marine products under the VFDP expected to increase from 1985 to 1987.

*4 Percentage of the overall output of marine products supplied from the VFDP to the Port Vila Fisheries Ltd., based on statistics of 1984.

*5 Quantity of ice used at the Natai shop for processing and preservation of 1 kg of fresh fish.

*6 Fluctuation in the arriving quantity of marine products, based on interviews carried on the occasion of the survey.

efficient operation minimizing the self-melting of ice inside the ice bin, capacity of the flake ice machines being mass-produced at the present time, etc., in a global way.

b) Ice bin capacity

Normally, the ice bin of the flake ice machine should have capacity sufficient to stow 2 to 10 days of production of the ice-making machine, so as to cope with fluctuations in the ice demand.

In this project the ice bin is designed for coping with 2 days of the ice-making capacity, by taking into consideration such factors as actual conditions of operation of the machine, self-melting quantity of ice, etc.

The required ice store capacity is calculated in the following.

0.5^{*1} ton/day x 2^{*2} units x 2^{*3} days ÷ 0.45^{*5} = 11.1 m^3

Note:

*1 Ice-making machine capacity

*2 Number of units of ice-making machine

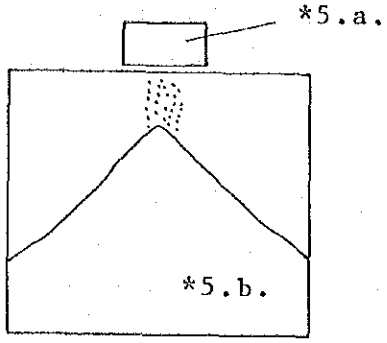
*3 Two days operation of the ice-making machine

*4 Weight of flake ice which can be stored in 1 cubic meter volume

*5 Storage rate of the ice bin

a. Ice-making machine

b. The storage rate of the ice bin is the ratio between the quantity of ice piled up in conic shape, as shown in the figure at left, and the total inner volume of the ice bin.



c) Specifications and quantity

- Type of ice-making machine:
  Outdoor weatherproof type flake ice machine
- Quantity: 1 set
- Type of ice to be produced: Flake ice
- Ice-making capacity: 500 kg/24hrs. x 2 units
- Refrigerating machine capacity:
  4,240 Kcal/h x 2 units
- Refrigerating machine criving motor:
  3.7 KW x 2 units

4-4-5 Equipment for promotion of small-scale export

(1) Objective and component equipment

These equipment for promotion of small-scale export under this project will be allocated to the Port Vila Fishery Ltd. Natai Shop.

The equipment in the project consists of the undermentioned components.

1) Polystyrene heat-insulating fish box*1 moulding machine.

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*1 White fish boxes popularly used in fish shops.

This machine is aimed at manufacturing containers of marine products to be exported.

2) Vacuum sealer

Equipment for packing the commodities in vinyl bags, and sealing the said bags in vacuum, so as to keep marine products from drying.

3) Handheld type small-sized powered strapping tool.

The tool for strapping polystyrene heat-insulating fish boxes with vinyl tapes.

4) Electric and bimetallic type thermometers

Thermometers for measuring the temperature of cold-stored or freezing-stored fish at the time of export.

(2) Conditions for design and selection

1) The quantity of polystyrene fish boxes required for the planned annual small-scale export (10 tons) is approximately 1,000 units.

Mannual operation moulding machine with the smallest capacity is selected for this project, because the required fish export container manufacturing capacity is extremely small.

2) As for the vacuum sealer, a manual operation type equipment with capacity conforming to the dimensions and quantity of fillet fish being processed at the Natai Shop at the present time will be selected in this project.

3) The hand-held type small-sized powered strapping tool should be a model suited for packing the aforementioned molded polystyrene fish boxes, and 2 identical units should be provided so as to conserve

the freshness of the commodities and making it possible to execute a rapid work.

4) The electric thermometer should be an equipment suited for measuring the temperature of the frozen fish.

(3) Specifications and quantities

1) Polystyrene heat-insulating fish box moulding machine

This machine consists of steam generator, bead forming unit, pressure box for moulding, dies for moulding polystyrene fish boxes, foamed beads filling table, etc.

- Type of polystyrene foam fish box moulding machine:
  Manual operation type machine
- Quantity: 1 unit
- Capacity: 1 box/approx. 3 minutes
- Steam generator:
  Approx. 250 kg/h x 7 kg/cm^2 x 1 unit
- Beads forming machine:
  . Inner volume of foaming machine:
  Approx. 200 litres x 1 unit
  . Motor: 0.75 KW x 1 unit
- Pressure box for moulding: 1 unit
- Dies for polystyrene fix box moulding: 1 set
- Foamed beads filling table: 1 unit
- Accessories and spare parts: 1 set

2) Vacuum sealer

- Type of vacuum sealer:
  Hand-operated type
- Quantity: 1 unit

- Size of the vacuum chamber:
  Approx. 50 cm x 50 cm x 20 cm
- Capcity: Approx. 1 to 2 times/minute
- Motor: 1.5 KW x 1 unit
- Accessories & spare parts: 1 set

3) Handheld type small-sized powered strapping tool

- Type of strapping tool:
  Handheld powered type tool
- Quantity: 2 units
- Applicable tape and tape dimensions:
  Plastic tape, 10 mm to 19 mm width
- Accessories & spare parts: 1 set

4) Fish body thermometers

Electric thermometer and bimetal type thermometers: 1 set

4-4-6 Equipment for fish collecting, weighing, processing and retailing

(1) Objective

These equipment supply aims at improving the capacity of the Port Vila Fisheries Ltd., taking charge of sales of marine products of the VFDP, regarding fish collecting, weighing, processing and retailing, so as to cope with the increasing quantities of the said commodities as a result of the implementation of this project.

These equipment will be alloted to the Port Vila Fisheries Ltd. Natai Shop and Santo Fish Shop, respectively. The types and capacities of the equipment in question are mentioned in the following.

1) Heat-insulating fish boxes (to be arranged at the airports at the vicinity of the fish marketing stations)

These are fish container boxes made of hard plastic and heat-insulating material, and will be disposed at airports located at the vicinity of small- and medium-scale fish marketing stations. The small- and medium-scale fish marketing stations will use for transporting marine products from the local airports to the Port Vila Fisheries Ltd. Natai Shop.

2) Digital platform scale equipped with summing-up and recording functions (to be installed at the Natai Shop)

This platform scale should be equipped with functions for summing up the measured weights and printing the said weight on the recording paper. Furthermore, it should be able to weight the daily quantity of marine products (approx. 900 kg) supplied from the small and medium-scale fish marketing stations in a prompt and accurate way.

3) Mechanical type platform scale (to be installed at the Santo Fish Shop)

This platform scale should be used to weight the marine profucts supplied from the VFDP to the Santo Fish Shop.

4) Electric saw for frozen fish (to be installed at the Santo Fish Shop)

This electric saw will be used to cut frozen

skipjaks and tuna in round slices, for fish steak.

5) Digital retailing scale equipped with cash register function (to be installed at the Natai Shop and Santo Fish Shop)

This scale will be used for prompt and accurate cash accounting in the retail sales, recording sales data of each kind of commodity, and surveying the sales trends of the commodities.

6) Cold store showcases for retailing (to be installed at the Natai Shop and Santo Fish Shop)

These cold store showcases should be suited for displaying fresh fish.

7) Pump and piping materials for live lobster tank (to be alloted to the Natai Shop)

Equipment for rearing live lobsters in tank so as to save energy and meet the demand of the customers.

(2) Conditions for design and selection

1) The heat-insulating fish boxes for collection of cargo to be selected under this project should be suited for air transportation of marine products.

2) The small-sized electric saw to be selected under this project should be suited for processing approximately 150 kg/day of skipjacks and tuna arriving from the fishing units on the project implementation year.

3) The small-sized digital scale equipped with cash-register function to be selected under this

project should be suited for retailing more than 30 kinds of marine products which are expected to a mount to more than 650 kg per day on the project implementation year.

4) The cold-store showcase for retailing should be designed so as to substitute the existing one, with insufficient capacity and impaired performance, and to display more than 30 kinds of commodities in an effective way.

The dimensions of the cold-store showcase should be determined by taking into consideration the selling quantities of the commodities and the installation spaces.

5) The pumps and the piping materials to be used for the live lobster tank should be suited for rearing the daily average of 50 kg of live lobsters sent from the fishing units.

The construction of the live lobster tank, the installation of the pumps and the piping work however, have no difficulty from the technical and cost standpoints, and can be taken charge of by the Port Vila Fisheries Ltd.

Under the circumstances, only the pumps, piping materials and the lilke will be provided under this project.

(3) Selection and basic design of the equipment

1) Heat-insulating fish boxes

a) Capacity and quantity

The heat-insulating fish boxes will be disposed

at the airports located at the vicinity of the small- and medium-scale fish marketing stations whose establishment is being planned in this project. Marine products collected at the small- and medium-scale fish marketing stations will be transported from the local airports to the Port Vila Fisheries Ltd. Natai Shop, by using these heat-insulating fish boxes.

The daily quantity of surplus marine products delivered from the medium-scale fish marketing stations and the capacity of heat-insulating fish boxes required for transporting them are calculated in the following.

4.7 fishing boats*1 x 30kg*2 x 0.45*3
= 63 kg/day

63 kg ÷ 0.375 ton/m^{3}*4 = 168 litres/day

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*1 Average number of outboard engine fishing boats utilizing each medium-scale fish marketing stations.

*2 Daily catch of each outboard engine fishing boat.

*3 Percentage of the marine products arriving at the Port Vila Fisheriese Ltd. Natai Shop to the total output of marine products of the VFDP, calculated from statistical data of 1964.

*4 Weight of fish which can be contained in 1 cubic meter volume.

In view of the aforementioned calculation results, it is necessary to provide two heat-insulating fish boxes with 84 litre capacity each at each one of the medium-scale fish marketing stations. The said capacity is determined by the space available inside the aircrafts, the ease of handling and other relevant aspects.

When carrying out the airlift two times in succession, it is necessary to double the aforementioned quantity of heat-insulating fish boxes to be disposed at the airports. Therefore the number of heat-insulating fish boxes to be disposed at the airports a mount to 4 units for each medium-scale fish marketing station. (Figure 8).

One heat- insulating fish box will be required to disposed at airports located at the vicinity of small-scale fish marketing stations, because in this case the cargo collection quantity is smaller compared with medium-scale fish marketing stations.

In reality however, the number of heat-insulating fish boxes must be doubled for each small-scale fish marketing station, by taking into consideration the airlift of marine production two times in succession. Under the circumstances, the total number of heat-insulating fish boxes required under this project is calculated in the followings.

4 boxes x 9 stations[*1] + 2 boxes x 8 stations[*2] = 52 boxes

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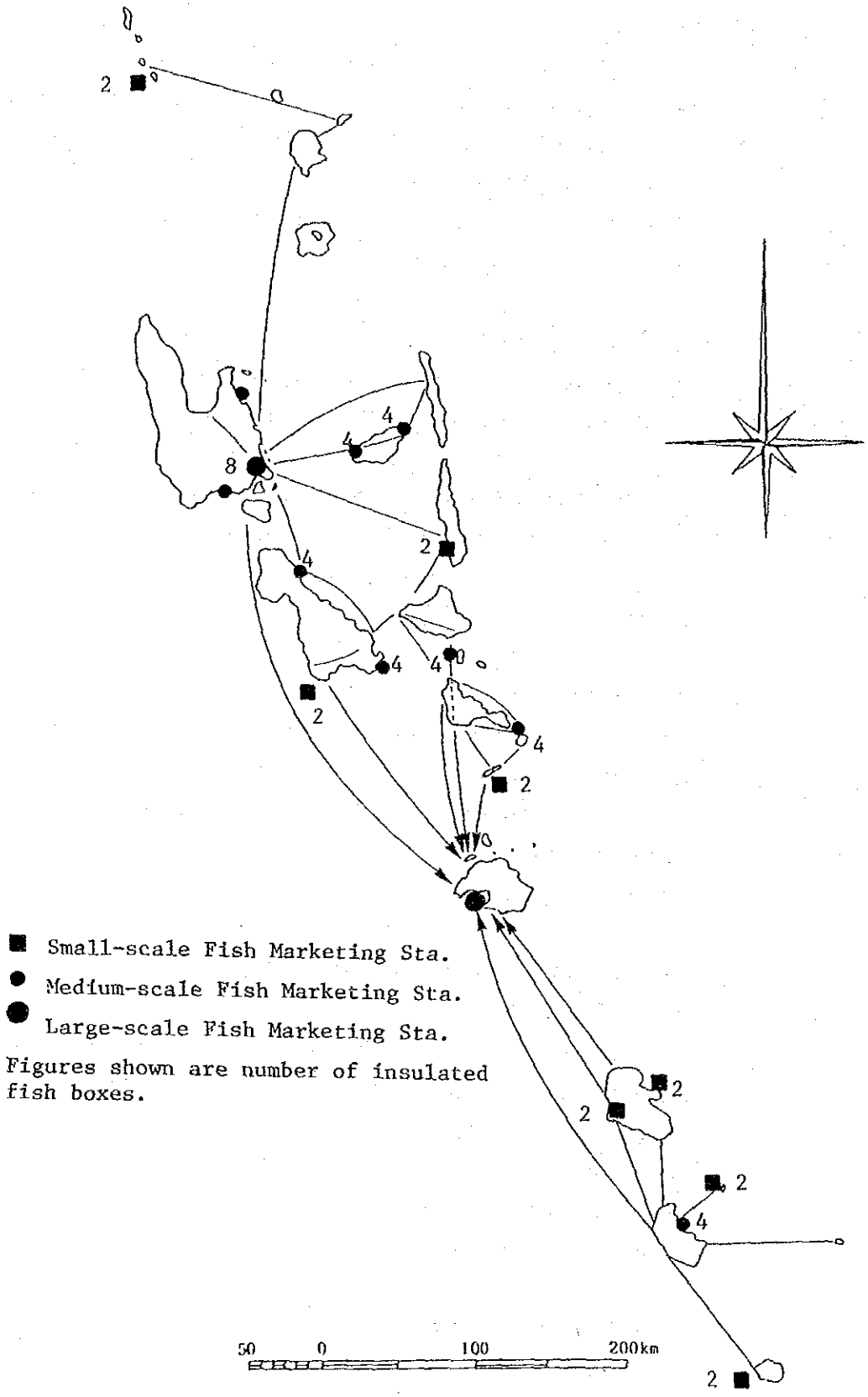
*1 Number of medium-scale fish marketing stations.

*2 Number of small-scale fish marketing stations.

Figure 8 : Arrangement of insulated fish box and airport



b) Specifications and quantities

- Type of heat-insulating fish box : Lightweight and rigid heat-insulating fish box provided with a lid, consisting of heat-insulating material with both faces covered with hard plastic.

- Capacity: Approx. 84 litres
- Quantity: Approx. 52 units

2) Digital platform scale equipped with summing-up and recording functions.

Specifications and quantity

- Type of platform scale: Electric type
- Quantity: 1 unit
- Measuring range: 0 to 150 kg
- Summing-up function: Provided
- Recording function by means of printer: Provided
- Weighting accuracy: 0.1 kg
- Accessories: 1 set

3) Mechanical type platform scale

Specifications and quantity

- Type of platform scale: Pointer type mechanical platform scale
- Quantity: 1 unit
- Weighting limits: 0 to 150 kg

4) Electric saw for frozen fish

Specifications and quantity

- Type of electric saw for frozen fish: Desk-top type electric saw
- Quantity: 1 unit
- Motor capacity: 400 W

5) Digital retailing scale with cash register function

Specifications and quantity

- Type of retailing scale: Electric type
- Quantity: 2 units
- Measuring range: 0 to 15 kg
- Cash register function: Provided
- Printer-type recording function: Provided
- Cash drawer: Provided
- Accessories: 1 set

6) Cold store showcase for retail sales

Specifications and quantity

- Type of cold store showcase for retail sales:
  Glass sealed type cold store showcase, provided with two display cases, upper and lower.

- Power consumption: 1.1 kw/4 meters, 0.75 kw/3 meters
- Quantity: 2 units
- Dimentions
  Height: Approx. 1.3 meter
  Length: Approx. 4 meters (for Natai Shop)
  Approx. 3 meters (for Santofish Shop)
- Door Sliding door on back side
- Temperature conditions: - 5°C
- Evaporator: Hairpin type

7) Pumps and piping materials for live lobster tank

a) Capacity of live lobster tank and pump

The required floor area of the live lobster tank is calculated in the following, based on the weight of the live lobsters to be reared and the quantity of live lobsters to be reared per unit floor area.

$$50kg^{\#1} \times 2^{\#2} \div 16.7\ kg/m^2 = 6m^2$$

The live lobster tank should have the following dimensions, by assuming that it has 2-meter in depth, and that a grate-shaped floor is installed in the middle so as to secure $6m^2$ floor area.

$$2\ m(L) \times 1.5\ m(W) \times 2\ m(D) = 6\ m^3$$

Water in the live lobster tank should be changed thrice per hour, which is the normal cycle, and two water-supply pumps, regular unit and stand-by unit, should be provided so as to disperser the risk of water supply stoppage due to malfunction of the pump.

The distance from the Natai Shop to the sea is 25 m, and the required piping length mounts to 65m in view of the building layout and pumps installation place.

Making the pressure calculation by assuming 65-meter piping length, 2.5-meter suction head, and 3-meter discharge head, it is concluded that the required total head is 10 meters, and that the pump driving power is approximately 1 KW.

b) Specifications and quantity

- Type of pump for the live lobster tank:
  Self-priming type centrifugal pump
- Quantity: One set consisting of 2 pumps
- Pump capacity: $18\ m^3/h \times 10\ mH$

#1 Daily arrival of live lobsters

#2 Fluctuation rate of the arriving quantity

#3 Quantity of live lobsters rearing per square meter of floor area

- Pump driving motor: 1.5 KW x 2 units
- Motor control switchboard: One set
  One set consisting of 2 switchboards
- Piping materials: 1 set

It must be borne in mind that the construction of the live lobster tank, the installation of the pumps and the piping work are not comprised within the scope of work of this project.

4-5 Equipment for strengthening the supporting services of the Fisheries Department

4-5-1 Small-sized extension service boat

(1) Objective

Extension service offices will be established at four places, Aoba Island, Malakura Island, Paama Island and Tongoa Island, and small-sized extension service boats will be allocated to the said offices, so as to strengthen the supporting services provided to the fishing units.

The small-sized extension service boats will take charge of the training of the fishermen under the auspices of the VFDP, transportation of fuel, ice and fishing gear to the fishing units, supply of spare parts of outboard engines, transportation of marine products caught by the fishermen, and small-scale repair of fishing boats and outboard engines (Figure 9).

(2) Design conditions

1) These small-sized extension service boats should have sea worthiness, because they will be navigated on the open sea.

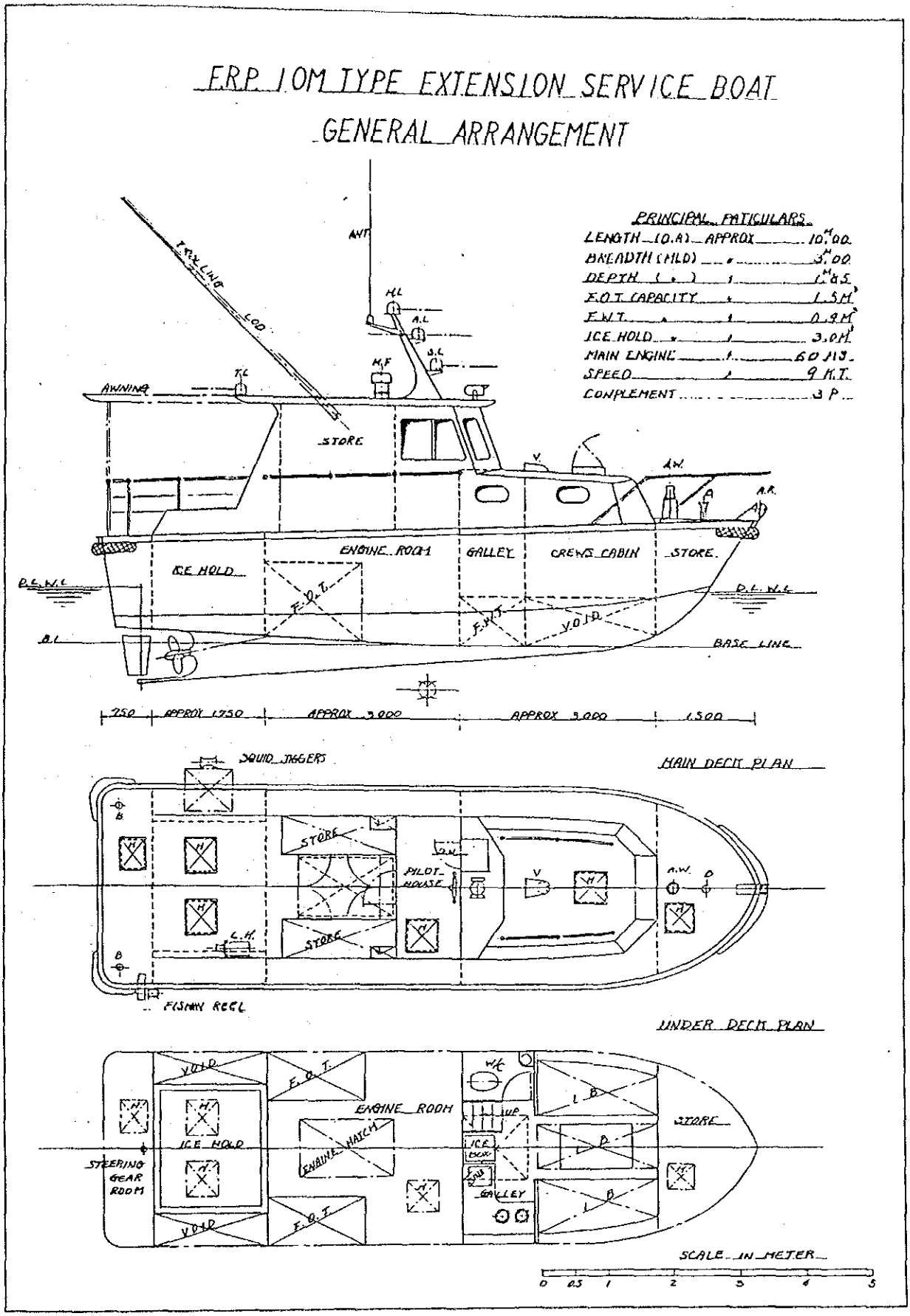


Figure 9: General Arrangement for Extension Service Boat

2) The endurance should be sufficient for 2 to 3 days, so as to visit and suport to fishing units in various places.

3) Living quaters should be provided for the three crew, consisting of a foreign technical staff, a fisheries department officer and a sailer.

4) Glassfiber reinforced plastic, with durability and easy maintenance, should be used for construction of the small-sized extension service boats.

5) The boat should be able to take charge of the training of fishermen of the VFDP, fishing trials, and fishing ground survey.

6) These boats should be able to take charge of small-scale repair of fishing boats and outboard engines, and furthermore they should be equipped with outboard engines to be lent to the fishermen of the VFDP during the repair of their outboard engines, so as to make it possible to continue their operation.

7) These boats should be provided with hold cum ice-store, fishing gear store and cargo space for storing fuel contained in drums, etc., for supplying ice, fishing gear and fuel to the fishing units and transporting the marine products caught by the fishermen to the fish marketing stations.

8) Diesel engine should be used as a main propulsion machine and to secure a cruising speed of 8.5 to 9 knots.

(3) Basic design

1) Boat length

These small-sized extension service boats should have

10 m overall length, consisting of 3 m for living quarters so as to cope with the three crew, 3 m for main engine and fuel tank, 1.8 m for hold cum ice-store, in addition to bow and stern void spaces.

2) Boat type

According to the 1984 meteorological statistics of Vanuatu, this country has severe meteorological and sea conditions, with 15-knot wind velocity and Beaufort scale-3 all over the year, with exception of March and April.

Under the circumstances, the deep V bottom shape is adopted in this project, in view of its seaworthiness.

3) Boat breadth

The length/breadth ratio should be rather large compared with ordinary same class boat, and the moulded breadth of the boat should be 3m, so as to secure easy fishing operation, good stability, etc., for the sake of training of the fishermen.

4) Boat depth

The moulded depth of the vessel should be 1.85 m, by taking into consideration the spaciousness of the living quater, capacity of the fish-hold cum ice-hold, succifient free-board for coping with the severe sea conditions, etc.

5) Design speed

Extraordinary hull strength is required to increase the cruising speed of the boat, in view of the storong waves in the sea area of Vanuatu.

It is decided to adopt a cruising speed of 9 knots, by taking into consideration such factors as the scale of the navigational sea area, economical speed determined by the vessel shape, etc., in a global way.

6) Main engine output and type

In this project it is decided to adopt a main engine with 60 HP output, which is the power required to secure 9 knot service speed in view of the attached design data, because the design full-loaded displacement of the boat is estimated to mount to approximately 10 tons. The main engine should be a diesel engine, in view of its economic efficiency.

(4) Specifications

1) Principal particulars

Length (overall)	Approx. 10.00 m
Breadth (moulded)	Approx. 3.00 m
Depth (moulded)	Approx. 1.85 m
Ice-store capacity	Approx. 3.00 m
Fuel-tank capacity	Approx. 1.50 m
Fresh water tank	Approx. 0.40 m^3
Complement	3 persons
Speed (service speed)	Approx. 9 KT

2) Main engine

- Type & quantity

  4-cycle marine diesel engine 1 unit

- maximum output Approx. 60 HP x 2800 RPM MAX.

3) Navigation instruments

- Steering equipment

  Hand-operated hydraulic steering device 1 set

- Compass — Magnetic compass — 1 set
- Radio telephone
  Approx. 25W HF radio telephone — 1 set
- Fish finder
  Small-sized, approx. 0 to 600 m — 1 unit

4) Fishing equipment, etc.
- Line reel
  Hydraulic-driving auto tension type
- Line hauler
  Hydraulic-driving type
  for bottom long line — 1 unit
- Squid jig machine
  Electric type & manual type — 1 unit each
- Trolling rod — GRP Approx. 6 m — 1 pair
- Anchor winch
  Hydraulic-driving vertical type — 1 unit

5) Machines and tools for repair
- Generator
  Portable Diesel engine generator
  2.5 KVA 220 V — 1 unit
- Electric woodworking tools
  Jigsaw, circular saw, planer, disk sander,
  and belt sander — 1 unit each
- Carpenter's tools — 1 set
- Engine repair tools
  Outboard engine repair tools — 1 set
  Inboard engine repair tools — 1 set
- Electric tools — Drill — 1 unit
- Outboard engines for lending,
  25 HP and 8 HP — 1 set

(5) Quantity
Small-sized extension service boats — 4 boats

4-5-2 Prefabricated small-sized warehouse for extension service office

(1) Objective

The prefabricated small-sized warehouse should be belonged to the extension service office, and will be used of for sales of fishing gear, marine chandlery, spare parts of outboard engines, etc., to fishermen of the VFDP, as well as middle-scale repair of outboard engines.

Tools reequired for middle-scale repair of outboard engines are described in details in the next section (Figure 10).

(2) Design conditions

a) The space should be sufficient to perform the duties intended.

b) Prefabricated unit should be adopted because of small-sized warehouse, so as to ease the construction work.

c) The strength should be sufficient to cope with the weather.

(3) Basic design

a) Floor area

The required floor area is calculated in the following, so as to conform to the proposed use.

- Fishing gear storage space	4 m^2
- Spare parts of the outboard engines storage space	2 m^2
- Fishing gear and outboard engine part sales counter	3 m^2
- Tools storage space	2 m^2

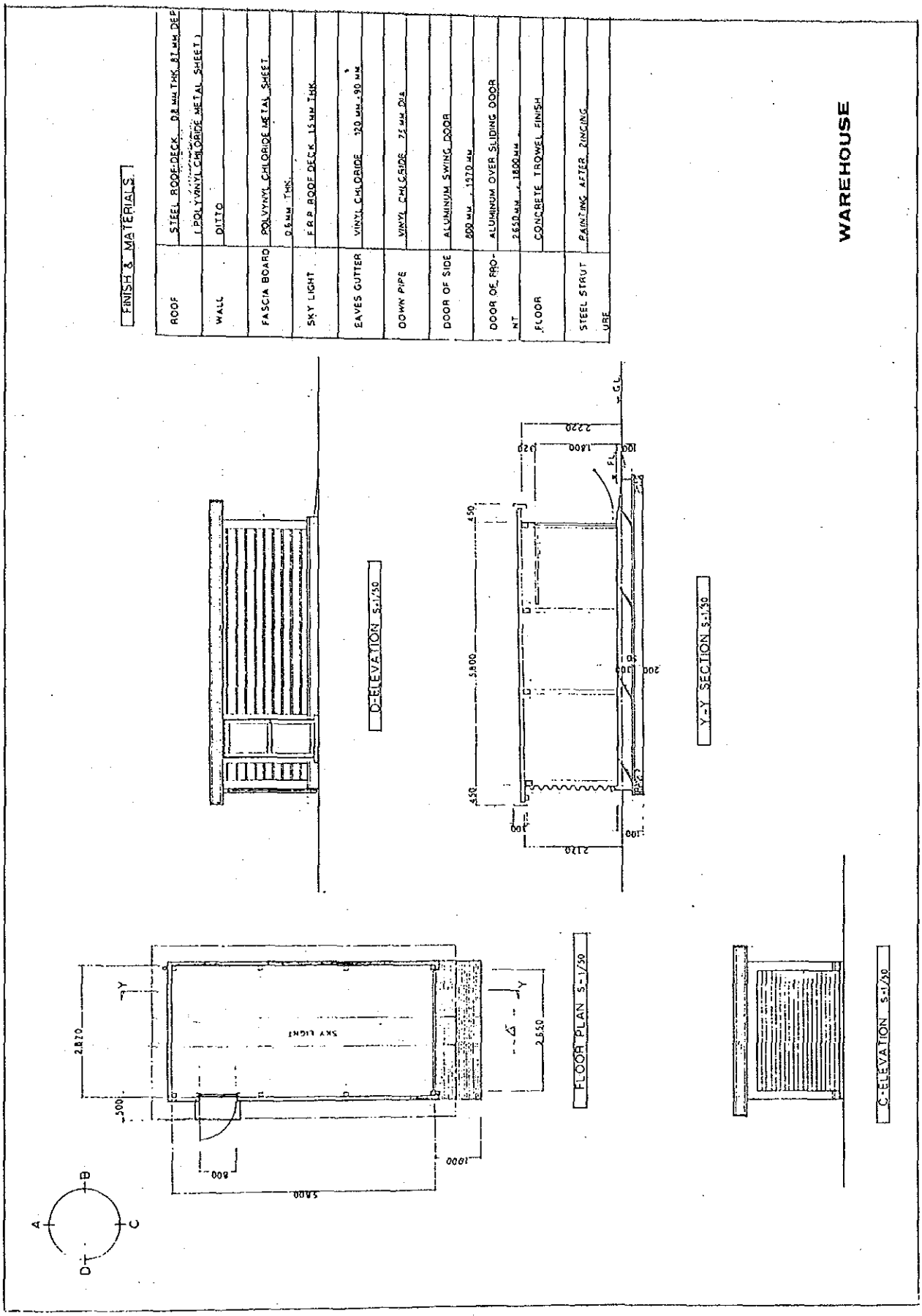


Figure 10: Plan of Warehouse

- Space for repair work 4 m2

TOTAL 15 m^2

b) Specifications

- Outside view

  Flat roof structure, corrugated panel wall.

- Material and structure

  Prefabricated steel warehouse, fabrication of moulded steel structure, roof and wall panels by means of bolts & nuts.

- Doors & openings

  Provided with full-opening front door, windows and emergency doorway.

- Size Length: Approx. 5.8 m
  Width: Approx. 2.6 m
  Height: Approx. 2.2 m

c) Quantity

Prefabricated small-sized warehouses: 4 units

4-5-3 Equipment of various kinds for the extension service offices

(1) Objective

Equipment of various kinds is used for upkeep and performance of the functions of the technical extension offices, and will be alloted to each one of the said offices.

(2) Selection conditions

1) Radio telephone

The radio telephone should be selected by taking into

condition such factors as the distances between the various communicating parties, such as the Fisheries department, extension service boats, etc., the frequency, the type of emission to be used, and other relevant aspects.

2) Motorcycle

The motorcycle should be suited for off-road conditions.

3) Handbearing compass

This compass should be a small-sized one and taking bearings easily.

(3) Specifications and quantities

1) Radio telephone

- Type of radio telephone:
  Single side-band short-wave and medium-wave radio telephone.
- Output: 100W
- Accessories: 1 set
- Quantity: 4 complete sets of the aforementioned equipment

2) Motorcycle

The effectiveness of using motorcycle when supporting the fishing units from the land depends on such factors as the distances between the extension service office and the fishing units object of support, the number of fishing units object of support, and the conditions of the land transportation network.

Of the four extension service ofices planned in this

project, three are located at the vicinity of the fishing units and the use of motorcycle does not bring about so much effects, but in the Malakura Island however, there are three fishing units operated outboard engine fishing boats, and they can be accessed by land traffic routes. Therefore, one motorcycle will be alloted only to the extension service office of the Malakura Island.

- Type of motorcycle: Motocross type (Agriculture type)
- Engine displacement: Approx. 120 cc
- Quantity: 1 unit

4) Handbearing compass

- Type of compass: Hand-bearing compass
- Quantity: 4 units

4-5-4 Fish aggregating device

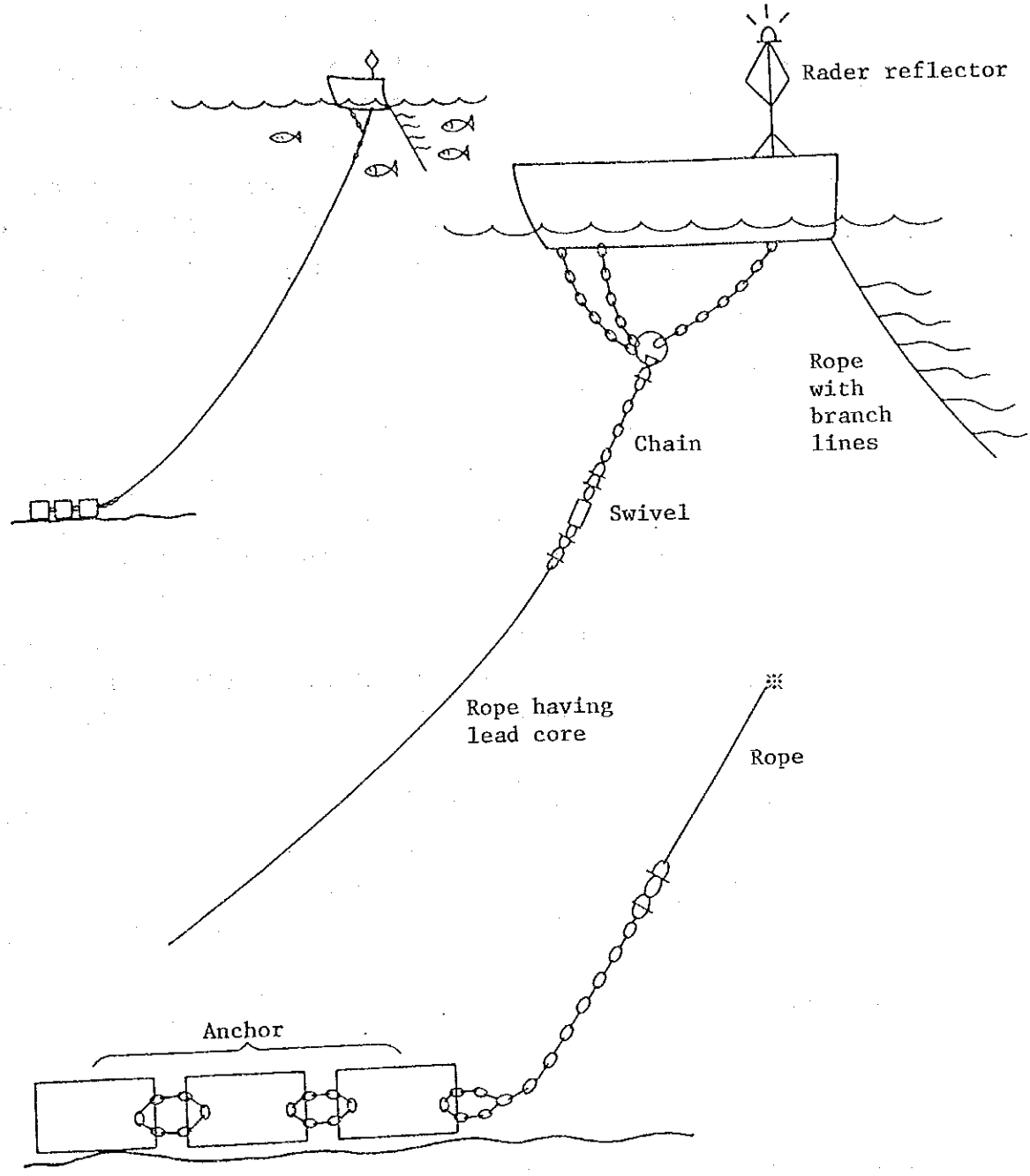
(1) Objective

Fish aggregating devices aim at improving the fishing efficiency of fishermen under the VFDP, by improving the fishing grounds and retaining schools of migrating skipjacks and tuna. The fish aggregating devices will be alloted to the Fisheries department, and the extension service offices will take charge of their maintenance (Figure 11).

(2) Conditions for selection

1) The rafts to be used as fish aggregating devices will be procured in Vanuatu, because they can be constructed in the wooden shipyard of the Espiritu Santo Island.

Figure 11: Composition of Fish Aggregating Device



(3) Selection of the equipment

1) Quantity

Four sets of rafts and mooring apparatuses will be provided, so as to make it possible to install them immediately at the various extension service offices.

Furthremore, a half of the total number of mooring apparatuses will be provided as spare units, because the fish aggregating devices have variable life span of 6 months to 2 years.

2) Specifications and quantity

- Fish aggregating devices
  Rafts to be used for the aggregating devices, ropes with lead-cores, chains, shackles and other mooring apparatuses: 4 complete sets

  It must be borne in mind however, that the rafts to be used for the aggregating devices will be procured in Vanuatu.

- Spare units of ropes with a lead cores, chains, shackles and other components of the fish aggregating device mooring apparatuses:
  2 complete sets

4-5-5 Small-sized repair service boat

(1) Objective

Repair service boat equipped with movable repair functions, and able to carry out the middle-scale repair of fishing boats and outboard engines of the VFDP as well as the repair of refrigeration equipment. This boat will be allocated to the Espirito Santo Branch of the Fisheries Department (Figure 12).

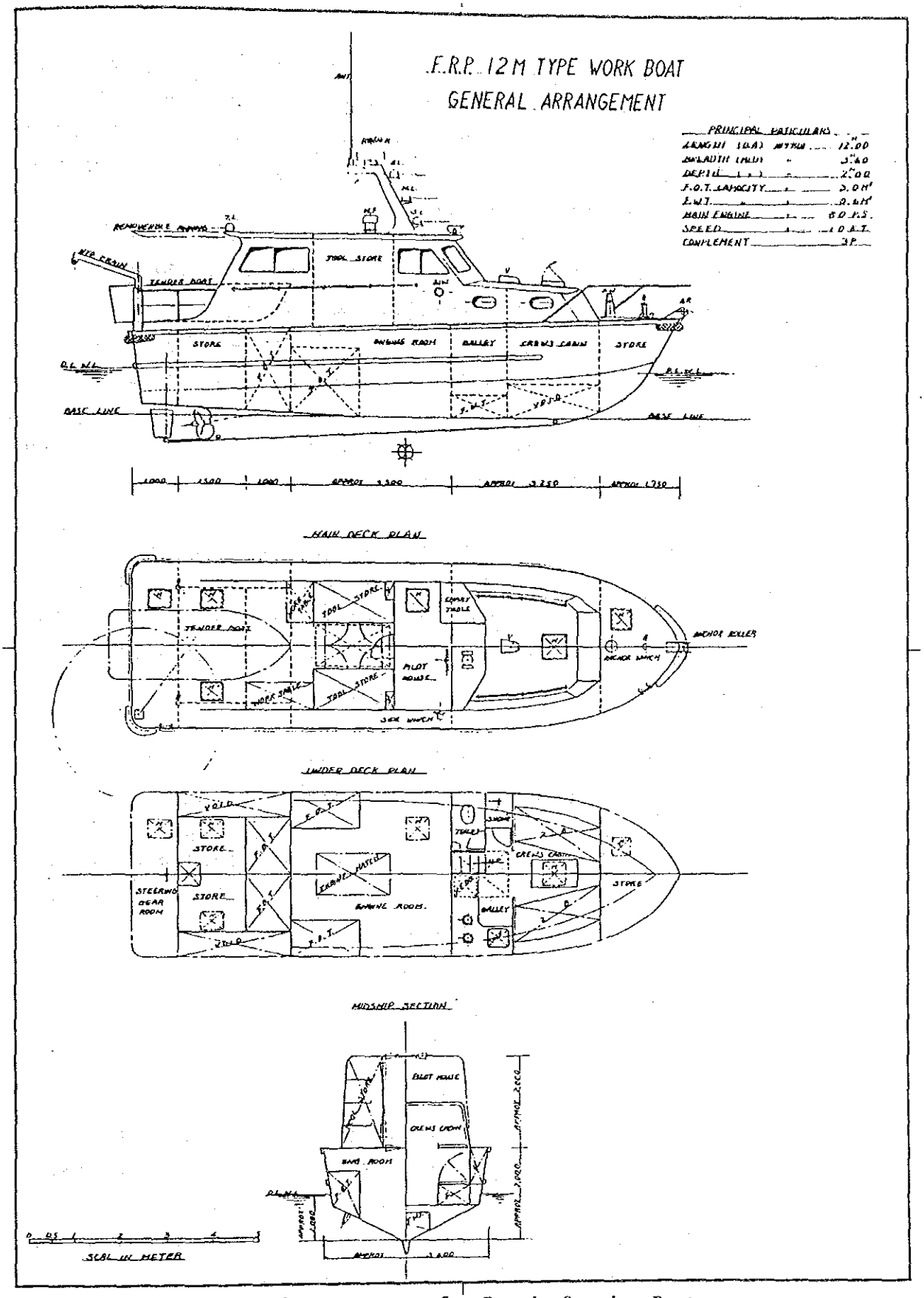


Figure 12: General Arrangement for Repair Service Boat

(2) Design conditions

1) The repair service boat will be based at the Espiritu Santo Branch of the Fisheries Department and will itinerate all fishing units to the north of the Efate Island. Therefore, it must have a minimum endurance of 180 nautical miles.

2) The boat will have four crew in view of the endurance, repair capacity, and other characteristics, and shall be provided with the coresponding accommodation.

3) The repair service boat shall be equipped with tools conforming to the purpose intended.

4) The repair service boat shall be provided with a tender boat to be used as a means of communication between the boat and the land, for landing the repair tools, etc., because few fishing units are provided with landing pier.

5) The service speed will be 10 knots, because the navigational area is enlargement.

6) Glass fiber reinforced plastic, with durability and easy maintenance, should be used for the construction of the small-sized repair service boat.

(3) Basic design

1) Boat length

The repair service boat will have 12 m overall length, which is 2 meters longer compared with the extension service boat, because it requires additional space for loading the tender boat, a small space for executing the repair work, etc.

2) Boat type

The deep-V bottom, similar to the extension service boats, shall be adopted, by taking into consideration the meteorological conditions and sea conditions of the Republic of Vanuatu.

3) Boat breadth

The moulded breadth shall be 3.6 m, with the same length/breadth ratio as the extension service vessels, by taking into consideration the minor repairs on board to be carried out, the stability of the ship, and other relevant factors.

4) Boat depth

The moulded depth of the boat should be 2.0 m, so as to provide the space for providing two stair bunks for the four crew in the living quarters.

5) Design speed

The service speed will be 10 knots, 1 knot more than extension service boats, because the service sea area of 180 nautical miles is large compared with that of the extension service boats and that the longer overall length of the vessel results in smaller propulsion resistance.

6) Main engine output and type

It is decided to adopt main engine with 80 HP output for securing a service speed of 10 knots, in view of the attached design data, because the full-load displacement of the vessel is estimated to mount to approximately 14 tons.

Diesel engine similar to that one of the extension service boat shall be adopted, in view of its economic efficiency.

(4) Specifications

1) Principal particulars

- Length (overall)	Approx.	12.00 m
- Breadth (moulded)	Approx.	3.60 m
- Depth (moulded)	Approx.	2.00 m
- Fuel tank capacity	Aapprox.	3.00 m^3
- Complement		4 persons
- Speed (service speed)		10.0 KT

2) Main engine

- Type
  Four-cycle marine diesel engine
- maximum power: Approx. 80 HP x 2800 RPM max.
- Quantity 1 unit

3) Navigation instruments

- Steering equipment Hand-operated hydraulic steering device		1 set
- Compass: Magnetic compass		1 unit
- Radio telephone Approx. 25JW HF radio telephone		1 set
- Fish finder	Approx. 0 to 2000 m	1 unit
- Radar	Approx. 40 nautical mile marine radar	1 unit

4) Deck equipment

- Anchor winch	Hydraulically-driven	1 unit
- Side winch	Hydraulically-driven	1 unit
- Tender boat 4 m, FRP-made, equipped with 8 HP outboard engine		1 unit
- Crane	Hydraulically-driven	1 unit

5) Repair machinery & tools

- Gas welding set	1 set
- Electric welding set	1 set
- Generator	
Portable diesel engine generator	
1.5 KVA x 220 V	1 unit
- Electric woodworking tools	
Jigsaw, circular saw, planer,	
disk sander, belt sander	1 unit each
- Carpenter's tools	1 set
- Engine repair tools	
Outboard engine repair tools	1 set
Inboard engine repair tools	1 set
- Powered tools: Drill, angle grinder,	
and double-heads grinder	1 unit each
- Freezing machine repair tools	1 set
- Air compressor	
Small-sized air compressor	1 unit

6) Outboard engines for lending:

25 HP & 8 HP	1 set

(5) Quantity

Number of boat:	1 boat

4-5-6 Tools for repair and maintenance

(1) Objective

1) Tools for small-scale repair stations

Tools for small-scale repair of fishing boats of the VFDP, replacement of exterior parts of outboard engines, daily maintenance of ice-making machines, generators, etc., and radio telephones for improving the effectiveness of the supporting services provided by the Fisheries department and the extension service

office should be allocated to the medium-scale fish marketing stations.

2) Tools for middle-scale repair stations

Tools for middle-scale repair of fishing boats, disassembly and assembly of outboard engines and diesel engines and their repair with replacement of parts, and ordinary maintenance wotk, should be alloted to the extension service offices.

3) Tools for large-scale repair stations

Tools for partial replacement of the shell plates of outboard engine boats, overhaul of outboard engines and diesel engines, repair of such parts and components as build-up crankshaft, fuel valve, suction & exhaust valves, etc., should be alloted to the head office and branch office of the Fisheries Department.

(2) Conditions for selection

1) The woodworking tools should be western-type ones.

2) The tools in question should be selected so as to conform to the scale of the fishing boats, outboard engines, diesel engines, freezing equipment and other small-sized equipment most used under the VFDP.

(3) Specifications and quantity

1) Tools for small-scale repair stations

a) Types of tools

- Hand tools for mechanical use:
  Set of hand tools for mechanical use consisting of spanners, screwdrivers, cutting pliers, hammers and like.

- Hand tools for woodworking use:
  Set of hand tools for woodworking use consisting of saws, planes, chisels, woodworking files and rasps, etc.

- Small-sized powered tools:
  Set of small-sized powered tools consisting of portable electric circular saw, electric drill, jigsaw, etc.

- Radio telephone: SSB 100 W 1 set

b) Quantities

- Tools: 9 complete sets of the aforementioned tools

- Radio telephone: 5 complete sets of the aforementioned radio telephone equipment

2) Tools for middle-scale repair stations

a) Types of tools

The tools mentioned in the following should be alloted, in addition to the tools for small-scale repair stations mentioned in 1) above, for the middle-scale repair stations.

- Tools for mechanical use:
  One complete set of special tools for outboard engines.

- Welding equipment:
  One complete set of small-sized gas welding equipment.

  One complete set of small-sized electric

welding machine.
Small-sized diesel engine generator.

b) Quantities
Four complete sets of the aforementioned items.

3) Tools for large-scale repair stations

a) Types of tools
The tools mentioned in the following, in addition to the tools for middle-scale repair stations mentioned in 2) above, should be alloted fo the sake of large-scale repair stations.

- Mechanical tools:
  Set of mechanical tools consisting of general-purpose lathe, lifter, small-sized table-top circular saw, etc.

- Engine repair tools
  One set of press machine for built-up crankshaft of the outboard engine.

- One set of fuel injection valve tester.

b) Quantity
Two complete sets of the aforementioned items.

4-5-7 Pontoon pier

(1) Objective

To be used for loading fuel, fishing gear, equipment, materials, tools repair parts and the like in the small-sized repair service boat. The pontoon pier should be alloted to the Espiritu Santo branch of the Fisheries Department.

(2) Design conditions

1) The pontoon pier should have scale sufficient for the small-sized repair service boat to come alongside, and for loading and unloading the equipment and materials with ease.

2) The material of the pontoon pier should be selected so as to facilitate its maintenance.

(3) Basic design

1) Scale

The length of the pontoon pier should be appropriate for the repair service boat with 12 m in length to use it. Generally speaking, when a boat comes alongside the pier, the pier length should be same or larger than the boat length. Furthermore, the width and depth of the floating pier should be determined by taking into consideration the stability of the pier and the workability on the pier.

In view of the aforestated considerations, it is decided to construct the pontoon pier with 12 m in length, 3 m in breadth and 1 m in depth.

2) Specifications and quantity

Scale of the pier:	12m(L) x 3m(B) x 1m(D)
Material:	Glassfiber reinforced plastic
Mooring equipment & accessories:	1 set
Quantity:	One complete set of the aforementioned items

4-5-8 Truck with crane

(1) Objective

The truck with a crane should be used for transportation of generators and ice-making machines with approximately 400 kg weight used at the medium-scale fish marketing stations and the like, fuel contained in drums used at the fishing units, as well as for cargo handling of the repair service boat and other transportation vessels. The truck should be alloted to the Espiritu Santo branch of the Fisheries department.

(2) Slection conditions

1) The truck with the crane to be selected should have capacity sufficient for hoisting and transporting equipment with approximatey 400 kg weight.

(3) Specifications and quantity

- Size of the crane truck: 2.5 ton truck
- Type and output of the engine:
  Diesel engine, approx. 90 HP
- Crane capacity: Approx. 1.6 t-m
- Quantity: 1 unit

4-5-9 *Equipment for education and training of fishermen of the VFDP*

(1) Objective

Equipment for practical training and audio-visual equipment should be alloted to the head and branch offices of the Fisheries department, so as to carry out an efficient training of fishermen of the VFDP. The objectives of each equipment are described in the following.

1) Outboard engine for the training boats of the Fisheries department.

As things now stand, the Fisheries department is using 5 training boats for training fishermen of the fishing units established anew, but is has plans for replacement the outboard engines because they are timeworn.

2) Portable speedmenters for training boats

These speed meters should be fitted in the training boats for the fishermen to acquire the capability of making the correct visual measurement of the boat speed, which is important in the trolling.

3) Portable echo sounder

These echo sounders should be lent to fishermen of the VFDP, under the control of the technical extension offices, to make the fishermen become familiar with the bottom condition in the fishing ground, so as to improve the fishing efficiency and reducing the damage and wearing of the fishing gear.

4) Audio-visual education aids

Audio-visual education aids such as 16 mm movie projectors, slides, panels, cutting model of outboard engines, etc., should be used for diffusion of knowledge referring to the maintenance and repair of the increasing number of outboard engines under the VFDP, so as to upgrade the operation rate of the said engines.

(2) Conditions for selection

1) The equipment under this project should be selected

in similar scale to those ones being used at the present time under the VFDP, and furthermore they should conform to the scale of the activities being VFDP.

2) The type of outboard engine to be selected should conform to the 5 outboard engine fishing boats being used at the present time by the Fisheries Department for training fishermen of the VFDP.

3) Tow units of porable echo sounders should be allocated to the head office and branch office of the Fisheries Department, respectively, so as to cope with the demand of various fishermen at a time.

(3) Specifications and quantities

1) Outboard engine

- Regular outboard engine
  Output: 25 HP
  Fuel: Mixed gasoline and lubricating oil
  Accessories & spare parts: 1 set
  Quantity: 5 complete sets of the afore-mentioned items
- Emergency outboard engine
  Output: 8 HP
  Fuel: Mixed gasoline and lubricating oil
  Accessories & spare parts: 1 set
  Quantity: 5 complete sets of the afore-mentioned items

2) Portable speed meter for training boats

- Type of speedmeter: Propeller type
- Quantity: 2 units

3) Portable type echo sounder

- Type of echo sounder:
  Portable, two-frequency, dry recording paper applicable type.
- Quantity: Four complete sets of the aforementioned items

4) Audio-visual educational aids

- Slides & movie films: 1 set
  Including movie films referring to structure of outboard engines.
- 16 mm movie projector: 1 set
  Including films referring to operation of outboard engine and small-scale fisheries in overseas countries.
- Other educational aids: 1 set
  Cutting model of outboard engine, panels, manuals, etc.

4-6 Implementation Scheme

4-6-1 Implementation plan

The overall progress schedule of this project is shown in the following chart.

Progress Schedule

Stage of Work \ Month	1	2	3	4	5	6	7	8	9	10	11	12	13
Conclusion of E/N	*												
Detailed Design													
Tender													
Approval of Drawing													
Manufacturing of Equipment													
Sea Transportation													
Installation & Training													
Delivery													*

4-6-2 Matters to be taken charge by the Government of Japan

A Japanese consultant will take charge of the execution design and supervision of the work. A Japanese firm will take charge of the manufacture, procurement, transportation, installation and handing over of the equipment and materials in conformity with the general contracting system and under the control of the said consultant. After the concluding of the Exchange of Notes referring to the grant-in-aid related to this project between the Government of Japan and the Government of Vanuatu, the Consultant will conclude the consultancy contract with the Fisheries Department of the Ministry of Agriculture, Forestry and Fisheries of Vanuatu (executive entity), and will start the preparation of

the execution of design. The said design will take 2.5 months, and the relevant work will be carried out by holding consultations with the Vanuatuan authorities concerned.

After the completion of the execution design, the contractor will be decided through a bid to be carried out by the executive entity. The Consultant will examine the offered price prepared by the awarded bidder. The awarded bidder will conclude the service contract with the executive entity, after confirming the appropriateness of the breakdown of the offer. The execution of the bid will take approximately 1.5 month.

Subsequent to the concluding of the contract between the Government of Vanuatu and the awarded bidder, the manufacture of the equipment will be started after obtaining the verification of the contract by the Government of Japan. Before starting the execution of the contracted services, the contractor should obtain the approval of the working drawings by the consultant, and then it should carry out the procurement and manufacture based on the said drawings. The procurement and manufacture of the equipment in Japan will take approximately 3.5 months. The procured and manufactured equipment will be inspected at the presence of the consultant, and then they will be transported by sea to the Republic of Vanuatu. The sea transportation of the equipment will take approximately 1 month. After arriving at the Republic of Vanuatu, part of the equipment will be handed over to the executive entity, and the other part will be installed at the prescribed sites by the contractor. The contractor should dispatch the personnel required for installation, test operation and operation guidance of the equipment. The consultant should go to the Republic of Vanuatu to attend to the installation and test operation of the equipment, and should confirm that the totality of the equipment have been handed over to the executive entity without any omission. The installation, test operation and operation guidance will take approximatery 3.5 months.

As can be seen, the complete execution of this project will take approximately 12.5 after the conclusion of the Exchange of Notes.

4-6-3 Matters to be taken charge by the Government of Vanuatu

The executive entity of this project is the Fisheries Department of the Ministry of Agriculture, Forestry and Fisheries. Work of practical level related to the implementation of this project will be taken charge by the VFDP Section of the Fisheries Department. In other words, consultations referring to the detailed design of equipment of this project, beforehand preparations of the equipment installation sites, consultations required concurrently with the project implementation and all relevant office work will be carried out by the said section. Furthermore, the said section will take charge of securing and executing the budget required in connection with the works to be borne by the Government of Vanuatu.

Prior to the implementation of this project, the Government of Vanuatu should finish all arrangements related to the site expropriation, land grading, foundation work, supply of electricity, supply of water, drainage, and all other works related to the prefabricated warehouses to be built adjacent to each one of the 4 technical extension offices, prior to the arrival of the relevant materials at the respective sites, for the Japanese firms to promptly start the warehouse erection work.

Also in connection with the ice-making machines to be installed at the 9 medium-scale fish marketing stations, the Government of Vanuatu should finish all the preparations required for their installation before the arrival of the materials at the respective sites.

In connection with the equipment to be delivered to the Port Vila Fisheries, Ltd., the said corporation should

construct the foundations required for installing the equipment in question and finish all required preparation before the arrival of the equipment at the respective sites.

That being so, the Government of Vanuatu should secure the budget required in connection with the aforementioned duties.

4-7 Approximate project cost

4-7-1 Estimation conditions

The approximate cost of this project is estimated on the following conditions.

(1) Epoch of estimation of the approximate project cost
December 1985.

(2) Currency exchange rate ¥200 = US$1 = 101 VATU

4-7-2 Approximate project cost

Cost to be borne by the Government of Vanuatu:
2,300 thousand Japanese Yens

1) Work to be taken charge by the Fisheries Department: Foundations of 4 prefabricated small-sized warehouses: 800 thousands Yen

2) Work to be taken charge by the Port Vila Fisheries Ltd.: Foundation, electric, water supply and other works related to the freezing stores, ice-making machines, etc.: 600 thousands Yen

3) Work to be taken charge by the medium-scale fish marketing station

(Fishing Units specialized in distribution and sales of marine products): Foundation work of ice-making machine sets, etc.:	900 thousands Yen
Total	2,300 thousands Yen

4-8 Administrative and running costs

The additional administrative expenses and running costs required anew as a result of the implementation of this project are listed in the followings.

4-8-1 Espiritu Santo Branch of the Fisheries Department

Annual administrative expenses and running costs:
TOTAL: 2,995,000 VT

(1) Annual expenses for operation of itinerant repair vessel

These expenses are calculated by assuming that the vessel is operated twice a month, totaling 12 days of operation.

1) Fuel cost
   - Fuel
     330 liters x 2 cruises x 12 months x 31 VT = 250,000 VT
   - Lubricating oil
     3% of the fuel price 7,500 VT
2) Maintenance and repair cost
   - Main engine
     3% of the engine price 22,500 VT
   - Other equipment
     Twice the aforementioned sum 45,000 VT
   - Ship body 100,000 VT

3) Tools & materials cost		50,000 VT
	Sub-Total	475,000 VT

Assuming that 60 outboard engines are repaired every year, that the parts replaced for repairing them are sold by topping 10% of their price, and that the annual repair cost of each outboard engine is 5,000 VT, the income brought about by the repair work will account for approximately 1/2 of the operating cost of the vessel. Therefore, measures should be taken so as to include the said income in the budget of the Department of Fisheries, so as to reduce the operating cost of the itinerant repair boat.

(2) Annual personnel expanditure

1) Technical personnel		
- Itinerant repair vessel		
70,000 x 12 months x 2 persons		1,680,000 VT
- Land repair section		
70,000 x 12 months x 1 person		840,000 VT
	Sub-Total	2,520,000 VT

When the itinerant repair vessel is anchored, the 3 technical personnel will take charge of the land repair section.

Assuming that 30 units of inboard and outboard engines will be repaired every year, that 10% of the cost of the parts replaced for repair will be topped on its price, and that the annual repair charge of each inboard/outboard engine will cost 5,000 VT, the repair service will bring about an annual income of aproximately 170,000 VT.

4-8-2 Extension Service Office

Annual administrative and running costs:

- Cost per office	4,307,200 VT
TOTAL COST	17,228,800 VT

(1) Annual expenses for operation of the technical extension vessels

The costs are calculated by assuming monthly 15 days of operation.

1) Fuel cost

- Fuel	
46 liters x 15 days x 12 months x 31 VT	= 240,000 VT
- Lubricating oil	
3% of the fuel price	7,200 VT

2) Maintenance and repair cost

- Main engine	
3% of the engine price	17,000 VT
- Other equipment	
Twice the aforementioned sum	34,000 VT
- Ship body	50,000 VT

3) Other expenses

Cost of fishing gear for test fishing and the like	
10% of the operating cost	35,000 VT
Sub-Total	383,200 VT

The technical extension vessel will have income equivalent to approximately 1/2 of its operating cost as a result of sales of marine products caught through tests of fishing gear and fishing methods and fishing ground survey.

(2) Annual personnel expenditure

1) Fisheries advisor (foreigner)		
3,000,000 x 1 person		3,000,000 VT
2) Technical personnel		
840,000 x 1 person		840,000 VT
3) Temporary deck crew		
84,000 x 1 person		84,000 VT
Sub-Total		3,924,000 VT

The totality of the personnel expenditures of the technical extension office will be covered with aid provided by the EC.

4-8-3 Port Vila Fisheries Ltd. Natai Shop

(1) Running Cost 1,180,000 VT

1) Flake ice machine

- Power cost

  3.7 KW x 2 units x 60% x 24h x 21 days/month x 12 months x 28 VT = 752,000 VT

2) Fish box moulding machine

- Raw materials	70VT x 1000 units	70,000 VT
- Power cost	4KW x 70h x 28VT	8,000 VT
- Fuel cost	3.5L x 70h x 31 VT	7,600 VT
- Maintenance cost: nozzle cleaning and maintenance of valves and pressure box		15,000 VT

3) Lobster preserve

- Power cost 257,500 VT

  1.5kw x 70% x 24h x 365days x 8VT

(2)	Annual personnel expenditures	1,620,000 VT
	1) Technical personnel	
	360,000 VT x 2 persons	720,000 VT
	2) Processing personnel	
	180,000 VT x 5 persons	900,000 VT
		2,800,100 VT

4-8-4 Port Vila Fisheries Ltd., Santo Fish Shop

(1)	Annual running cost	560,000 VT
	1) Freezing store	
	- Power cost	
	5.5KW x 40% x 24h x 365 days x 28VT	540,000 VT
	- Maintenance cost: refrigerating machine oil and ordinary maintenance costs	20,000 VT
(2)	Annual personnel expenditures	240,000 VT
	1) Technical personnel	
	240,000 VT x 1 person	240,000 VT
	Total	800,000 VT

Facilities for storage, collection of cargo, sales and processing to be introduced under this project are only part of the facilities under the control of the Port Vila Fisheries Ltd. Nevertheless, the arrival of commodities is expected to increase as a result of the smooth operation of the fishery units (39 units) and small- and medium-scale fish marketing stations to be established under the auspices of this project.

Port Vila Fisheries Ltd. will make and additional predepreciation profit mounting to 42,283 VT for every ton of

additional marine products arriving anew as a consequence of the implementation of this project. By the way, Port Vila Fisheries Ltd. is expected to handle an annual quantity of 230 tons of fresh fish under this project. In reality it is difficult to make an accurate estimation of the contribution of this project in terms of profitability of the Port Vila Fisheries Ltd. as a whole, because the project itself is part of the company business, but anyway, the additional assets and running costs resulting from the implementation of this project can be depreciated by handling an additional quantity of marine products mounting to approximately 20 tons.

5. PROJECT EVALUATION

The undermentioned effects are expected as a result of the implementation of this Project.

(1) Expansion of new Fishing Units

This project comprises equipment for establishing 39 new Fishing Units. Immediate increase of approximately 100 tonnes in the output of marine products is expected as a direct result of the smooth operation of these equipment. On the other hand, securing stable marketing route for fishermen of the existing Fishing Units by equipping small- and middle-sized Fish Marketing Stations will help motivate the fishermen, increasing as a consequence the output of marine products. The said indirect increase in the output of marine products is expected to a mount to approximately 100 tonnes/year, and therefore the implementation of this project is presumed to bring about direct and indirect increase in the output of marine products mounting to approximately 200 tonnes/year. (The total output of marine products under the auspices of the VFDP in 1984 mounted to approximately 100 tonnes). Furthermore, the annual number of fishermen engaging in the fishing activities work as a result of the implementation of this Project is estimated to mount to approximately 20,000 man days.

(2) Improvement of the distribution and sales of marine products

If equipment of the various fields to be provided under this project is used in the most effective way it will be possible to deliver annual quantities of fresh fish mounting to approximately 230 tonnes to the Port Vila Fisheries Ltd. In addition to the said direct effect, securing sales routes for the marine products will

motivate the fishermen, making therefore indirect contributions to expanding the production, as mentioned before. Furthermore, the increasing supply of marine products to the urban areas of the country would help to reduce the imports of canned fish that mount to 800 tonnes per year, resulting therefore in saving precious foreign currency. Besides, the expansion of small-scale export of marine products will be a positive means for earning foreign currency, with considerable impact on the economy of the Republic of Vanuatu.

(3) Strengthening of the supporting system of the Fisheries Department

Direct effects to be brought about in the support system of the Fisheries Department by equipment supply under this Project can not be determined in quantitative terms, but anyway, it is unquestionable that there will be substantial improvements to the future development of the VFDP in terms of development of human resources and other relevant aspects. On the other hand, improvements in the repair section and supply services will make direct contributions to reducing the down rate due to equipment trouble, reducing loss of working days by repair, etc. contributing therefore to the economical operation of the VFDP.

(4) Demonstration effects of this project

Equipment for establishing Fishing Units, small- and middle-scale Fish Marketing Stations, etc., under this Project will be sold to the local fishermen with 50%-subsidy from the Vanuatu Government Financial resources for subsidizing the next group of applicants for the programme would be secured through an effective operation of the 50% of the establishment fund borne by the fishermen. Therefore, it would be possible to secure twice as much equipment at those provided at the beginning

under this Project, by operating the said fund 7 or 8 times. Furthermore, the effects of this Project is expected to last longer because fishing gear and the like to be provided under its auspices will be sold to the existing fishermen at the purchasing price.

As can be seen, this Project can be rated high, because the effects of the equipment to be provided under its auspices will exert long-lasting effects, instead of being a single-shot cooperation to the VFDP.

(5) Qualitative change of VFDP

It has to be emphasized that the Project is not just a simple cooperation for the part of VFDP in 1987. Because the Project is a stepboard for the change of a scope of VFDP from an increase of quantity of VFDP (increase of numbers of Fishing Units) to improve of quality for the total operation of VFDP.

It can be expected that cooperation effects in this manner as greater than the cooperation for simple increase of the Project scale, considering the effects and benefits of the Project can be extended up to the existing Units of VFDP. In other words, if the improvement of such function as fish marketing system, supporting services are not attained at the moment, the effects of expansion of Fishing Units having been done so far, will be reduced due to the drop out of existing Fishing Units which will not effectively obtain the necessary such services extended by outside of Units as fish marketing services and governmental supporting services.

6. CONCLUSION AND RECOMMENDATIONS

The village Fisheries Equipment Improvement Project of the Republic of Vanuatu is expected to bring about the effects and benefits mentioned in the project evaluation. The equipment and materials required for accomplishing the 3 objectives proposed within the context of this project, 1. establishment of new Fishing Units, 2. improvement of the distribution and sales of marine products, and 3. strengthening of the support system of the Fisheries Department are expected to be used in an effective way, based on the 4-year experience of the VFDP, and with mutual interaction of the objectives. The VFDP, which this project cooperates with, is not only the key programme in the fishery sector of the Republic of Vanuatu, but it is also very important from the socio-economic standpoint, because it will contribute to narrow the economic gap between the urban and rural areas of the country, to reduce the hard currency outflow, to earn foreign currency, and to develop human resources. Therefore, the Project is closely related to the future development of the VFDP as a whole, and under the circumstances it is concluded that the grant-in-aid to be provided by the Government of Japan to this project is extremely significant.

In particular, the following recommendations are made for the sake of smooth implementation of this project.

(1) This project proposes the recruitment of personnel required for strengthening the support system of the Fisheries Department. The number of Vanuatuan manpower required anew in this connection mounts to 7 persons, and financial resources to cope with 4 of them have already been secured. That being so, to take the applicable measures for the remaining 3 persons as well, so as to secure the required personnel by the time of implementation of this project is strongly proposed. As for the foreign technical experts expected to come to Vanuatu, arrangements should be made so as to secure their

participation in the respective duties at the time of implementation of this project.

(2) In connection with the vessels to be provided under the auspices of this project (itinerant repair vessel and technical extension vessel), budgetary measures should be taken so as to secure sufficient financial resources for their operation, and furthermore other applicable measures should be taken in advance so as to secure the effective execution of the support activities related to the VFDP, by the vessels in question. Furthermore, if there is possibility of making use of the income obtained within the scope of the support activities for the sake of reducing the running cost of these vessels, as mentioned in the section referring to the administrative and operation costs, the measures required in this connection should be taken accordingly.

(3) The required budget mentioned in 4-6-3 should be secured, and the applicable measures should be taken in advance, so as to make it possible to execute the construction of the foundations and all other duties to be taken charge by the Government of Vanuatu without obstruction the smooth progress of this project.

(4) This project proposes an important switchover in the VFDP, as mentioned in the previous chapter referring to the project evaluation. It is unquestionable that the development policy adopted so far by the VFDP, consisting of the quantitative expansion of the production sector (establishment of many Fishing Units), succeeded in implanting an idea that fishery is a promising business among the farmers of the country, and the program has been particularly significant in this connection. As things now stand however, activities related to the distribution sector and strengthening of the support system are lagging behind, and as a matter of fact many of the Fishing Units composing the production sectors are isolated and far away

from the said logistical lines.

In this connection, it will be necessary to promote VFDP ballancing between quantitative expansion and qualitative improvement, namely, expansion of the number of Fishing Units and Improvement of Fish Marketing system and Government Supporting services.

(5) The implementation of VFDP so far is characterized as the bottom up plan respecting the will of local participants. This type of execution manner of project certainly provides incentive for local people and helps their autonomous growth of the Fishing Units. The some problems are caused on the otherhand. The bottom up Project will not always lead well ballanced Project as a whole, mentioned above section 4. Accordingly the total operation of the Project results uneffective way.

Therefore, the well ballanced combination of top down type approach (project guided by the Government) with bottom up one will be necessary for the future development of VFDP. Bottom up approach for the selection of sites for Fishing Units. Top down approach for the selection of sites for Fish Marketing Stations.

In addition, even if the bottom up approach is taken for the selection of the sites for Fishing units, Fisheries Department has to fully examine the economical operation of the Units after the establishment of the Units. As mentioned in Financial Evaluation, if the Fishing Units are located at the area having no such fish marketing facilities as Small- or Medium-Fish Marketing Station, it is difficult to operate in economical way. In this context, it is strongly recommended that the site for Fishing Unit has to be selected taking into consideration the following criteria. "The Fishing Units can use facilities related to fish market and market its products to urban market".

APPENDIX

APPENDIX

MENBER OF THE SURVEY TEAM

Duty	Name and Agency
Team Leader	Dr.Keiji Nasu Research Counsellor, Resources Division, Research Department, Fisheries Agency of the Ministry of Agriculture, Forestry and Fisheries.
Project Coordinator	Miss Nobuko Kayashima Grant Aid Planning and Survey Department, Japan International Cooperation Agency (JICA)
Fisheries Expert	Mr. Takashi Yamamoto Overseas Agrofisheries Consultants, Co.,Ltd.
Equipment and Material Expert	Mr. Kenji Okamura Overseas Agrofisheries Consultants, Co.,Ltd.
Fishing Boat Expert	Mr. Takashi Yamamoto Overseas Agrofisheries Consultants, Co.,Ltd.

LIST OF INTERVIEWED PERSONS

Ministry of Agricluture, Forestry and Fisheries

Name	Position held
Mr. Iolu J. Abbill	1st Secretary.
Mr. Richard Kaltongga	Director, Fisheries Dept.
Mr. Wycliff Bakeo	Principal Officer in Snato Branch Office.
Mr. Richard Stevens	Manager, Village Fisheries Development Program.
Mr. Chris S. Bowley	Fisheries Advisor.
Mr. Simeon Mahit	Fishing Gear Shop Officer
Mr. Rave Robin Nihaki	Officer, Fisheries Dept.

Persons related to the VFDP

Mr. Kent Ollis	Foreign Volunteer, VFDP.
Mr. L. John Dyson	Boat yard Manager Advisor.
Mr. Petro Rite	Manager, Association in Remre.
Mr. Willie Was	Fishermen, VFDP.

Port Vila Fisheries Ltd.

Mr. John N. Nicholson	Manager, Natai Shop.
Mr. John Lee	Manager, Santofish Shop.
Mr. Harris Takaw	Whole Sales Manager, Natai Shop.

National PLanning and Statistics Office

Mr. Augustine Garae	Director.
Mr. Jean Pierre Nirua	Desk Officer.
Mr. Verna Outland	Aid Coordinator.
Mr. Rick Woodham	Senior Planning Officer.

Ministry of Foreign Affaires and External Trade

Mr. Nikenike Vurobarauu	Secretary.
Mr. F. Kalotiti	Senior Officer, Bilateral Aid.
Mr. John Jeanjack Sablan	Protocol desk.

Vanua Navigation Ltd.

Mr. Geoffrey J. Clark	General Manager.

SURVEY SCHEDULE

No. of day	Date & Day of week	Location and trip	Survey contents
1	25th of sep. Wed.	Tokyo ---	Trip(Overnight trip in airplane)
2	26th Thu.	-Noumea--Port vila	Discussions with authorities of the Fisheries Department, Ministry of Agriculture, Forestry and Fisheries.
3	27th Fri.	Port Vila	Courtesy call to the Ministry of Agriculture, Forestry and Fisheries, National Planning and Statistics Office and Ministry of Foreign Affairs and External Trade. Survey the fish market.
4	28th Sat.	Port Vila --- Emoa --Port Vila	Survey a site under the Village Fisheries Development Program.
5	29th Sun	Port Vila ---- ---Luganville	Site survey and data collection.
6	30th Mon.	Luganville	Visit to the branch office of the Fisheries Department and survey a fish market and boat building yard.
7	1st of Oct. Tue	Luganville -- Port Orly -- Hog Harbour -- -- Luganville	Survey sites under the Village Fisheries Development Program.
8	2nd Wed.	Luganville -- -- Port Vila	Survey a fishing gear selling shop and discussions with authorities of the Fisheries Department.

SURVEY SCHEDULE (to be continued)

No. of day	Date & Day of week	Location and trip	Survey contents
9	3rd Tue.	Port Vila	Discussions with authorities of the Fisheries Department.
10	4th Fri.	Port Vila	Discussions with authorities of the Fisheries Department.
11	5th Sat.	Port Vila	Discussions with authorities of the Fisheries Department.
12	6th Sun.	Port Vila	Data collection and sorting.
13	7th Mon.	Port Vila	Signature of the minutes od discussions at the Ministry of Agriculture, Forestry and Fisheries.
14	8th Tue.	Port Vila	Discussions with authorities of the Fisheries Department.
	(Schedule of Officers)		
14	8th Tue.	Port Vila --- Nandi	Team Leader Dr. Keiji Nasu and Miss Nobuko Kayashima Leave from Vanuatu.
15	9th Wed.	Nandi -- Suva	Reporting to the Japanese Embassy and JICA Office.
16	10th Thu.	Suva -- Nandi -- ------ Sidney	Trip.
17	11th Fri.	Sidney ----	Trip. (Overnight trip in airplsne)
18	12th Sat.	-----Tokyo	Return to Japan.

SURVEY SCHEDULE (to be continued)

No. of day	Date & Day of week	Location and trip	Survey contents
	(Survey schedule of consultants)		
15	9th of Oct. Wed.	Port Vila	Discussions with authorities of the Fisheries Department.
16	10th Thu.	Port Vila	Discussions with authorities of the Fisheries Department.
17	11th Fri.	Port Vila	Discussions with authorities of the Fisheries Department, National Planning and Statistics Office and Staff of the Natai Shop and survey.
18	12th Sat.	Port Vila	Data sorting and observation of the exhibition of the Ministry of Agriculture, Forestry and Fisheries.
19	13th San.	Port Vila	Data sorting and consaltations. the Fisheries Department.
20	14th Mon.	Port Vila	Discussions with authorities of the Fisheries Department.
21	15th Tue.	Port Vila -- --- Nandi	Leave-taking visit to the Fisheries Department, Natai Shop, Ministry of Agriculture, Forestry and Fisheries and overnight trip in airplane.
22	16th Wed.	Tokyo	Return to Japan.

MINUTES OF DISCUSSIONS

ON

THE VILLAGE FISHERIES EQUIPMENT IMPROVEMENT PROJECT

IN

THE REPUBLIC OF VANUATU

In response to the request made by the Government of the Republic of Vanuatu for the Village Fisheries Equipment Improvement Project (hereinafter referred to as "the Project"), the Government of Japan decided to conduct a Basic Design Study and the Japan International Cooperation Agency (hereinafter referred to as "JICA") has sent to Vanuatu the team headed by Dr. Keiji Nasu, Research Counsellor, Resources Division, Research Department, the Fisheries Agency, from September 25th to October 16th, 1985.

The Team has carried out a field survey, held a series of discussions and exchanged views with the authorities concerned of the Government of Vanuatu.

As a result of the study and discussions, both parties have agreed to recommend to their respective Governments to examine the results of the study attached herewith towards the realization of the Project.

Port Vila, October 7th, 1985

Keiji Nasu

Keiji Nasu
Team Leader
Japanese Study Team
JICA

Mr. Iolu Abbil
First Secretary
Ministry of Agriculture,
Forestry & Fisheries

ATTACHMENTS

1. The title of the Grant Aid Project is "the Village Fisheries Equipment Improvement Project".

2. The objective of the Project is the Improvement of the local fisheries in Vanuatu in order to develop the production capacity of fresh fish sufficient for local demand and to generate employment and income in the rural areas by providing the necessary infrastructure.

3. Fisheries Department of the Ministry of Agriculture, Forestry and Fisheries is the executing authority of the Project and will be responsible for the control of the equipment purchased under the Japanese grant aid.

4. The Japanese Study Team will convey to the Government of Japan the desire of the Government of Vanuatu that the former takes necessary measures to cooperate in implementing the Project and provides necessary equipment as listed in Annex 1 within the scope of Japanese economic cooperation in grant form.

5. The Government of Vanuatu has understood Japanese Grant Aid system explained by the Team which includes a principle of use of a Japanese consultant firm and a Japanese general contractor for implementation of the Project.

6. The Government of Vanuatu will take necessary measures as listed in Annex 2 on condition that Grant Assistant by the Government of Japan is extended to the Project

7. The final report in English on the Project will be submitted to the Government of the Republic of Vanuatu by the end of January, 1986.

K. K.

Annex-1.

Items required in order of priority by the Government of Vanuatu whose cost will be borne by the Government of Japan.

1. Equipment for fish preservation processing, distribution and retail sales.

2. Fishing gear.

3. Tools.

4. Boats, propulsion engines and marine equipment.

5. Vehicles.

K.N.

Annex-2.

Following arrangements will be required to be taken by the Government of Vanuatu.

1. To carry out site preparation such as clearing, filling and levelling of installation works.

2. To arrange the appropriate buildings with, if necessary, facilities for distribution of electricity, water supply, drainage and other incidental facilities before commencement of installation works.

3. To ensure prompt unloadings, tax exemption, customs clearance at ports of disembarkation in Vanuatu and prompt internal transportation therein of the products purchased under the grant.

4. To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Vanuatu with respect to the supply of the products and services under the verified contracts.

5. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into Vanuatu and stay therein for the performance of their work.

6. To maintain and use properly and effectively the equipment purchased under the grant.

7. When the products, purchased by the grant from the Government of Japan, are sold and leased to the units of the Project, the Government of Vanuatu shall take necessary measures to ensure the following:-

(1) To deposit the amount to be obtained by such sale or lease

K.M.

.../.2

in a suitable account of the Government of Vanuatu as a counter-part fund.

(2) To utilize the above-mentioned counter-part fund for purpose of fishery development and maintenance of the equipment purchased by the Government of Japan.

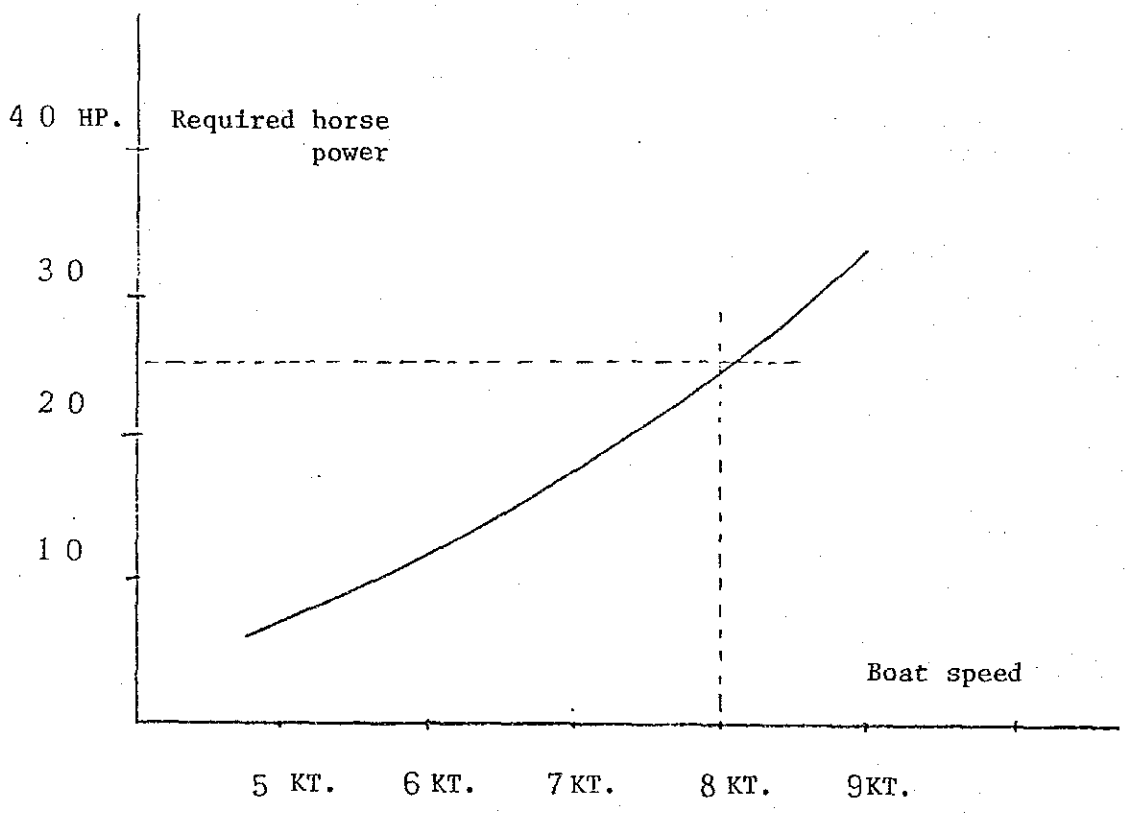
(3) To report to the Government of Japan upon the use of fund.

K.K.

7 M class

Inboard diesel engine fishing boat

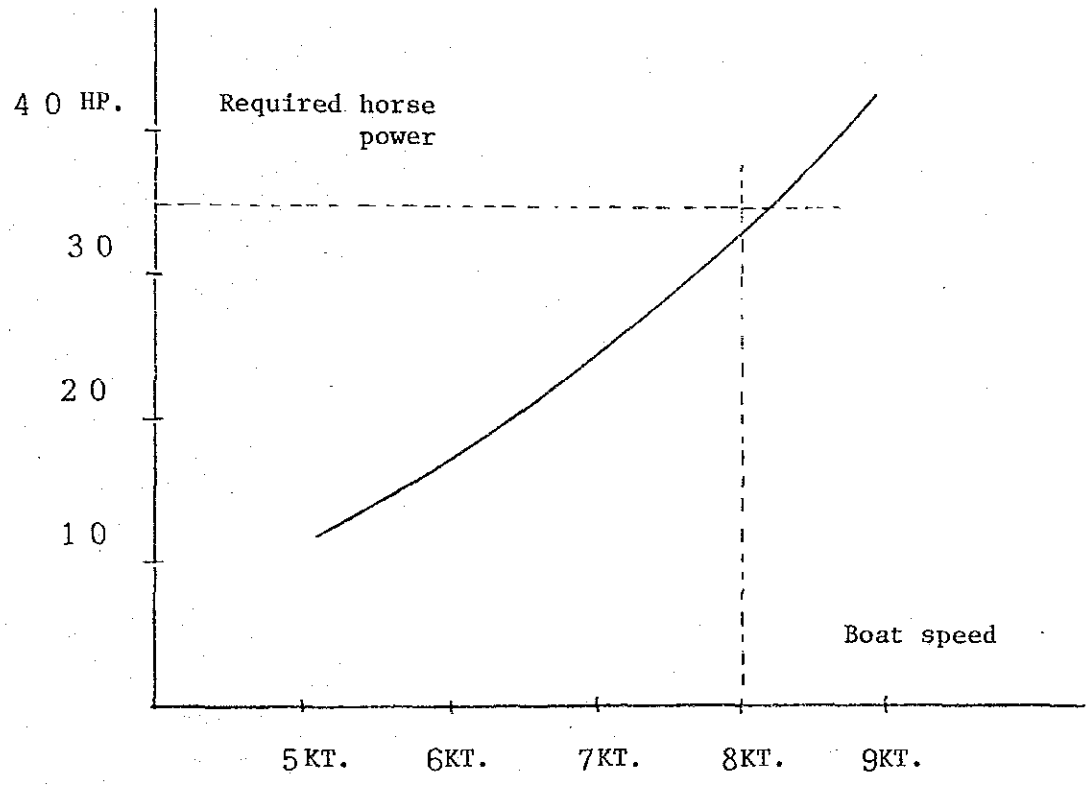
Speed - Output Curve



10 M class

Inboard diesel engine fishing boat

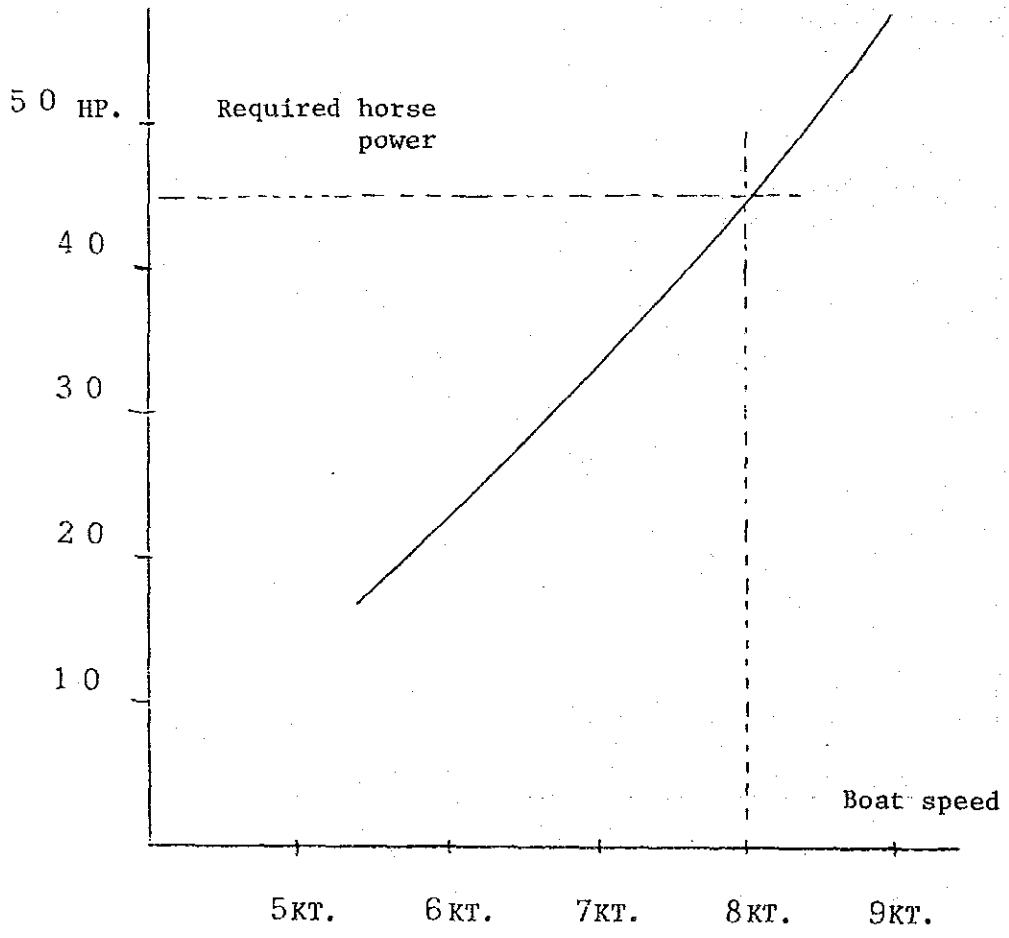
Speed - Output Curve

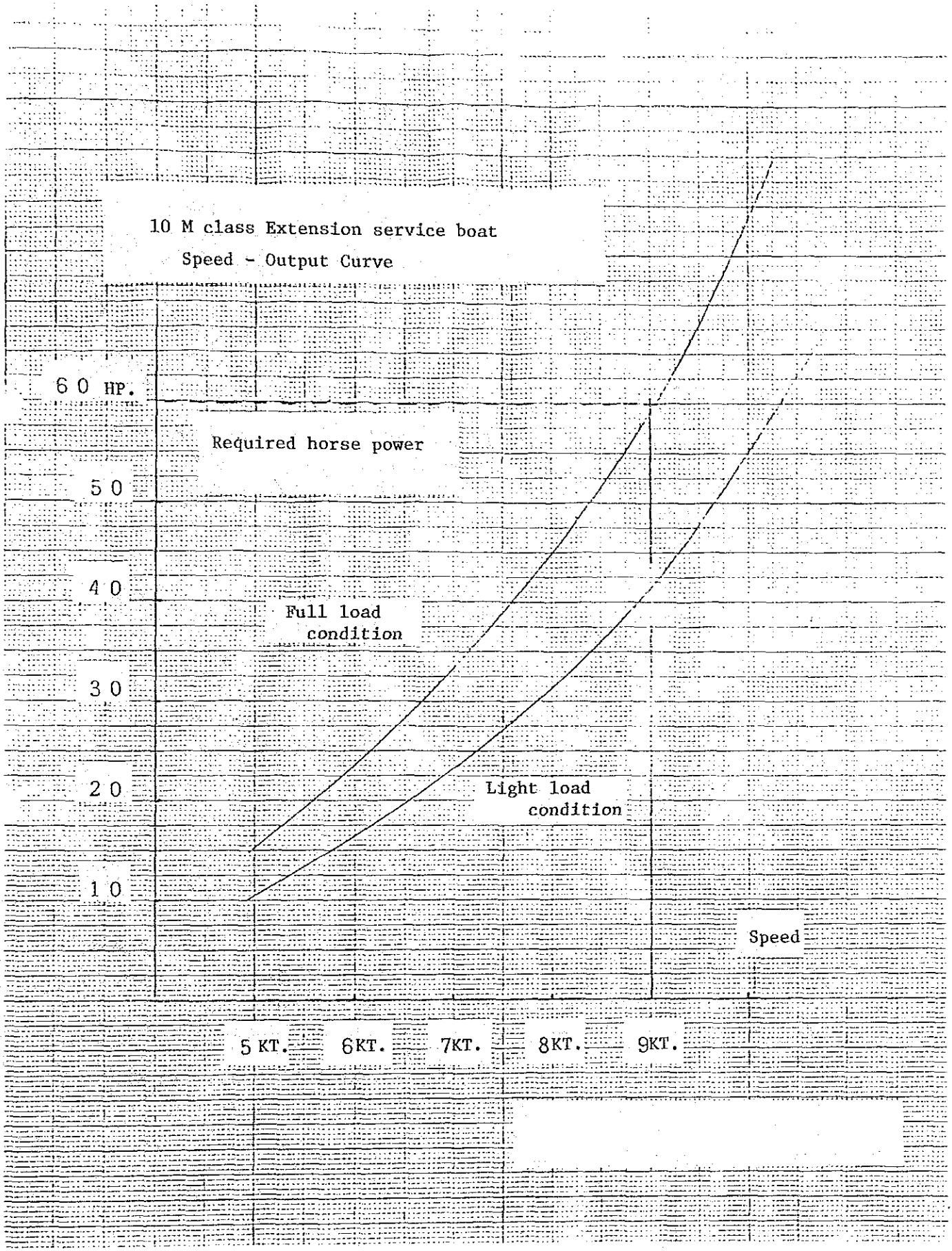


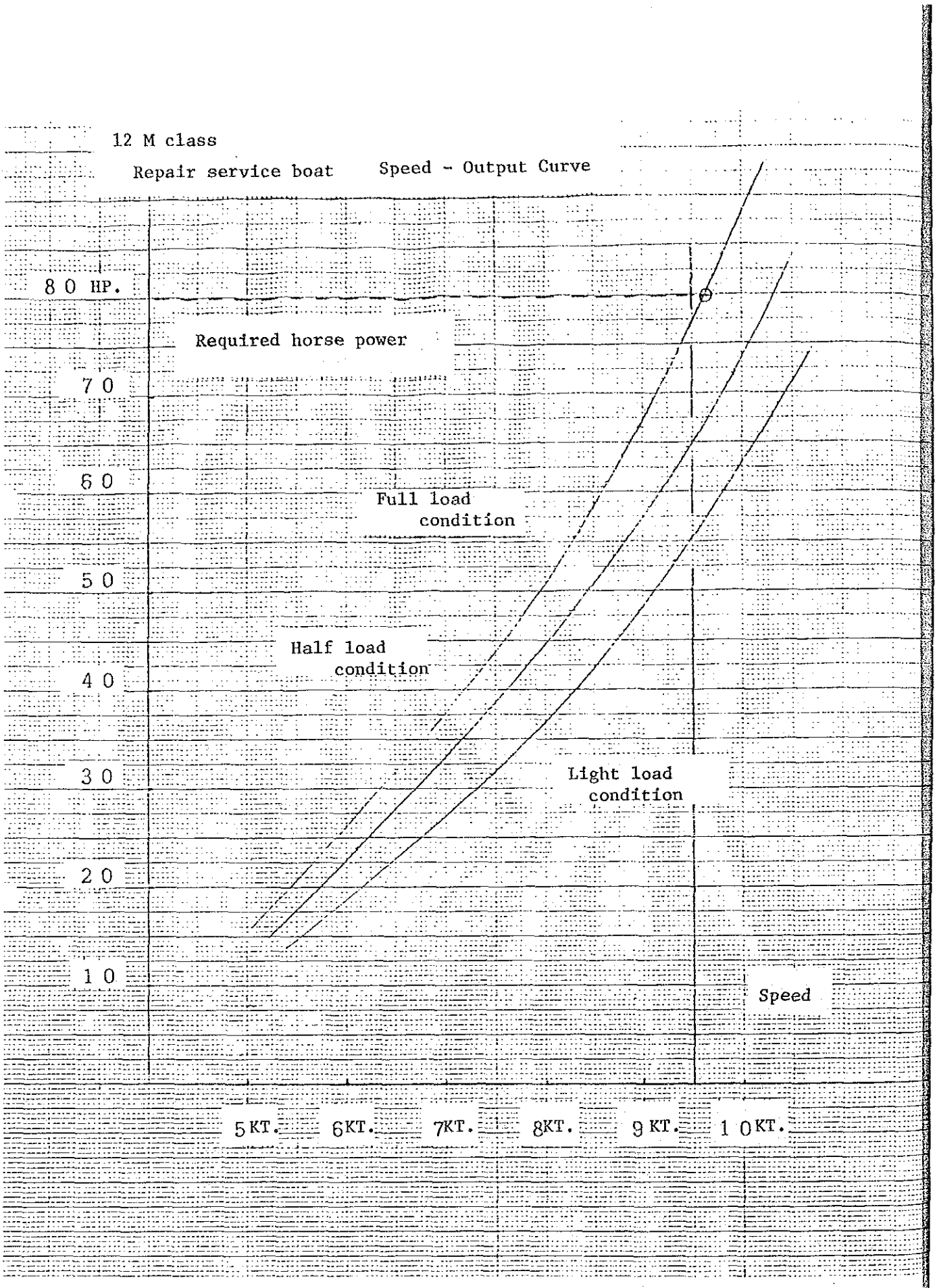
12 M class

Inboard diesel engine fishing boat

Speed - Output Curve




10 M class Extension service boat
Speed - Output Curve
60 HP.
Required horse power
50
40
Full load
condition
30
20
Light load
condition
10
Speed
5 KT.
6KT.
7KT.
8KT.
9KT.


12 M class
Repair service boat
Speed - Output Curve
80 HP.
70
60
50
40
30
20
10
Required horse power
Full load condition
Half load condition
Light load condition
Speed
5KT.
6KT.
7KT.
8KT.
9KT.
10KT.

FISH PRICE

Port Vila Fisheries Ltd, Natai Shop, as of October 1985.

No.	Name of Marine Product	Price VT /Kg
1.	Red snapper	480 VT
2.	Skipjack and Tuna	300 VT
3.	Mangrove crab	840 VT
4.	Crab	350 VT
5.	Oyster	650 VT
6.	Mussel	2,400 VT
7.	Boiled and peeled shrimp	1,200 VT
8.	Dorado (fillet)	580 - 680 VT
9.	Cocoonut crab	700 VT
10.	Squid leg only	450 VT
11.	Fresh water prown	800 VT
12.	Red snapper (fillet)	680 VT
13.	Shark (fillet)	300 VT
14.	Smoked fish (eel)	650 VT
15.	Smoked fish (others)	550 VT
16.	Lobster	840 VT
17.	Slipper lobster	650 VT
18.	Red snapper	290 VT
19.	Sea bass	290 VT
20.	Groupers	290 VT
21.	Skipjack (round)	250 VT
22.	Miscellaneous demersal fishes (sized under 25 cm)	250 VT
23.	Fish head	100 VT
24.	Wahoo	290 VT
25.	Spine venomous fish	260 - 280 VT
26.	Rainbow runner	250 VT
27.	Amberjack	250 VT
28.	Yellowfish	250 VT
29.	Horse mackerel	250 VT
30.	Parrot fish	230 VT
31.	Mackerel	220 - 260 VT
32.	Sardine	200 VT
33.	Black marlin	480 VT
34.	Sail-fish	480 VT
35.	Swordfish	480 VT

PRICES OF ORDINARY COMMODITIES (AS OF OCTOBER 1985)

Supermarket (Port Vila)

1.	Oange	35 VT/unit
2.	Pineapple juice (produce of Australia)	55 VT/425 ml
3.	Canned sardine (produce of Morocco)	55 VT/90 g
4.	Fresh bread	20 VT/pc

Grocery store (Espiritu Santo Island)

1.	Cigarette	170 VT/pack
2.	Fresh bread	15 VT/pc
3.	Canned tomato sardine	40 VT/12 g

Popular restaurant (Espiritu Santo Island)

1.	canned beer (made in Australia)	130 VT/can
	(made in Holland)	150 VT/can
2.	Orange juice (canned	100 VT/can
3.	Coca-cola (canned	100 VT/can
4.	Steak teps 1 dish	300 VT
5.	Fried noodles with beef 1 dish	350 VT
6.	Fried rice with port and egg 1 dish	400 VT
7.	Coffee	170 VT/cup
8.	Egg	179 VT/unit
9.	Chicken & egg soup 1 dish	300 VT
10.	Egg soup 1 dish	150 VT
11.	Curry rice with beef 1 dish	170 VT

FINANCIAL EVALUATION

This section carries out the financial evaluation of the equipment for small- and middle-scale fish marketin stations, and examines the possibility of reimbursement of loans and depreciation.

1. Block ice machine set

(1) Quantity of fresh fish handled at the Maskelynes area fish marketing station

The maskelynes fish marketing station is used only by opne outboard engine fishing boat and having a handling record of only 282 kg of marine products as of 1984. Both of these figures are smallest among medium-scale fish marketing stations under this project examination is in the following.

This base is selling fresh fishes to the Port Vila Fisheries Ltd., because it has access to a nearby airport. The demand growth will double the number of working days of the outboard engine fishing boat, and after the establishment of the station the annual output of marine products of the VFDP outboard engine fishing boat is expected to grow to the value calculated in the following.

30kg*1 x 7 days/month*2 x 2*3 x 12 months = 5,040kg

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*1 Average daily catch of outboard fishing boats under the VFDP.

*2 Average number of monthly working days of outboard engine fishing boats under the VFDP.

*3 Increase rate of outboard engine fishing boat working days.

(2) Income and expenditure of the block ice machine Figure 1 shows the annual output of marine products in the abscissa and the amount of money in the ordinate. Of the two inclined lines with gentle slope, the upper one shows the total jamount of the expenditures, and the inclined line with steep slope shows the turnover, the hatched portion comprehended between the two lines shows the profit before depreciation. The output of 5,967 kg/year of marine products shows the limit which allows the reimbursement of the loan used for purchasing the ice-making machine.

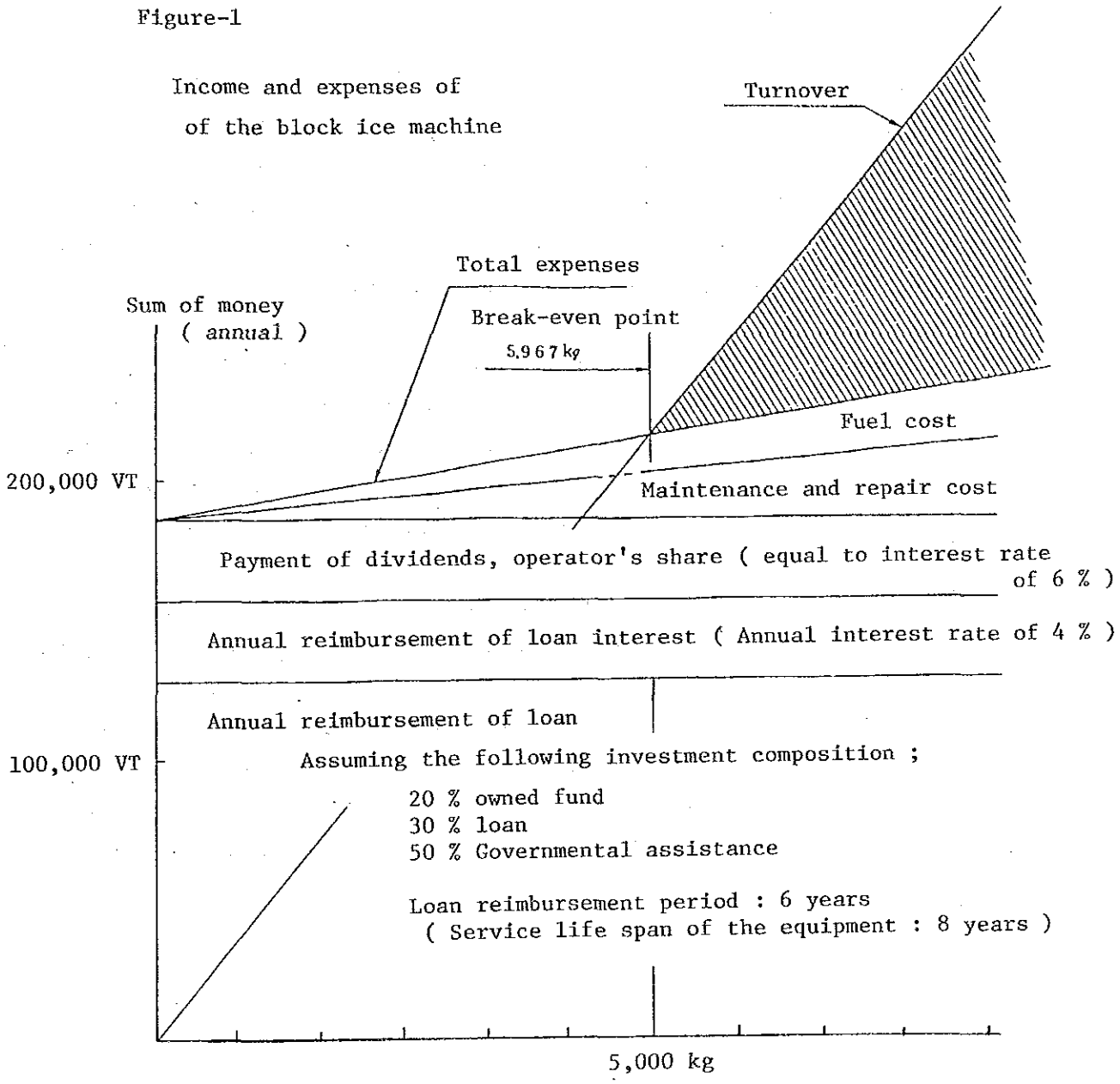
(3) Evaluation

In this case it is rather difficult to reimburse the loan even when the catch of canoes of the VFDP operating in the area in question is taken into consideration, because it mounts to barely 659 kg/year, and the output of marine products of 1 outboard engine fishing boat of the VFDP is 5,040 kg/year. However, it is expected that the VFDP outboard engine fishing boat will increase in number, because Maskelynes area is good fishing ground for lobsters.

Therefore, it is desirable that the Fisheries Department take generous measures for rearing the Maskelynes fish marketing station, such as the application of the 1-year lending system of the ice-making machine set, the establishment of new fishing units in the area in question, etc.

As for the other medium-scale fish marketing stations, they are perfectly able to reimburse the loan for purchasing the ice-making machine, and furthermore they are in conditions of depreciating part or all of the equipment as well.

Figure-1


Income and expenses of
of the block ice machine
Turnover
Total expenses
Sum of money
(annual)
Break-even point
5,967 kg
Fuel cost
200,000 VT
Maintenance and repair cost
Payment of dividends, operator's share (equal to interest rate of 6 %)
Annual reimbursement of loan interest (Annual interest rate of 4 %)
Annual reimbursement of loan
100,000 VT
Assuming the following investment composition ;
20 % owned fund
30 % loan
50 % Governmental assistance
Loan reimbursement period : 6 years
(Service life span of the equipment : 8 years)
5,000 kg

2. Income and expenditures of absorption-type refrigerator

The applicable line of reasoning is the same as in the previous section.

(1) Evaluation

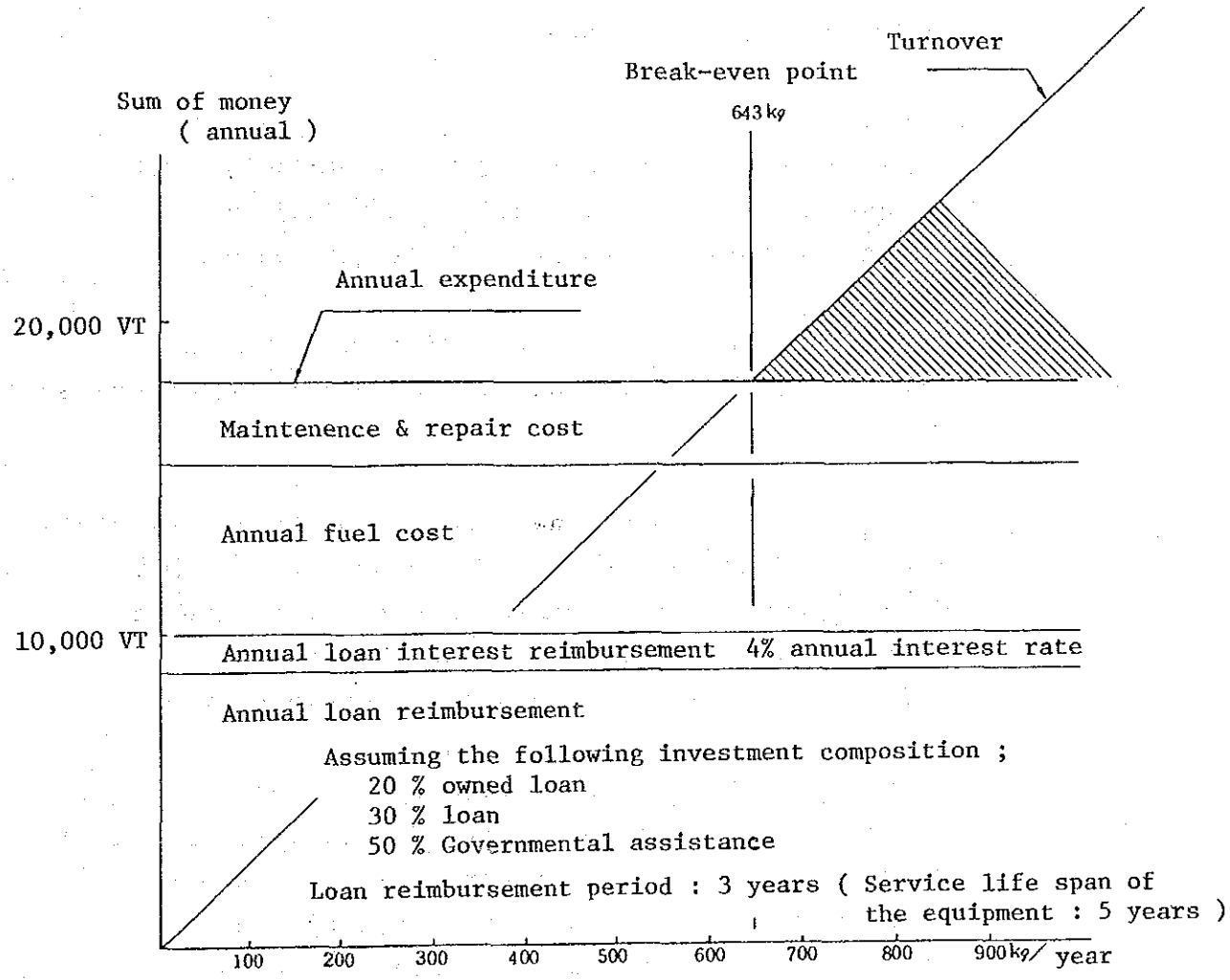
The annual sales of marine products required for reimbursing the loan used for purchasing the absorption-type refrigerator is 643 kg. Of the 8 small-scale distribution and sales bases under the this project, Aniwa and Erromango will h ave difficulties for reimbursing the loan for the time being.

However, it is importance that VFDP is developed in the southern area including both project sites in view of effective use of fishing ground and resources. Besides, expansion of fishing unit in number and activation of existing ones under VFDP are expected.

Therefore, it is desirable that the Fisheries Department take appropriate measures, such as the equipment lending system, establishment of new fishing units in the area in question, etc., for rearing the two small-scale fish marketing stations. As for the other 6 stations, they are in conditions of reimbursing the loans, and furthermore it is possible to depreciate part or all of the equipment.

Figure-2

Income and expenses of the absorption type refrigerator



3. Outboard engine fishing boat

(1) Calculation conditions

1) Service life span

- Wooden fishing boat 8 years
- Outboard engine 2 years
- Marine chandlery 2 years

2) Income

Sales of marine products.

3) Expenses

Marine chandlery, fishing gear, outboard engines, fuel, maintenance & repair, ice, fishermen's share, and loan reimbursement including interests.

(2) Financial evaluation of outboard engine fishing boat depending on having access to the medium- and large-scale fish marketing stations.

1) When the outboard engine fishing boat uses the station and has an annual output of marine products mounting to 5,040 kg/boat, it can reimburse the loan used for purchasing the boat and furthermore the total profit after the depreciation mounts to 500,000 VT.

2) When the outboard engine fishing boat does not have access to the station and its annual catch is barely 2,520 kg/boat, it will record losses in the first 2 years and in the 5th when the outboard engine is replaced, but as a total balance of the 8-year service life span of the fishing boat it will have a total profit before depreciation of 180,000 VT. It must be borne in mind however, that the fishing boat can not be depreciated in this case.

3) Approximately a half of the outboard engine fishing

boats under this project belong to the case 1) or are able to operate by selling their catches to markets of large vellages, but on the other hand it is concluded that the remaining half of fishing boats will find difficulties for attaining their economic dindependence. This is a shortcoming of bottom-up type projects. And it is recommended to regard the marketing as a condition for establishing fishing units.

4) Outboard fishing boats having access to the stations

Year	*1 Fixed cost	*2 Operation cost	*3 Maintenance cost	Replacement cost	*4 Turnover	Balance	
	*5						
1st year	93,080	339,600	47,600	-------	604,800	124,520	VT.
2nd year	93,080	339,600	47,600	-------	604,800	124,520	VT.
	*6			*8			
3rd year	49,920	339,600	47,600	160,000	604,800	7,680	VT.
4th year	49,920	339,600	47,600	-------	604,800	167,680	VT.
5th year	49,920	339,600	47,600	-------	604,800	167,680	VT.
	*7						
6yh year	------	339,600	47,600	160,000	604,800	57,600	VT.
7th year	------	339,600	47,600	-------	604,800	217,600	VT.
8th year	------	339,600	47,600	-------	604,800	217,600	VT.
						*10 1,084,880	VT.
				*9 520,000		564,880	VT.

5) Outboard fishing boats without access to the stations

Year	*12 Fixed cost	*13 Operation cost	*14 Maintenance cost	Replacement cost	*15 Turnover	Balance	
1st year	*5 93,080	169,800	47,600	-------	302,400	- 8,080	VT.
2nd year	93,080	169,800	47,600	-------	302,400	- 8,080	VT.
3rd year	*6 49,920	169,800	47,600	-------	302,400	35,080	VT.
4th year	49,920	169,800	47,600	-------	302,400	35,080	VT.
5th year	49,920	169,800	47,600	160,000	302,400	-124,920	VT.
6yh year	*7 ------	169,800	47,600	-------	302,400	85,000	VT.
7th year	------	169,800	47,600	-------	302,400	85,000	VT.
8th year	------	169,800	47,600	-------	302,400	85,000	VT.
						*10 184,080	VT.
				*9 520,000		-336,000	VT.

6) Expenditures and turnover when the station is accessible

*1 Annual fixed cost (loan reimbursement)

	Boat	Outboard engine	Marine chandlery	
a) Price	520,000	160,000	40,000	VT.

	Boat	Outboard engine	Marine chandlery	
b) Percentage of governmental assistance for the total price	50%	50%	50%	
c) Purchasing price	260,000	80,000	20,000	VT.
d) Owned fund (10% of the total cost)	52,000	16,000	4,000	VT.
e) Loan sum	208,000	64,000	16,000	VT.
f) Interest (4%) 5 years	41,600			
2 years		5,120	1,280	VT.
g) e) + f)	249,600	69,120	17,280	VT.
h) Reimbursement period	5 years	2 years	2 years	
i) Annual reinbursement sum	49,920	34,520	8,640	VT.
j) Annual fixed cost				
*5 1st to 2nd year	49,920 +	34,520 +	8,640 = 93,080	VT.
*6 3rd to 5th year	49,920 +	0 +	0 = 49,920	VT.
*7 6th to 8th year	0 +	0 +	0 = 0	VT.

*8 Replacement of the outboard engine.
The government does not subsidize the replacement engines to be puechased by the fishermen.

*9 Replacement of the fishing boat.

*10 Cumulative profit.

*2 Annual operation cost

Fuel oil cost	5,040 kg x 30 VT. =	151,200 VT.
Crew's share		
14 days x 150 VT. x 3.5 persons x 12 months =		88,200 VT.
Fishing gear cost	5,040 kg x 10 VT. =	50,400 VT.
Ice cost	5,040 kg x 0.5 x 15 VT. =	37,800 VT.
Marine chandlery	40,000 VT. x 30 % =	12,000 VT.
	Total	339,000 VT.

*3 Annual maintenance cost

Outboard engine		
parts cost	160,000 VT. x 10 % =	16,000 VT.
personal expenditure	160,000 VT. x 10 % =	16,000 VT.
Hull	520,000 VT. x 3 % =	15,600 VT.
		47,600 VT.

The undermentioned numeric values obtained as a result of analysis of the relevant data are used in this study.

a) Annual output of marine product : 5,040 kg.
b) Fuel cost required to catch 1 kg of marine products : 30 VT.
c) Monthly working days : 14 days.

d) Daily per capita income of the crew : 150 VT.
e) Number of crew of each outboard engine fishing boat : 3.5 persons.
f) Fishing gear cost consumed to catch 1 kg of marine product : 10 VT.
g) Price of 1 kg of ice : 15 VT.

*4 The annual output and turnover of marine products will mount to the values calculated in the following when the selling market of marine products is expanded and the demand is strengthened as a result of accessing to the stations.

30 kg x 7 days/month x 2 times x 12 months = 5,040 kg

5,040 kg/boat x 120 VT./kg = 604,800 VT.

6) Expenditures and turnover when the station is not accessible.

*12 The annual fixed cost is the same as in case 1)

*13 The boat operation cost is halved, proportionally to the number of working days and the catch.

*14 The maintenance is the same as in case 1), but the outboard engine will be replaced in the 5th year because the operation time decreases.

*15 When the station are not accessible, the market for selling marine products is limited, and the demand decreases. The operation rate of the outboard engine fishing boat decreases, the output of marine products decreases, and the turnover of marine products becomes 1/2 of that of case 1).