1) acoustic laboratory

2) dry laboratory

3) wet laboratory

4) fish sample processing space

4.3 Basic Design Work

4.3.1 Basic Design Components

(1) Dimensions

To determine the principal dimensions of a ship, it is generally necessary to calculate the cubic capacity of the cabins, various tanks, engine room based on the capacity and number of the main and auxiliary engines, fish holds and storages, etc. below deck and also to calculate the spaces for cabins, steering house and laboratories above deck and the size of the fishing deck, etc. The balanced distribution of all these facilities, stability and the ship's expected speed, etc. are then considered in finalizing the ship's dimensions.

During the preliminary work in Japan, data on similar research vessels was examined and compared to the contents of the request and the draft design was decided on the basis of the provisional main dimensions and other main items relevant to the design of the research vessel in question. In the decision of the vessel's gross tonnage of less than 500 tons, the following points were taken into consideration.

1) If the gross tonnage is 500 tons or more, the vessel is subject to the SOLAS (International Convention on Safety of Life-at-Sea) which demands the provision of a special fire prevention construction, special fire-fighting and life-saving equipment. Nautical instruments should also meet the standards set by the IMO. These extra contraction and equipment will not be required for the operation of the proposed research vessel.

2) If the gross tonnage is 600 tons or more, the statutory crew must be increased. It is difficult for Namibia to immediately meet such requirements.

The main dimensions of the vessel were decided through the following examination processes based on the above design conditions.

Preparation of Draft Basic Design (Work Conducted in Japan)

1) Examination of the requested contents.

2) Examination of the necessary sizes of the fish hold, fuel tank and fresh water tank, etc. based on the vessel's operation plan.

3) Examination of the requested fishing methods, gear and apparatus.

4) Examination of the optimal cabin layout to accommodate complement of 28.

5) Examination of the required main engine output.

6) Examination of the power generator capacity.

7) Examination of the arrangement and size of the engine room.

8) Examination of the requested research instruments and equipment.

9) Examination of the laboratory layout.

10) Estimation of the required CN (LxBxD)

11) Examination of the requested dimensions.

12) Examination of the main dimensions of similar research vessels.

13) Decision on the main dimensions of the proposed research vessel and preparation of the general arrangement.

14) Preparation of the lines, hydrostatic table and Bonzean's curve.

15) Estimation and confirmation of stability.

16) Adjustment of the general arrangement.

17) Preparation of the draft design plan.

Consultations with Namibian Side and Basic Design

1) Confirmation of the required capacities of the fish hold, fuel tank and freshwater tank.

2) Confirmation of the fishing methods, gear and apparatus.

3) Confirmation of the cabin layout to accommodate a crew of 28.

4) Confirmation of the required main engine output.

5) Confirmation of the power generator capacity.

6) Examination and confirmation of the required research instruments and equipment.

7) Examination and confirmation of the space and arrangement of laboratories.

8) Examination to improve the freeboard on the aft. deck.

9) Review of the main dimensions and preparation of general arrangement.

10) Preparation of lines, hydrostatic table and Bonzean's curve, and examination and confirmation of stability.

11) Confirmation of the optimum lines.

12) Adjustment of the general arrangement.

13) Final confirmation of the principal dimensions.

1) Main Dimension Adopted by Draft Design

In the preliminary work in Japan, the following calculations were conducted to decide the main dimensions for the draft design.

i) Relative Ratios of L, B and D

The general ratios of L/B and B/D for vessels with same purposes as the requested vessel are as follows.

L: length between perpendiculars

B: moulded breadth

D: moulded depth

L/B = 3.88 - 5.0

B/D = 2.0 - 2.4

The value of L/B take large score in accordance with the design speed and ship size. As the proposed vessel is small with a fast design speed, it has been decided that the value of L/B for the proposed vessel is 4.6. The value of B/D determines the ship's stability. A top heavy ship with the centre of gravity tending to shift upwards must have a large B/D value. In the case of a ship which requires a freeboard (distance between waterline and deck) to emphasize seaworthiness, the B/D value becomes smaller. As the proposed ship is required to be seaworthy, a small value B/D value of 2.1 has been adopted.

ii) Calculation of L, B and D

L/B = 4.6 ... (a)

B/D = 2.1 ... (b)

L = 4.6B, B = 2.1D

$L \times B \times D = (4.6 \times 2.1 \times D) \times 2.1D \times D = 20.28D^3$

The value of Cb (block coefficient: the value obtained by dividing the displacement below the waterline by L x B x D) is given as 0.67 with the depth D. The space of the sheer and camber of the proposed vessel is set at 6% of the space at depth D. The space below the upper deck is as follows.

$V = L \times B \times D \times 0.67 \times 1.06 = 20.284D^3 \times 0.67 \times 1.06\ (= 896.3m^3)$

Therefore, $D^3 = 896.3 \div 20.28 \times 0.67 \times 1.06 = 62.24$

$896.3 \div (20.28 \times 0.67 \times 1.06) = 62.23$

Given the above calculation result, the value of D is 3.96 (m). Based on equation (c) cited earlier, the value of B is 8.32m (B = 2.1 x D = 2.1 x 3.96). Similarly, the value of L based on equation (b) is 38.27m (L = 4.6 x B = 4.6 x 8.32). The adopted values of L, B and D for the basic design of the proposed research vessel are as follows.

L = 38.00m

B = 8.30m

D = 4.00m

The above decision on the main dimensions was made in order to satisfy the required performance of the vessel, taking the past performance records of similar vessels into consideration.

Based on the above, it was confirmed that the calculation of the CN (cubic number), which is generally used as the index for ship size, of 1,262 for the proposed research vessel was sufficient.

The above calculation result indicates a large gap in terms of the various dimensions of the original request and the basic design findings. As the originally requested dimensions might necessitate the gross tonnage of the vessel exceeding 500 tons to secure the proper stability, they were rejected on safety grounds.

	Original Request	Basic Design	Difference
Fish Hold (inclusive of Freezing Room)	$198m^3$	$51m^3$	$158m^3$
Fuel Tank	$180m^3$	$150m^3$	$30m^3$
Clear Water Tank	$60m^3$	$50m^3$	$10m^3$
Dimensions (Loa×Lpp×B×D (m))	45x39.5x10x4.5	43.5x38x8.3x4	
CN	1,777	1,262	

Note: The requested capacities are those given in the vessel specifications attached to the request.

2) Main Dimensions Adopted by Basic Design

During consultations with the Namibian side, the DRM requested two major changes in the draft design from 2 aspects, i.e. ① the adoption of a double deck structure to ensure a sufficient freeboard and ② the provision of 2 net drums.

i) Examination of Double Deck Structure

A thorough examination found the adoption of a double deck structure impossible due to the following reasons.

① Adoption of a double deck structure would mean the recommencement of the entire design work. As a long time would be required to confirm the appropriateness of the new design, completion of the Project by the target completion date would be impossible.

② The dimensions of the vessel would significantly increase, making it certain that the gross tonnage of the vessel would exceed 500 tons, in turn resulting in a substantial cost increase and a demand for higher crew qualifications.

③ The simple change of the moulded depth to create a dual deck structure would be impossible without changing the vessel length and breadth as such a change would reduce the stability of the vessel.

The freeboard of the draft design, which increased the freeboard of the Benguela by some 50%, was given a relatively large value for a single deck ship in anticipation of rough weather at sea. Nevertheless, the DRM expressed further concern for the wave thrust from the stern during trawling operation. Consequently, it was decided to increase the sheer of the stern to raise the freeboard height of the stern deck. This alteration does not directly affect the main dimensions of the vessel.

ii) Provision of 2 Net Drums

There are several ways to arrange 2 net drums, i.e. ① left and right, ② up and down and ③ front and rear. The first choice is physically impossible because of the breadth of the vessel. The second choice is also not viable in the present case unless the breadth and depth of the vessel are modified as it would raise the centre of gravity. Moreover, the second choice is dangerous as the view of the stern from the bridge would be blocked. Placing of the 2 net drums along the vessel in the lengthways direction is, therefore, necessary.

The main dimensions were modified taking the following requirements into consideration.

① To maintain the stability and fishing function of the vessel to achieve its objectives without changing its breadth and depth.

② To minimize the length of the vessel while ensuring its required fishing functions.

③ To limit the gross tonnage of the vessel below 500 tons despite modification of its length to avoid an unnecessary increase of the construction cost and maintenance cost.

④ To give top priority to the improvement of the laboratories vis-a-vis allocation of extra space below deck as a result of the extension of the ship length.

As the result of examination, expansion of 3.7m of the vessel's length between the perpendiculars is optimum to satisfy the above requirements while ensuring the minimum fishing deck space for trawling operation with 2 net drums arrangement. The new length between the perpendiculars is 41.7m (38m + 3.7m).

iii) Overall Length of Vessel

The ship length between the perpendiculars means the distance between the after side end of the rudder post and the fore side of the stern on load line while the overall ship length means the distance between the fore end and after end of the ship's structure.

① Horizontal Distance Between Back End of Rudder Post and Back End of Ship's Structure

In the case of a trawler, it is common practice to provide a horizontal distance equivalent to some 6% of the ship length between the perpendiculars to avoid damage to the rudder by the tangling of fishing gear (such as otter board and warp).

L x 0.06 = 41.7 x 0.06 = 2.50m

In addition, the proposed research vessel requires an overhanging galosh at the stern to mound the block for trawling net extraction. Consequently, the horizontal distance between the back end of the rudder post and the back end of the ship's structure is 3.16m as shown below.

2.50m + 0.5m = 3.00m ... (a)

② Horizontal Distance Between Fore End of Stem on Load Line and Fore End of Ship's Structure

If the angle of the stem against the horizontal plane is assumed to be the standard 60° in a straight line, the horizontal distance between the fore end of the stem under load line conditions and the fore end of the ship's structure is given by the following equation.

Horizontal Distance = (freeboard + initial trim x 1/2 + upper deck sheer under load line conditions + height of forecastle deck + height of bullwork) x $1/\tan\theta$ = 0.9 + 0.4 + 0.2 + 2.3 + 0.8 = 4.6 x $1/\tan\theta$ = 2.45m ... (b)

Accordingly, the overall ship length is 43.61m

Accordingly, the overall ship length is 43.61m.

(a) + (b) + 38m = 3.00 + 2.45 + 41.7 = 47.15m

An approximately length of 47.2m is, therefore, adopted for the basic design.

Based on the above calculation results, the main dimensions of the vessel are now as follows.

Total Length:	approximately 47.2m
Length between Perpendiculars:	41.7m
Moulded Breadth:	8.3m
Moulded Depth:	4.0m

The gross tonnage of the vessel is approximately 485 tons and the GoM and FB at the midship are as follows.

	GoM	FB
Fully Loaded Departure from Port	0.81m	0.975m
Arrival at Survey Area	0.67m	1.157m
Departure from Survey Area	0.66m	1.191m
Return to Port	0.56m	1.329m

The following table shows how the specifications of the vessel have been changed to those of the basic design.

Vessel Type	Original Request Stern Trawler Double Deck	Draft Design Stern Trawler Single Deck	Basic Design Stern Trawler Single Deck	Benguela Stern Trawler Single Deck
Total Length (m)	45.0	43.5	47.2	44.20
Length between Perpendiculars (m)	39.5	38.0	41.7	37.49
Moulded Breadth (m)	10.0	8.3	8.3	9.45
Moulded Depth (m)	4.5	4.0	4.0	3.96
CN	1,777.5	1,262.0	1,384	1,403
Crew Strength	32 - 28	28	28	28
Fish Hold Capacity (m^3)	198	51	51	40
Fuel Tank Capacity (m^3)	180	150	150	137
Fresh Water Tank Capacity (m^3)	60	50	55	36
Gross Tonnage (tons)	500	426	485	494
GoM/FB (fully loaded departure)(m)	-	0.94/0.77	0.81/0.98	0.46/0.42
GoM/FB (at fishing grounds) (m)	-	0.66-0.79/0.97-1.13	0.66-0.67/1.16-1.19	0.20-0.42/0.62-0.80
GoM/FB (arrival at port) (m)	-	0.53/1.28	0.56/1.33	0.15/0.87

(2) Main Engine Output

The main engine output must be decided on the basis of the required speed and required towing power during fishing operations.

1) Required Output Based on Speed

The main engine output is decided based on the ship's resistance which is determined by such factors as the ship length and breadth, ship shape, waterline and trim, etc. Margins are added in view of the propulsion efficiency and the possible effect of the sea conditions on the engine performance. The required engine output can be calculated by the following equation.

Output = Resistance x Speed ÷ Propulsion Efficiency

The calculation results are given below.

Length between Perpendiculars	: 41.70m
Moulded Breadth	: 8.30m
Waterline	: 3.10m
Cb	: 0.67
Displacement	: 722 tons
Wetted Surface Area:	: 476m^2
Sea Margin	: 20%
Main Engine Margin	: 15%

Speed (knots)	9.5	10	11	11.5
Required Output (ps)	606	700	981	1,240
Main Engine Output (ps)	713	823	1,154	1,459

(constant revolution/blade angle adjustment)

Therefore, the required main engine output to support the requested vessel speed of 9.5 knots is 713 ps.

2) Required Towing Output Under Fishing Operation

The maximum net towing power is required by the proposed research vessel when conducting midwater trawling. In particular, the fishing of horse mackerel requires a minimum speed of 4.5 knots with a net opening of more than 30m, creating a fishing gear resistance of 11 tons. The required net towing force is expressed in terms of the fishing gear resistance at a moving speed of 4.5 knots. The net dragging power is largely affected by the propeller performance. The propulsion force generally increases in accordance with the propeller size but is subject to limitations by the waterline and stern shape conditions. When a vessel is required to avoid propeller-borne vibration, as in the case of the present vessel, it must have a sufficiently clear propeller aperture (distance between the stern structure and propeller).

(Conditions)

Length between Perpendiculars	: 41.70m
Moulded Breadth	: 8.30m
Waterline	: 3.10m
Cb	: 0.67
Displacement	: 722 tons
Wetted Surface Area	: 476m2
Propeller Diameter x Revolution Speed	: 2,300mm x 289 rpm
Propeller Type	: high skewed CPP (controlled pitch propeller)
Sea Margin	: 10%
Main Engine Margin	: 15%

Speed (knots)	3.5	4.0	4.5
Required Net Dragging Power	6.0	7.9	10.0
Required Output (ps)	667	889	1,200
Main Engine Output (ps)	785	1,046	1,412

In short, the calculation suggests that 1,412 ps is required to obtain a net dragging power of 10 tons at a towing speed of 4.5 knots.

Based on the considerations given in 1) and 2) above, the required main engine output is set at approximately 1,400 ps.

(3) Fuel Tank

The planned duration of survey trips of the proposed vessel operating out of Port Walvis Bay is approximately 15-20 days. In the design of the vessel, however, the fuel tank must capable of supporting continuous trips of approximately 30 days in order to meet possible future requirements for expansion of the research area. The following conditions have been adopted to calculate the fuel oil requirement.

Speed	: 11.5 knots
Cruising Duration	: 7 days
Survey Duration	: 23 days

Based on these conditions, the calculated fuel consumption for cruising and surveying purposes is shown in the table below.

1) Consumption During Cruising Period

	Main Engine	Auxiliary Engine
Required Output	1,225 ps	150 ps
FO Consumption	145 grammes/ps/hour	165 grammes/ps/hour
FO Specific Gravity	0.86 kg/l	0.86 kg/l
FO Consumption (l/day)	1,225x0.145x1/0.86x24=4,957	100x0.165x1/0.86x24=460.5
Cruising Duration (days)	7	7
FO Consumption (Kl/trip)	34.7 Kl	3.22 Kl
Total (Kl/trip)	37.92 Kl	

2) Consumption During Survey Period

Average Engine Output of Main Engine During Survey Operation

	Average ps / VH	Operation Hours / Day	Average ps / 24 Hrs
Sampling	900	5	187
Acoustic Survey			
Average 9-10 knots (650 ps)	650	12	325
Oceanographic Survey (160 ps)	160	12	80
Average	592 ps		

	Main Engine	Auxiliary Engine
Required Output	590 ps on average	150 ps
FO Consumption (l/day)		150x0.165x1/0.86x24=690
Survey Duration (days)	23	23
FO Consumption (Kl/trip)	55 Kl	15 KL
Total (Kl/trip)	70 Kl	

As the above consumption figures are theoretical, a margin should be added to the design fuel tank capacity to allow for increased consumption due to such external factors as the weather and to maintain stability during the return voyage. According to the standard adopted by the Fishery Agency in Japan, the residual fuel volume at the time of returning to a port is set at 10% of the tank capacity. Using this 10% margin, the required fuel tank capacity for the proposed vessel is as follows.

FO Consumption During Cruising Stage	:	37.9 Kl
FO Consumption During Surveying Stage	:	70.0 Kl
Total	:	107.9 Kl
Margin (10%)	:	10.8 Kl
Grand Total	:	128.7 Kl

In the design of the fuel tank capacity, a fuel load ratio of 80-90% is adopted to allow fuel expansion and air pocket in the tank due to trim conditions of the vessel. A fuel load ratio of 90% is adopted as the planned fuel oil for the vessel is diesel oil which has excellent flow due to a low coefficient of thermal expansion and low viscosity and also as the ship's trim will be designed to achieve the optimal conditions. As a result, the fuel tank capacity should be $143m^3$ (128.7 x 1/0.9) and the design capacity is set at $150m^3$.

(4) Fish Hold

The purpose of fishing by the proposed research vessel is to estimate the stock and the fish size. However, the vessel is not a fishing boat, of which the concern is to maximize the catch, and the fish hold will only be used to keep fish samples. Consequently, it is unnecessary for the vessel to have a large fish hold.

The research vessel is expected to catch some 0.5 tons of pelagic, bottom and other fish samples per day. Given the survey duration of up to 23 days, the required fish hold capacity is 11.5 tons of fish (0.5 tons/day x 23 days). Assuming a loading factor of 0.3 tons/m^3, the required fish hold capacity is approximately 40m^3 (11.5 tons ÷ 0.3 tons/m^3).

4.3.2 Onboard Facilities

(1) Fresh Water Tank

The Benguela, the research vessel currently in operation, has a fresh water tank capacity of 36m^3 to cater for the complement of 28. Its longest trip so far has been 17 days and a minimum of 8 tons must be reserved to maintain the stability of the vessel. The per capital consumption of the Benguela is 59l/day ((36,000 - 8,000) ÷ 17 ÷ 28 = 59l/person/day). In the case of the proposed research vessel, however, the fresh water consumption is calculated based on 30 day voyages.

In general, the fresh water consumption per capita is 60 - 100 l/day and the above figure of 59 l/person/day requires conscious efforts to restrict water consumption. In the case of the present Project, a daily per capita consumption figure of 80l is adopted in addition to 200l/day for cleaning survey equipment, etc.

Complement	:	28
Trip Duration	:	30 days
Fresh Water Consumption	:	0.008 tons/person/day x 28 + 0.2/day = 2.44 tons / day
Total Consumption	:	approximately 73.2 tons (2.44 tons / day x 30 days)

Some 7 tons of fresh water must be continually kept to maintain the optimal trim and stability of the proposed research vessel. The resulting fresh water tank capacity required is 80.2m^3. From the viewpoint of the vessel's navigational requirements, it is calculated that the optimum fresh water tank capacity is approximately 55m^3. The difference between this and the above theoretical requirement of 80.2m^3 will e produced by a distilling plant using waste heat from the main engine cooling water.

The required volume of fresh water production/day is 0.84 tons on average ((80.2m^3 - 55m^3) ÷ 30). The fresh water production amount of the distiller is in proportion to the output of the main engine. As the production of a large volume of water in a short operation period by the main engine is necessary to ensure the production of the required amount of water for the proposed research vessel of which the average engine output during survey operation is rather small, it appears appropriate to make the distiller capacity double the required production amount. With a distiller efficiency factor of 0.9, the design distiller capacity is 1.87 tons/day (0.84 x 2 ÷ 0.9). Consequently, a distiller which is capable of producing 2 tons of fresh water/day will be installed.

(2) Refrigerated Provision Chamber

The following 2 provision chamber will be provided for the proposed research vessel.

Storage	Capacity	Temperature
Meat chamber	approximately $4m^3$	-18°C
Vegetable chamber	approximately $5m^3$	-4°C

(3) Painting

Long life anti fauling paint shall be applied for the external painting of the shell below the waterline.

(4) Outfittings and Deck Machinery

1) Steering Gear

Electric hydraulic steering gear for the flap rudder will be installed to achieve a good steering performance with a steering speed of 70 degrees/24 seconds.

2) Anchor chain

As the standard anchor length is inadequate in certain areas, the design anchor chain length is to be of abt 300m.

3) Mooring

2 moorings will be installed on both sides of the stern so that they can also be used for fishing operation.

4) Bow Thruster

The wind condition for vessels mooring at quays in Namibia is 24 knots. Given a standard mooring speed of 0.25m/sec, the capacity of the bow thruster can be calculated as follows.

Wind Velocity (Vw)	: 24 knots = 12.34m/sec
Mooring Speed (Vs)	: 0.25m/sec
Wind Pressure Area (Aw)	: 183m^2
Area under Perpendiculars (As)	: 132m^2
Length between AP and Thruster (L)	: 38.7m
Length between Perpendiculars (Lpp)	: 41.7m
Wind Pressure Area (Mw)	: $0.0735 \times 10^{-3} \times Aw \times Vw^2 \times L/2$
Water Pressure Area (Ms)	: $73.2 \times 10^{-3} \times Aw \times Vw^2 \times L/2 \times 1/2$
Bow Thruster Thrust (T)	: (Mw + Ms)/L

$Mw = 0.0735 \times 10^{-3} \times 183 \times 12.34^2 \times 41.7/2 = 41.7$ T-M

$Ms = 73.2 \times 10^{-3} \times 132 \times 0.25^2 \times 41.7/4 = 6.3$ T-M

$T = (41.7 + 6.3) \times 1/38.7 = 1.26$ T

Assuming an efficiency of 85%, the value of T is 1.48 (1.226 ÷ 0.85). The required thrust of the bow thruster is 1.5 T. The design power source for the bow thruster is the hydraulic pump driven by the main engine to save energy and to reduce the generator capacity requirement.

4.3.3 Accommodation

(1) The following plan for crew accommodation has been decided through consultations with the Namibian side.

Crew

Captain	1	single berth cabin x 1
Chief Engineer	1	single berth cabin x 1
Chief Mate	1	single berth cabin x 1
Second Officer	1	single berth cabin x 1
Second Engineer	1	single berth cabin x 1

Third Engineer	1	single berth cabin x 1
Ratings	12	double berth cabin x 6
Scientists and Technicians		
Chief Scientist	1	single berth cabin x 1*
Senior Scientist (male or female)	1	single berth cabin x 1*
Scientists (male or female)	2	double berth cabin x 1
Technicians	4	double berth cabin x 2

* An additional fold-away bunkbed will be provided for the chief scientist's cabin and senior scientist's cabin.

(2) A central air-conditioning system will be installed to serve the cabins, steering house, mess room and laboratories. An independent air-conditioning unit will be provided for the acoustic laboratory.

(3) The bed size for cabins located on the upper deck will be 1,900mm (length) by 800mm (width) while that for cabins below the upper deck will be 1,900mm (length) by 700mm (width).

(4) 2 sets of WCs and shower rooms will be provided for officers' use while 3 sets of WCs and shower rooms will be provided for ratings, scientists and technicians. An addition WC and shower cubicle will be provided for female scientists.

(5) An electric cooking range will be provided in the galley.

(6) The minimum clearance height in the accommodation area will be 2m.

(7) Rainwear Changing Room: a rainwear changing room will be provided at the entrance of the accommodation quarters from the fishing deck.

4.3.4 Laboratories

(1) Acoustic Laboratory

This laboratory is designed to conduct acoustic surveys using various acoustic equipment, including scientific sounders. As good linkage with the wheel house is required, this laboratory will be located on the deck immediately below the wheel house to provide good access. In principle, survey equipment will be placed on exclusive racks with some extra space accommodate equipment to be added in the future in addition to the initial range of equipment to be transferred from the Benguela. Space will be provided at the back of the racks to allow equipment adjustment and maintenance from behind. A work table will also be provided in the laboratory. The laboratory will have an independent air-conditioning unit to ensure the proper functioning of equipment.

(2) Dry Laboratory

This laboratory will mainly be used to conduct physical, chemical and other observations relating to the marine environment. The subject items for monitoring will include temperature salinity, DO and pH of seawater. The main facilities are a work table, sink, seawater tap, fresh water tap and water supply pipes. The laboratory will be located next to the wet laboratory.

(3) Wet Laboratory

The wet laboratory is designed to process seawater samples and to conduct tests and observations on fry and plankton, etc. The main facilities are a work table, sink, seawater tap, fresh water tap and water supply pipes. It is necessary to ensure that the floor has good drainage and is rustproof. Particular attention should be paid to the location and dimensions of the door to permit easy access to the laboratory from the work deck.

(4) Fish Sample Processing Room

This room is designed to check the sampled fish species including fish size, weight and spawning condition, etc. It will be located next to the work deck. A collapsible work table, sink and water tap will be provided to facilitate the work. The design of this room should prevent the leaking of light directly onto the surface of the sea during night work.

4.3.5 Machinery

(1) Main Engine

The main engine will be a medium speed diesel engine which will provide power take-off for the deck machineries because of the small vibromotive force. The engine will be insulated from the hull structure by rubber pads to reduce vibration and noise. The external piping for the main engine will have flexible joints in view of reducing vibration and noise. The fresh water cooling method will be used to prolong engine life and to obtain maximum heat for the generation of fresh water. A silencer will also be used to reduce the exhaust noise of the main engine.

(2) Propeller

A controllable pitch propeller with high skewed blades will be used for better maneuverability and lower vibromotive force. The propeller aperture will take as much as possible to reduce the ship's stern vibration and noise associated with the propeller.

(3) Power Generators

The electricity supply specifications on board the vessel will be 380V, 50Hz, 3 phase AC for power equipment and 220V, single phase AC for small power equipment and lighting, etc. which correspond to shore electric service. A diesel engine-driven power generator capable of meeting all the vessel's power demands under the normal navigation will be installed. An additional power generator with the same capacity will also be installed as a stand-by. The power control unit for the power generating plant should be capable of adjusting the power source of major equipment on board within allowable range. Power source stabilizing devices will be provided for the acoustic equipment and data processing equipment. The power generators will have the same insulation as the main engine to reduce vibration and noise. During anchorage at the base in Port Walvis Bay, the vessel will receive electricity supply from the shore ground and no generator will be used on board the vessel.

(4) Refrigeration

The design temperature for the fish hold is -25°C. Because of the low seawater temperature the compressor will be the single stage compressor for easy maintenance and simple structure. The refrigerant will be of R-22 to establish compatibility with the air-conditioning facilities. The cooling system of the freezer will be of air blast while the grid coil system with easy maintenance will be adopted for the fish hold.

(5) Fresh Water Generator

A fresh water generator capable of producing 2 tons of fresh water per day using waste heat from the main engine cooling water will be installed.

(6) Monitoring Room

A monitoring room with an independent air conditioning unit will be established in the engine room to monitor the operational condition of the main engine, auxiliary engines and refrigerating machinery etc. A power distribution panel will also be installed in this monitoring room. The target of noise level will be 85db or less.

4.3.6 Fishing Gear

In general, an oceanographic research vessel such as that proposed tends to have a larger complement and a larger accommodation area on the upper deck to house laboratories than a trawler, making a long trawl fishing deck impossible. The safe installation of adequate fishing gear in a limited deck space is, therefore, absolutely essential. In the case of the proposed research vessel, the trawl winch will be installed on each side of the stern deck to prevent the free running of wire rope on the upper deck during fishing operation (shooting or hauling nets). A net drum will be positioned at the centre of the upper deck to improve the efficiency of net work and to provide the maximum deck space for fishing operation.

The required performance of these trawl winches will be based on the requirements for midwater trawling which demands the largest tensile strength while the drum capacity will be designed based on the requirements for 600m deep bottom trawling. Two (2) independent net drums will be installed one for the midwater trawling and the other for bottom trawling respectively.

(1) Trawl Winches

In general, the design net winding speed for bottom trawling is 60-90m/min. As the proposed research vessel will also be engaged in midwater trawling, therefore, a slightly faster net hauling speed is required. Consequently, the design net hauling speed will be 80m/min at mid drum.

The fishing gear resistance is roughly proportional to the square of the water velocity. As the resistance of the midwater trawling net apparatus is 10 tons at 4.5 knots, the tension at design net hauling speed is approximately 3.3 tons as calculated below.

Design Net Winding Speed : $Vw = 80m/min = 80/60 \times 1 \div 0.514$
$= 2.6$ knots

Midwater Trawling Speed : $Vs = 4.5$ knots

Midwater Tension : $Ts = 10$ tons

Net Winding Tension : $T1 = Ts \times Vw^2 \div Vs^2 = 10 \times 2.6^2 \div 4.5^2$
$= 3.3$

The design tension (T) must take the forward movement of the vessel (1 knot) and the margin of 30% for waves into consideration. Consequently, the required winch tension is 8.24 tons.

$T = 3.3 \times (2.6 + 1)^2 \times 1.3 \div 2.6^2 = 8.24$

2 winches capacity of each 8 tons x 80m/min will be installed. The warp winding capacity of the trawl winches will be 2,000m in view of the design maximum depth of 600m for bottom trawling by the proposed research vessel.

The required output of the trawl winches will be approximately 180ps. If a power generator is to be used to supply the above power, the required power generator would be prohibitively large and uneconomical and, therefore, the main engine will be of power source to the trawl winches.

(2) Net Drums

The net hauling speed should be modest to prevent deterioration of the net by friction and a common hauling speed of 60m/min has been adopted as the design net handling speed of the net drum.

The net winding tension is determined by the catch quantity and reaches the maximum level just before the cod is aboard the slipway. As the catch quantity fluctuates, however, it is impractical to decide on the required net winch capacity based on the assumed maximum catch. It is common practice to provide an additional strong winding winch to cater for a large catch. The proposed research vessel will use this method and the required net winch tension has been calculated using the equation for the trawl winches for the situation where the cod end is still submerged.

$Vw = 60m/min \div 60 \times 1 \div 0.514 = 1.95$ knots

$T1 = 10 \times 1.95^2 \div 4.5^2 = 1.9$ tons

$T = 1.9 \times (1.95 + 1)^2 \div 1.95^2 = 4.35$ tons

Two net winch capacity of each 4.5 tons x 60m/min will be installed and power to the net winch will be supplied by the main engine in view of the same reason given for the trawl winches.

4.4 Survey Equipment Plan

(1) Survey Items and Objectives

In order to study the fisheries resources within the Namibian EEZ, it is necessary to have a good understanding of the marine environment, including physical and chemical oceanography, seabed topography and benthic conditions. Direct assessment of the condition and abundance of fish stock species is carried out by combined acoustic and trawl surveys. The overall fluctuations in stock abundance and conditions within the fishing grounds can only be understood by collecting and analyzing data over many years. The main requirement for surveys and equipment necessary to achieve those objectives are described bellows.

1) Stock Assessment Survey: To assess the available fish stock. Based on past data, the fluctuation of the stock over the years can be examined and provided direct estimate for the introduction of resources control and/or fishing control measures such as the maximum catch or quota.

2) Ecological Survey: To understand the ecological aspects of fishery resources, including the distribution, seasonal migration, spawning, feeding and growth of the various fish species. This data is essential to estimate the biomass of resources and provides the basis for efficient management of the resources and fishing operation's.

3) Physical and Chemical Surveys: To understand the preferred marine environment for fish in order to assist the search for good fishing grounds and the preservation of habitats.

4) Primary Productivity Survey: To observe the seasonal changes in primary productivity in order to predict changes of the resources availability from the viewpoint of the food link.

5) Plankton Survey: to identify seasonal changes of the plankton level in a subject sea area in order to predict changes of the resources availability and the environment for feeding.

6) Benthos Survey: To sample seabed life in order to assess the prospect of fishing grounds based on the varieties and quantities of life.

7) Bottom material Survey: To study the bottom material conditions in order to understand their effects on the ecological system.

(2) Survey Methods and Data Processing

1) Stock Assessment Survey

There are 2 types of stock assessment surveys, i.e. the direct method through actual sampling of fish stock and the indirect method using a scientific sounder (acoustic survey). The acoustic surveys assist in calculating biomass by integrating the scattering strength of fish shoal detected by sound travelling underwater. This technique is widely used in fishery resource evaluation to obtain a quick assessment of the stock together with the sampling method. The DRM uses both methods on the M/V Benguela for surveying biomass of the resources.

The biomass of resources survey firstly establishes a survey grid in the subject sea area and requires the research vessel to accurately navigate along the grid lines while operating the scientific sounder. The research vessel then conducts sampling at several sampling points on the grid to check the fish species and the composition and size of each species of fish, etc.

Data Processing

(a) Sampling

Direct Data : gross weight, size, individual weight and spawning condition weight, etc. of each species

Data Presentation : individual graphical presentation for each species and display of fishing ground chart for each species

(b) Scientific Sounder

Direct Data: : average rear scattering strength (SV) and target strength (ST) per unit ($1m^3$)

Indirect Data : size of fish shoals per unit ($1m^3$)

Data Presentation: horizontal distribution and display of fish shoals, vertical distribution and display of fish shoals and total coverage of fish in the subject area

2) Ecological Survey

The ecological survey will include direct visual observation, laboratory culture on the ground and a tracking survey using biotelemetry and/or a tracking tag. The applicability of direct visual observation is limited to a very small area and is only used for lobster surveys. For the present Project purposes, the ecological survey mainly relies on sampling data and biological survey data.

3) Physical Oceanographic Survey

There are several methods to collect a physical oceanographic data. The classic method is the establishment of sampling points to monitor the water temperature and salt content, etc., to sample water from different depths using a water sampler equipped with a thermometer and to determine the salinity of each sample. Another method involves the use of a CTD at similar sampling points to electrically determine the distribution of salinity values with depth. Other methods of measuring temperature and salinity values include continuous recording at the surface or midwater data while towing a thermo-salinometer or a similar instrument, and meteorological satellite data can also be used to determine the surface seawater temperature over a wide area, etc.

<u>Data Processing</u>

(a) Classic and CTD Methods

Direct Data : vertical measurement of water temperature and salinity

Indirect Data : estimate of density in situ, sound velocity and geostrophic current

Data Presentation: vertical distribution chart of water temperature, salinity and density, vertical cross-section of water temperature, salt content and density and T-S diagram

(b) Sailing Method

Direct Data : surface or midwater water temperature and salinity value along sailing path

Indirect Data : density in situ and sound velocity, etc.

Data Presentation : time-series graph and horizontal distribution of water temperature and salinity

(c) Meteorological Satellite Method

Direct Data : infrared photographs

Indirect Data : relative sea surface temperature

Data Presentation : surface isothermal graph

4) Chemical Survey

Again, there are several methods to conduct a chemical survey. The classic method is to collect water samplers at field stations to determine the values of dissolved oxygen (DO), pH and nutrient salts. Other methods include electric measurement at sampling points using a CTD equipped with a DO/pH sensor and by continuous monitoring of midwater data while towing a DO/pH sensor-equipped object.

<u>Data Processing (Classic and CTD Methods)</u>

Direct Data : dissolved oxygen (DD), pH and nutrient salts by layer

Indirect Data : nothing worth mentioning

Data Presentation : vertical distribution chart of DO, pH and nutrient salts, vertical cross-section of DO, pH and nutrient salts and T-DO diagram

5) Primary Productivity Survey

The primary productivity index is generally shown in terms of the amount of chlorophyll-α. The classic method to determine the amount of chlorophyll-α is to establish water sampling points and to extract acetone from the filtered sample water. Other methods include ① electrical measuring at fixed stations using a fluoro-photometer and ② the continuous recording of data by feeding either pumped sampled water to the flow cell of the fluoro-photometer or by sampling water collected by a towed object equipped by a fluoro-photometer. Use of a radio-isotope such as C14 can also determine the activated primary productivity. In this case, sampled water is placed into a clear bottle and a dark bottle, injected with C14 and incubated at a water temperature and photo environment similar to the sampling point. The absolute C14 count is then measured by a scintillation counter to determine the amount of activated plant plankton. Although the original Namibian request included the provision of such equipment, it was decided not to take the requested equipment into the project due to reasons given later.

Data Processing

(a) Classic and Vertical Fluoro-Photometer Methods

Direct Data : chlorophyll-α count by layer

Indirect Data : nothing worth mentioning

Data Presentation: vertical distribution chart of chlorophyll-α and vertical cross-section of chlorophyll-α

(b) Sailing Method

Direct Data : surface or midwater chlorophyll-α count along survey grid line

Data Presentation : time-series graph and horizontal distribution of surface and/or midwater chlorophyll-α

6) Plankton Survey

While some objectives of phytoplanktons sampling are the same as those of the primary productivity survey, the phytoplankton survey also involve species identification. In general, the sampling of phyto plankton requires a plankton net. A large water sampler or pump may also be used but those method are uncommon. There are 2 methods of using a plankton net, i.e. ① vertical sampling at a fixed station and ② horizontal sampling at the midwater level while maintaining a constant depth. The sampled plankton is fixed by formalin in the case of both methods.

Data Processing

Direct Data : types and quantities of plankton

Indirect Data : changes of water mass

Data Presentation: : vertical and horizontal distribution chart of plankton mass and distribution chart of different species

7) Benthos Survey

A bottom grab is used to sample the benthos and living creatures are screened by a sieve and fixed.

Data Processing

Direct Data	:	types and quantities of benthos
Indirect Data	:	changes of water mass and benthic conditions
Data Presentation	:	horizontal distribution chart of benthos and distribution chart of different species

8) Demersal Survey

A soil sampler is also used for the demersal survey.

Data Processing

Direct Data	:	demersal conditions
Indirect Data	:	interference of types of demersal fish
Data Presentation	:	horizontal distribution chart of demersal conditions

(3) Equipment Required

Data on the ecology of fish, marine environment and biological conditions play an important role in any resources survey and evaluation. This basic research field requires a long-term commitment. As the main objective of the proposed research vessel is to estimate biomass of fishery resources by direct acoustic surveying and trawling, the equipment to be provided for the vessel should consist of that suited for this purpose. It is understood that survey equipment for basic research will be procured by the DRM as part of its efforts to consolidate marine research. Moreover, equipment which does not require direct installation on the vessel and which can be brought on-board by scientists depending on the research purposes is not included in the list of equipment to be provided under the Project.

Based on the above understanding, the equipment required is listed below under separate headings, i.e. (A) that to be provided under the Project and (B) that to be procured by the DRM.

	(A) Provided Under the Project	(B) Procured by DRM
1) Resources Size Survey		
(a) Sampling Method	fishing gear	weight scale, genital gland scale, length measure
(b) Acoustic Method	scientific sounder, sonar, acoustic tidal current meter	data post-processing system
2) Physical Survey		
(a) Classic & CTD Methods	Nansen water sampler, deep-sea reversing thermometer, salinograph, CTD with winch	other necessary equipment
(b) Sailing Method	thermo-salinograph	
(c) Meteorological Satellite Data	satellite image receiving unit	
3) Chemical Survey		
(a) Classic Method	rosette sampler, DO sensor (attached to CTD)	DO meter, pH meter, nutrient salt analyzer and others
4) Primary Productivity Survey		
(a) Classic Method	Rosette sampler, Calvert net (for vertical sampling), Bongo net (for horizontal sampling), flowmeter	filtering unit, centrifuge, spectro-photometer, deciccator and others
(b) Sailing Method	on-site fluoro-photometer	
5) Plankton Survey	Culvert net (vertical sampling), Bongo net (horizontal sampling)	microscope, counter
6) Benthos Survey	Eckmann bottom sampler	other necessary equipment
7) Demersal Survey	Smith-McIntire sampler	other necessary equipment

Note: The Government of Namibia requested the provision of equipment to survey basic productivity using the C14 method. The installation of such equipment on the proposed research vessel will require a special room and other facilities pursuant to the "Prevention of Radiation Damage Caused by Radio Isotope Act". As an extra substantial amount of funding and additional manpower are necessary to meet the legal requirements, no Japanese marine research vessel carries such equipment. Moreover, it is impossible to obtain C14 samples unless a technician who has successfully passed the radiation technician examination organized by the Japan Isotope Association is provided. Regulations on facilities dealing with radioactive materials in Japan are much more restrictive than in other countries. Consequently, the provision of the requested equipment under the Project is found to be impossible.

4.5 Main Design Items

The main design items and corresponding figures for the proposed research vessel are listed below.

(1) Vessel

Vessel Type : long forecastle, single deck stern trawler

Material : steel

Classification	:	Nippon Kaiji Kyokai (NK)
Overall Length	:	approximately 47.20m
Length (Lpp)	:	approximately 41.70m
Moulded Breadth (B)	:	approximately 8.30m
Moulded Depth (D)	:	approximately 3.10m
Gross Tonnage	:	approximately 485 tons
Main Engine Output	:	approximately 1,400 ps
Propeller	:	variable pitch propeller
Speed	:	approximately 11.5 knots
Fish Hold Capacity	:	approximately 51m^3 (inclusive of freezing room)
Fuel Tank Capacity	:	approximately 150m^3
Fresh Water Tank Capacity	:	approximately 55m^3
Complement	:	approximately 28

(2) Survey Equipment

Laboratories

Acoustic Laboratory	:	1
Dry Laboratory	:	1
Wet Laboratory	:	1
Fish Sample Processing Room	:	1

Fishing Apparatus

Bottom and Midwater Trawling Apparatus

Trawl Winch	:	2
Net Drum	:	2
Fishing Gear	:	1 set
Line Hauler for Crab Fishing	:	1

Oceanographic Equipment

General-Purpose Oceanographic Winch	:	1
Winch for CTD	:	1

Main Survey Equipment

Scientific Sounder : 1 set

Transceiver and processor unit:

38/120 kHz, Split beam

Acoustic integrater

Display unit: 14" colour CRT

Printer unit.

Scanning Sonar : 1 set

Sounding range	:	Approx. 60m - 2,000 m by range selector
Display	:	Approx. 14" colour CRT

Recording Echo Sounder : 1 set

Sounding range	:	Approx. 10m - 700 m
Display	:	Paper recording

Doppler Current Meter : 1 set

Measurement range	:	Current Max. 5 knot
		Ship's speed Approx.–10 to 20 knot

Current measurable at any depth between 5 ~ 200 m

Display	:	Approx. 14" colour CRT

Thermo-Salinograph : 1 set

Measurement range	:	Temperature Approx. –5 to 35 degree C.
		Conductivity Approx. 0 to 7 S/m
Accuracy	:	Temperature Approx. 0.02 degree C.
		Conductivity Approx. 0.001 S/m

With Data processing unit and Display unit

CTD and Rosette Sampler : 1 set

CTD

Measurement range	:	Conductivity Approx. 0 to 7 S/m
		Temperature Approx. –5 to 30 degree C.

With Data processing unit and Display unit DO sensor provided

Rossette sampler

Water sampling bottle 1.7 litre x 12 pcs.

Sampling commander

Reversing Water Sampler : 12 sets

Nansen water sampler : 1.3 liter

with reversing thermometer

Plankton Net : 2 sets

Bongo net

Diameter	:	Approx. 700 mm
Mesh size	:	Approx. 0.5 mm

CalVET net

Diameter	:	Approx. 270 mm
Mesh size	:	Approx. 0.3 mm

Lab. Fluoro-meter for Chlorophyll : 1 set

Measuring Chlorophyll-a in both lab. and field

Measurement range : 5ppb at minimum

Submersible Fluorometer : 1 set

Measuring Chlorophyll-a, underwater

Measurement range	:	0.01 — 100 μg/litre
Accuracy	:	±0.01 μg/litre

Light meter (Quantum meter) : 1 set

Composed of Multi-channel data logger

Quantum sensor

Underwater quantum sensor

Underwater cable Approx. 75m in length

Refrigerator (approx. 200 litter) : 1 set

Capacity	:	Approx. 200 liter
Temperature	:	Approx. 5 ~ 10 degree C.

Freezer (approx. 200 litter) : 1 set

Capacity	:	Approx. 200 liter
Temperature	:	Approx. –25 degree C.

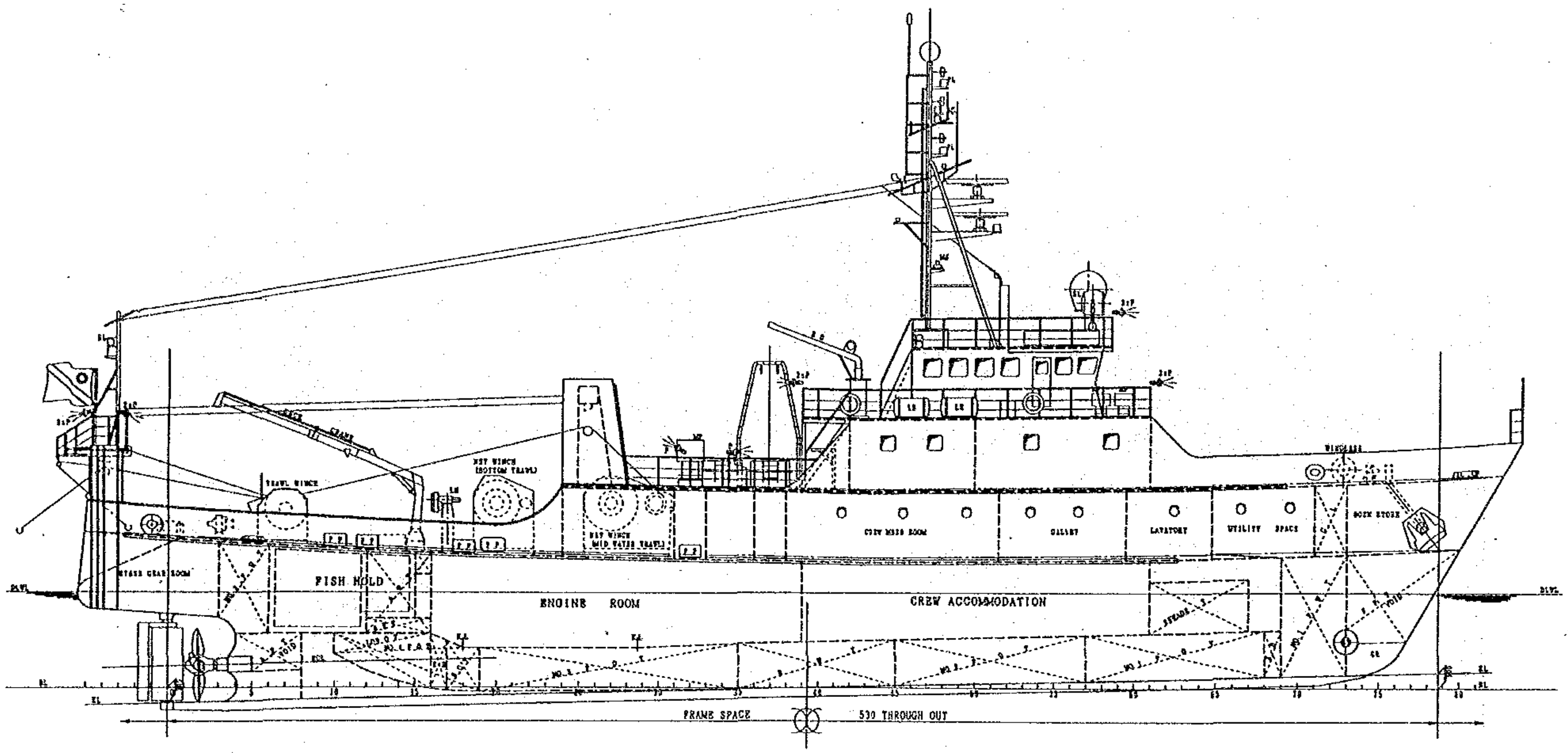
BASIC DRAWINGS

1. General arrangement of the vessel

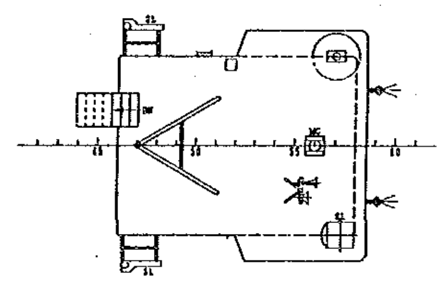
2. Bottom trawl net

3. Midwater trawl net

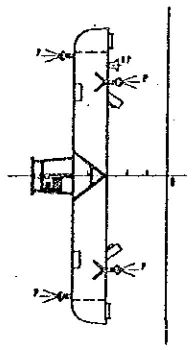
PRINCIPAL PARTICULARS	
LENGTH OVER ALL	47.20 m
LENGTH BET. P. P.	41.70 m
BREADTH MLD	8.30 m
DEPTH MLD	4.00 m
DRAFT MLD DESIGNED	3.10 m
GROSS TONNAGE	485 t
MAIN ENGINE	1400 ps
SERVICE SPEED	11.5 kt
COMPLEMENT	28 p



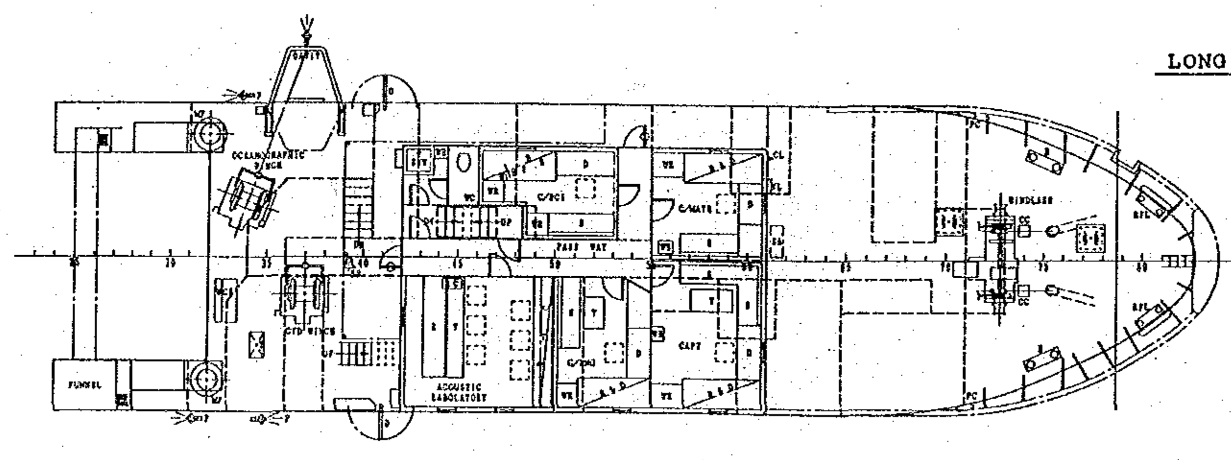
COMP. BR. DECK



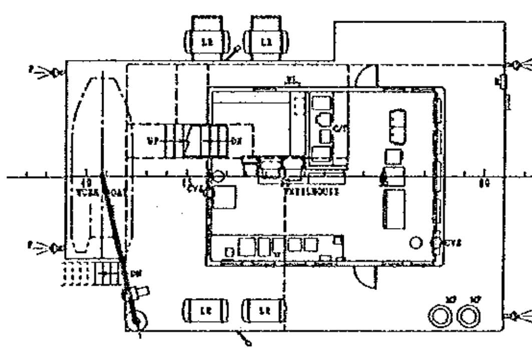
GALLOWS TOP



LONG FCLE DECK



NAV. BR. DECK

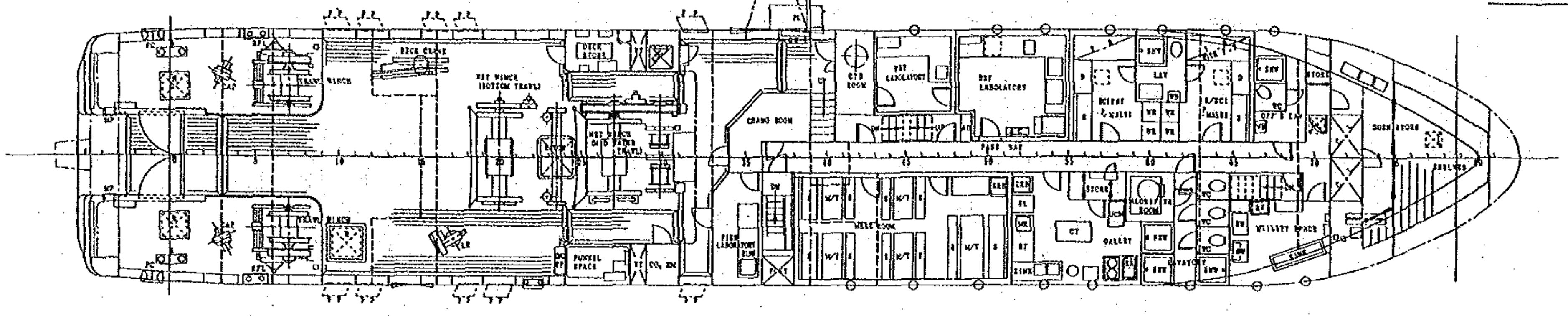


FISHERIES RESEARCH VESSEL

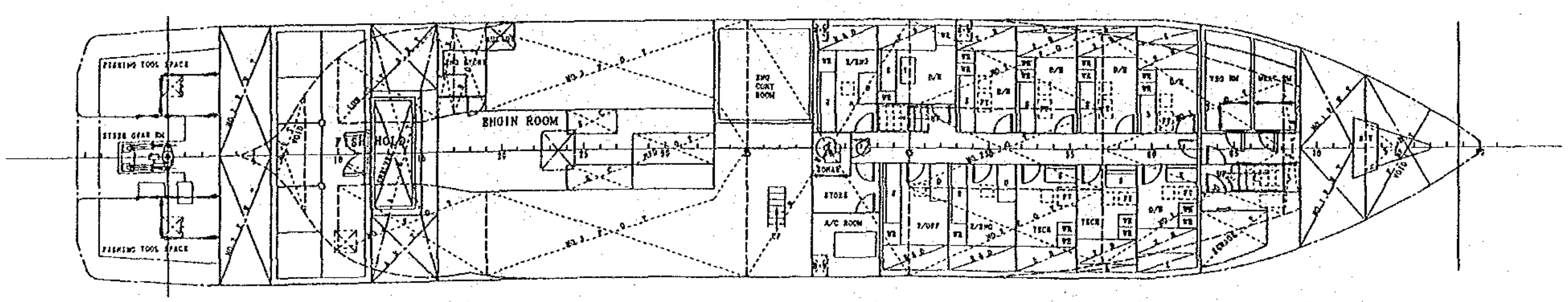
GENERAL ARRANGEMENT

SCALE 1/100

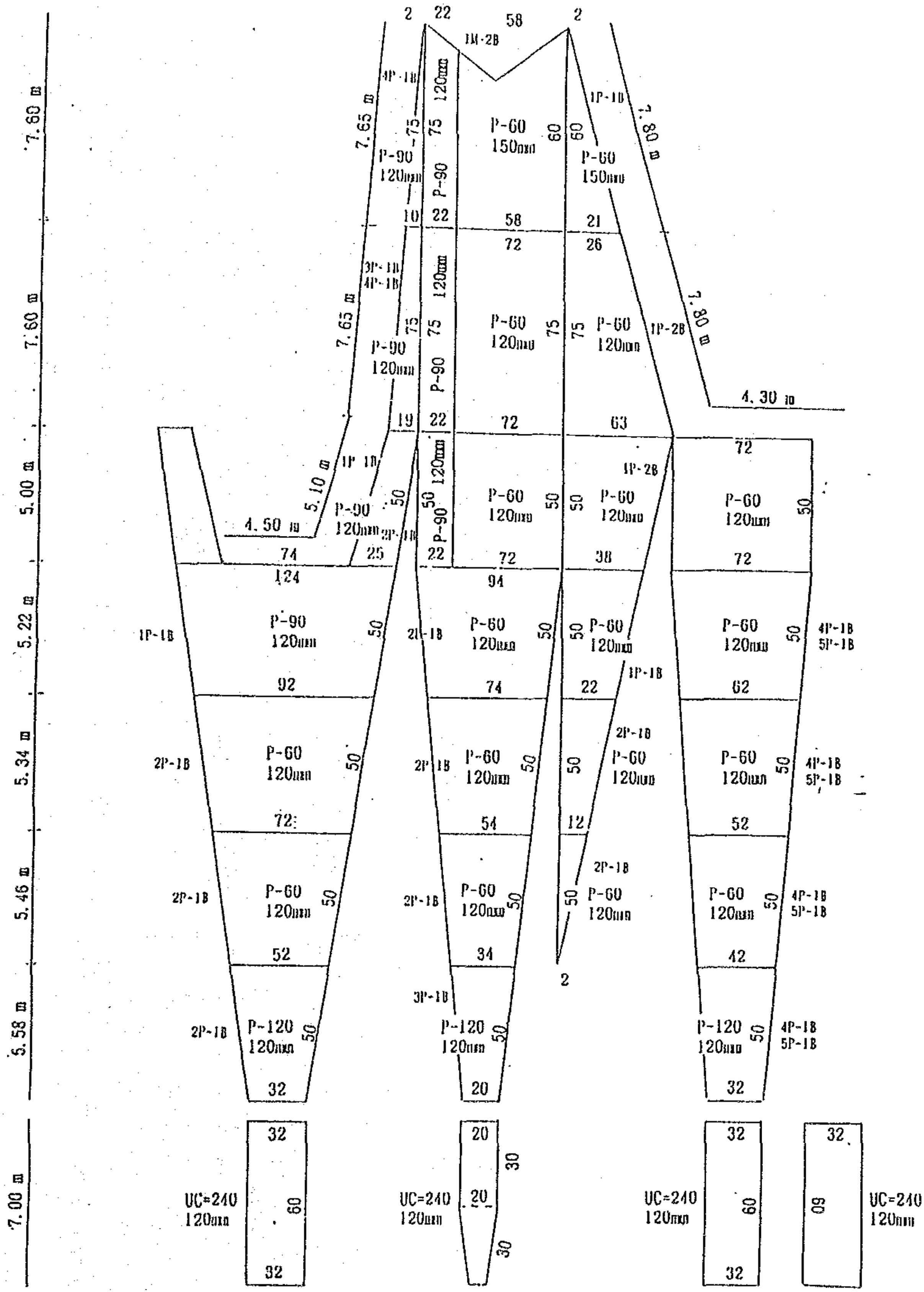
UPPER DECK



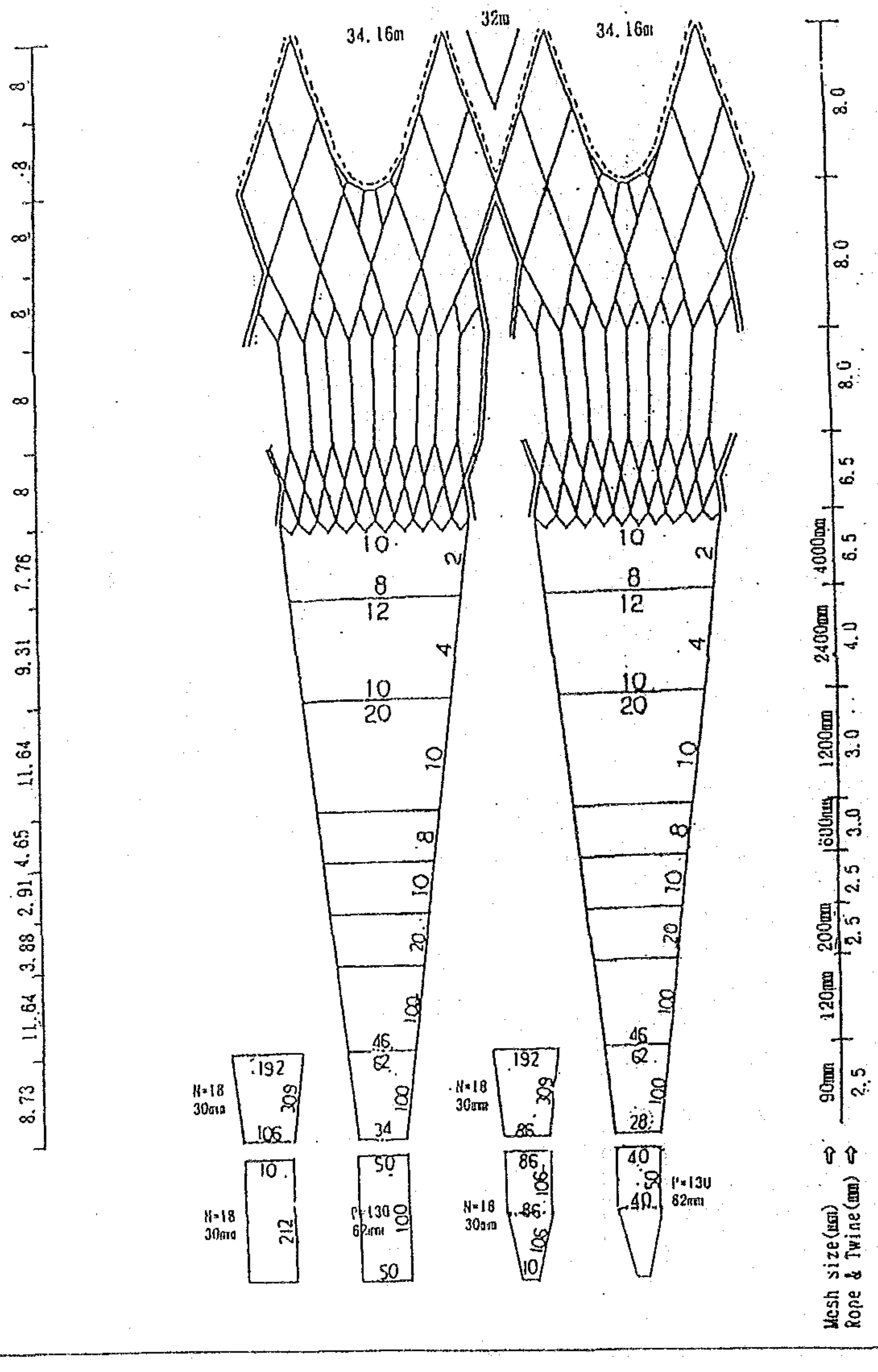
HOLD PLAN



BOTTOM TRAWL NET



MIDWATER TRAWL NET



4.6 Vessel Building Plan

(1) Building Policy

The proposed vessel is a multi-purpose research vessel which will conduct acoustic surveys using scientific sounders and fishing gear for sampling fish stock as well as oceanographic surveys in the Namibian EEZ. A high level of vibration, sound and bubble free technologies, proper seaworthiness and good manoeuvrability are, therefore, required to assist the vessel's survey functions.

A shipbuilding yard which has rich experience in the construction of marine research vessels and a highly capable design staff should be assigned to work on the construction of the vessel.

(2) Scope of Work to be Undertaken by Governments of Namibia and Japan.

1) Scope of Work to be Undertaken by Government of Japan

The scope of work to be undertaken by the Government of Japan in the case of the Project being implemented with Japanese grant aid cooperation is as follows.

(a) Construction of research vessel and necessary tests on the vessel in Japan.

(b) Provision of surveying equipment, fishing gear, spare parts, drawings and manuals.

(c) Transportation of the vessel and equipment described in (a) and (b) above to Namibia and payment of the transportation insurance premium.

(d) Provision of consultancy services for the detail design assistant for tendering and work supervision work.

2) Scope of Work to be Undertaken by Government of Namibia

The scope of work to be undertaken by the Government of Namibia in the case of the Project being implemented with Japanese grant aid cooperation is as follows.

(a) Obtaining of all necessary permission and approval for the possession of the new fishery resources research vessel and for the implementation of the Project.

(b) Swift customs clearance of the vessel and all equipment to be exported to Namibia under the Project and tax exemption for all such items.

(c) Inspection during the construction stage and completion stage by Namibian officials and all relevant costs.

(d) All other work necessary for the implementation of the Project but not listed in the scope of work to be undertaken by the Government of Japan.

(3) Shipbuilding Supervision

1) Implementation Plan

Upon signing of the E/N for the Project, the selected Japanese consultant will prepare the detailed project implementation plan through close consultations with the Project-related organizations in both countries. This plan will address the detailed design in line with the basic principles adopted in preparation of the tender documents and preparatory work conducted by the Namibian side.

This implementation plan will incorporate the optimal schedule which will allow the completion of the entire Project within the period specified by the E/N and will take in the account the period required to construct the vessel including procurement and delivery of the equipment.

The DRM will be responsible for the implementation of the Project and will conduct without delay all necessary work, including the contracts for consultancy and shipbuilding, banking and the issue of the letter of payment authorization.

2) Supervision

The consultant will organize the project team responsible for conducting the detailed design work and work supervision in line with the guidelines for grant aid provided by the Government of Japan and the consultancy agreement for the Project. This project team will conduct without delay all necessary work, including the approval of drawings, inspections at the shipbuilding yard and manufacturing factories and supervision of shipbuilding, etc., and will provide advice and guidance whenever necessary. Supervision of the shipbuilding work will be conducted by experts in accordance with the work progress.

3) Shipbuilding Schedule

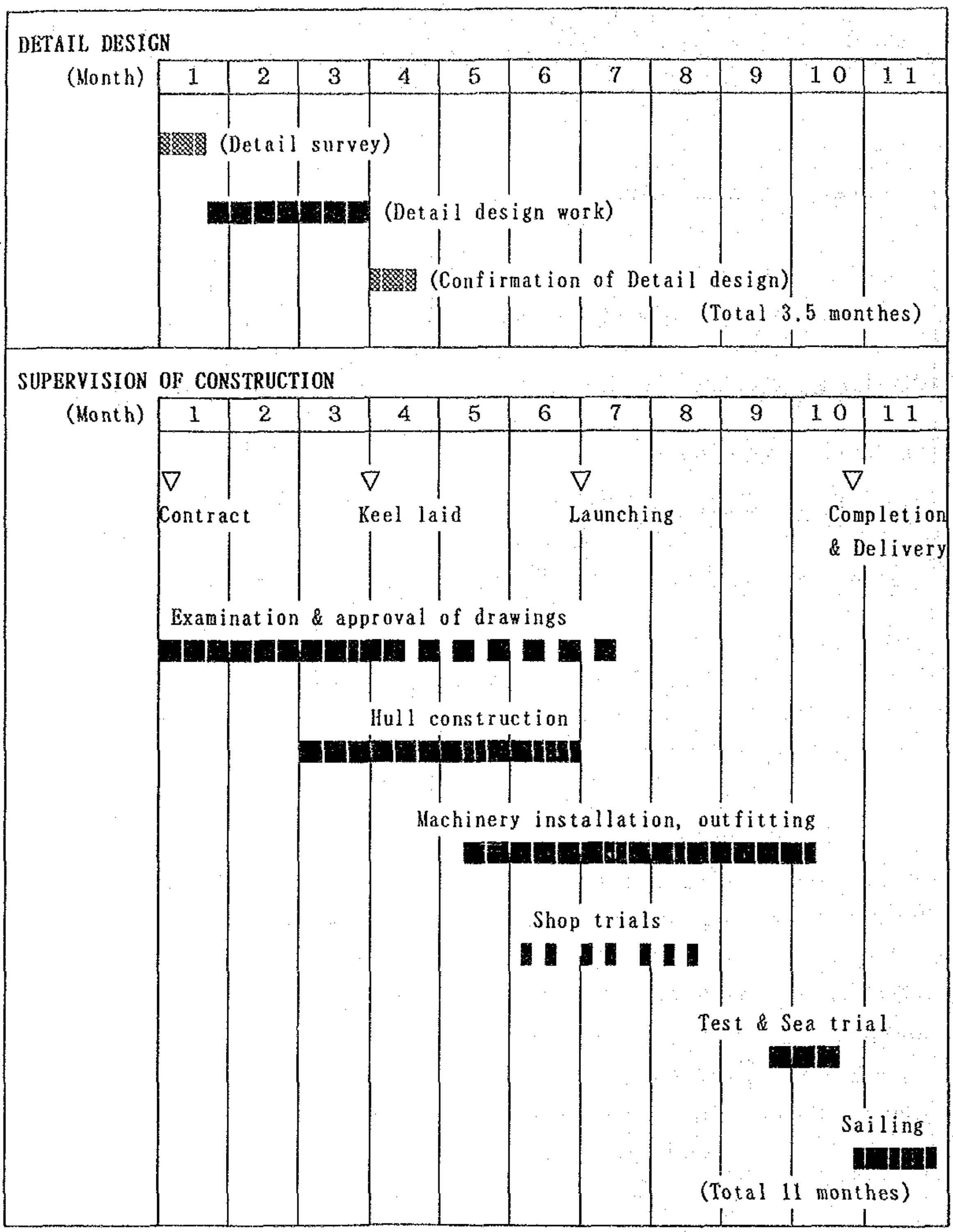
The shipbuilding schedule is shown in the project implementation schedule.

4) Transportation

Upon completion of the construction work, exportation and other necessary arrangements, the research vessel will sail from Japan to Port Luderitz in Namibia.

Project Implementation Schedule	
Consultancy Contract - Contract with Successful Bidder	: approx. 3 months
Construction Contract - Final Delivery	: approx. 9.5 months
(Contract - Keel Laid)	: (approx. 3 months)
(Keel Laid - Launching)	: (approx. 3 months)
(Launching - Completion)	: (approx. 3.5 months)
Delivery on Sea	: approx. 40 days

PROJECT IMPLEMENTATION SCHEDULE



CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Government of Namibia is aware of the importance of fisheries to its national development and intends to achieve effective utilization of the fishery resources within EEZ through appropriate control procedures on fishing. Such control of resources and fishing operations requires basic data on fish resources, such as the size and distribution of the available species and the maximum sustainable yield. This project proposes the construction of a new research vessel to facilitate and improve the scope of such fish resource surveys.

It was only been 2 years since the Government of Namibia, after its independence, commenced its own marine administration and began to create a research system for fishery resources control. The Ministry of Fisheries and Marine Resources (MFMR) is currently trying to secure scientists to conduct fisheries resource evaluation and oceanographic surveys and is also in the process of constructing a new laboratory at Swakopmund. In line with the consolidation of the MFMR's research capacity, the original request included many facilities and much equipment to be provided with the vessel. In preparing the basic design for the Project, however, it was decided that the main objective was to replace the existing research vessel, the "Benguela" in order, to allow for efficient estimating of biomass of fishery resources by sampling and acoustic surveying. The vessel in question will be equipped with bottom and midwater trawling apparatus, acoustic equipment including scientific sounders and other equipment for surveying marine life and the oceanographic environment.. This is vital to expand the range of the survey work conducted by the Benguela and also to allow for fish surveys at depths of over 100 m which is currently beyond the "Benguela's" ability. The implementation of the Project is expected to have the following positive effects.

(1) Expansion of Survey Area and Progress in Resources Assessment.

The introduction of the new research vessel will enable the expansion of surveys in terms of both area and depth compared to the present limited survey scope because of the modest net drawing power of the R/V Benguela. In particular, the prospect of conducting mid depths and bottom fish surveys which are beyond the capability of the Benguela will make it possible to determine the distribution and size of mid depths and bottom fish resources. The continuous fisheries and oceanographic survey to be conducted by the new vessel over a long period of time will result in the closer understanding of the dynamics of the resources in relation to the marine environment and provide accurate estimations of the biomass and fluctuations in fish stock.

(2) Improved Efficiency of Marine Administration

The fisheries resources data to be collected by the new vessel will provide the basis for appropriate administrative regulations and guidelines for fishing permits, fishing seasons, grounds, quotas, size of fishing gear and number of fishing boats allowed, etc. thus preventing the depletion of resources, and also making marine administration more efficient and effective.

(3) Development of New Businesses and National Economy

Coupled with government measures to foster the fisheries industry, the fishery resources information provided by the new vessel will enable the development of new businesses in this sector, and will create new employment opportunities to assist the development of the national economy.

5.2 Recommendations

The following recommendations are put forward to make the operation of the new vessel both efficient and effective and to ensure the above-mentioned positive effects.

(1) Training of Operating Crew

It is essential that the crew members of the new vessel have sufficient navigation and fishing experience for the operation of the vessel. At present, Namibian seamen are not well experienced and lack the necessary qualifications (licenses) to operate a vessel. The R/V "Benguela" is, currently operated by Icelandic experts who fill the positions of captain, chief engineer, chief mate and second engineer, and who instruct the local crew members. For the immediate future, at least, it is necessary to transfer the Icelandic and Namibian crew of the R/V "Benguela" to the new vessel to ensure its safe and effective operation. Such technical cooperation should be extended to the operation of research vessel. Moreover the MFMR has to take the other necessary measures listed below to man the new vessel effectively.

- Recruitment of local seamen with appropriate qualifications and/or experience.

- Improvement of the working environment for seamen, including better wages.

- Training and education of local seamen to obtain the necessary qualifications.

(2) Maintenance

Safe and effective operation of the new vessel will require regular maintenance of the hull, fittings and equipment. Crew members must be aware of the importance of maintenance work to ensure a high maintenance level. Such awareness must be instilled in each seaman during training and education courses.

At the same time, the provision of adequate on-shore maintenance and repair facilities is important. The MFMR should employ an expert with extensive knowledge and experience in this field to establish a reliable maintenance system, and procedure for the vessels it owns so that any request for repair or servicing by a captain or chief engineer can be met with a prompt response and good technical support.

(3) Reinforcement for New Research Vessel

The introduction of the new research vessel will make it possible to conduct bottom and midwater fish sampling which the "Benguela" can not. Nevertheless, it is extremely difficult for a single research vessel to cover the vast sea area off the Namibian coast to identify the area's available resources. The size of the new vessel suggests that it should not conduct surveys on small pelagic fish in shallow coastal areas for safety. Data on pelagic fish in shallow coastal areas should be collected from small fishing boats operating in these areas. In the future, however, the procurement of small research vessels with a shallow draft and long cruising range will be necessary in order to carry out pelagic fish surveys in the inshore area.

Finally, the new vessel is mainly designed to conduct fishery resources surveys by means of trawl sampling and acoustic surveying. With the consolidation of the research capability in terms of both manpower and equipment, it may be desirable to study the possibility of acquiring another vessel which is more appropriate to the task of conducting basic research in the fields of marine biology and oceanography.

(4) Consolidation of Research Facilities with the Planned Vessel

The DRM has been consolidating its marine survey and research capability by means of recruiting the relevant staff, constructing a new research centre at Swakopmund and planning the relocation of the research centre at Luderitz. It will be important for the DRM to prepare an integrated, long-term research plan which covers such basic fields as primary productivity, ecology and the marine environment and to introduce the facilities and equipment required for the research plan.

This Project will introduce the planned research vessel with several laboratories in view of the recognized importance of basic research on marine biology and environment. The scope of the surveys and experiments suggested by the DRM is; however, beyond the capability of the new research vessel. The improvement of land research facilities on land and also by improved research linkage between the planned research vessel and the land research facilities should be implemented. This linkage is particularly important for the surveys on marine biology and environment to be conducted by the research vessel. The marine research system and facilities should be improved taking the research linkage into consideration.

(5) Strengthening of Resources and Fisheries Control System

The improved resources survey capability will provide much more reliable information on the conditions of resources, biomass and TAC's, which in turn will facilitate the precise control of fishing right, quota, fishing seasons, fishing grounds and fishing gear, etc., thus facilitating fisheries control system. In order to create such effects, it is also indispensable for the MFRM to strengthen the fishing control system including surveillance for effective execution of the fishing policies and regulations.

APPENDIX

1. Member List of the Study Team
2. Survey Schedule
3. List of Personnel Net for the Study
4. Minutes of Technical Discussions
   (Requests on the specifications of the vessel)
5. Minutes of Discussions
6. Current Conditions of R/V Benguela

Appendix-1. Members List of the Study Team

1-A Field Survey Mission

Team leader	Akira Kuroiwa	Senior Fishing Boat Inspector, Fishing Boat Division, the Fisheries Agency
Project coordinator	Sasaki Katsuhiro	Deputy Director, Second Basic Design Study Division, Grant Aid Study and Design Dept., Japan International Cooperation Agency
Ship designer	Tsuyoshi Kannno	Overseas Agro-Fisheries Consultants Co., Ltd.
Fisheries research planner	Kazuyuki Kawashima	Overseas Agro-Fisheries Consultants Co., Ltd.
Engine designer	Akinori Shigenaka	Overseas Agro-Fisheries Consultants Co., Ltd.
Outfitting planner	Kazumi Iida	Overseas Agro-Fisheries Consultants Co., Ltd.

1-B Draft Report Explanation Mission

Team leader	Tsuneo Kokubu	Assistant Director, Office of the Overseas Fisheries Cooperation, Fisheries Agency
Project coordinator	Shuji Ono	Second Basic Design Study Division, Granny Aid Study & Design Department, Japan International Cooperation Agency
Ship designer	Tsuyoshi Kannno	Overseas Agro-Fisheries Consultants Co., Ltd.
Outfitting planner	Kazumi Iida	Overseas Agro-Fisheries Consultants Co., Ltd.

Appendix-2. Survey Schedule

2-A Field Survey

Date	Place	Activity
Aug 25 (Tue)	Harare - Windhoek	Arrived at Windhoek
26 (Wed)	Windhoek	Meeting with Director of Resource Management (DRM) Arrangement of survey schedule
27 (Thu)	Windhoek - Wakopmund	Visited the National Planing Committee (NPC) Discussions with the scientists of DRM for the project and specifications of the vessel.
28 (Fri)	Swakopmund	Discussions with the scientists of DRM on the project and specifications of the vessel. Surveyed port facilities and dockyard/works in Walvis Bay.
29 (Sat)	Swakopmund	Surveyed R/V Benguela in Walvis Bay
30 (Sun)	Swakopmund	Team meeting
31 (Mon)	Swakopmund	Discussions with the scientists of DRM on the project and specifications of the vessel
Sept 1 (Tue)	Swakopmund - Luderitz	Visited the harbor office and the Marine Training Center in Luderitz Surveyed the port facilities
2 (Wed)	Ludiritz - Windhoek	Visited fisheries companies and fish processing factories,
3 (Thu)	Windhoek	Discussions with DRM on the project and specifications of the vessel
4 (Fri)	Windhoek	Discussion with DRM on the project and specification of the vessel Conclusion of the minutes
5 (Sat)	Windhoek	Team meeting
6 (Sun)	Windhoek - Harare	Left Windhoek

2-B Draft Report Explanation

Date		Place	Activity
Nov	15 (Sun)	Harare - Windhoek	Arrived at Windhoek
	16 (Mon)	Windhoek	Meeting with the Directorate of Resource Management (DRM) Explanation/discussion on the draft report and design of the vessel
	17 (Tue)	Windhoek	Discussion on the design of the vessel
	18 (Wed)	Windhoek	Meeting the DRM for the project, Conclusion of the minutes
	19 (Thu)	Windhoek	Visited the Fisheries Research Center in Swakopmund, and surveyed R/M Benguela in Walvis Bay
	20 (Fri)	Windhoek	Meeting with DRM for the project Left Windhoek

Appendix-3. Lift of Personnel Met for the Study

3-A Field Survey

Ministry of Fisheries and Marine Resources

Mr. Helmut Angula	Minister of Fisheries and marine Resources
Mr. Calle Schlettwien	Permanent Secretary
Mr. Kan Kondi	Deputy Permanent Secretary
Dr. B.W. Oelofsen	Acting Director, Directorate of Resource Management
Dr. Gert Cloete	Chief Marine Researcher
Mr. David Boyer	Principle Marine Biologist
Mr. E. Klingelhoeffes	Principle Marine Biologist
Mr. C. Beyers	Chief Marine Technicain
Mrs. Noli	Marine Biologist

Ministry of Works, Transport and Communication

Mr. L.A. Jonker	Chief Control Officer, Marine Affairs, Department of Transport

Icelandic International Development Agency (ICEDA)

Mrs. D. Stefansdottir	Project Manager
Mr. V. Helgason	Fisheries Biologist
Mr. H. Valdimarsson	Marine Scientist
Mr. S. A. Shedarsen	Captain, R/V Benguela
Mr. S. Gunnarsson	Chief Engineer, R/V Benguela

R. N. Barnmwell & Association (Marine engineering consultant in Walvis Bay)

Mr. J. Owen	Marine surveyer & Cargo superintendent

Seaflower Lobster Corporation Ltd.

Mr. P. Schwieger	Managing Director

Luderitz Harbour Office

Capt. B. Radfort	Harbour Master.

Rossing Foundation, Luderitz

Mr. G. Kings	Project Manager, Maritime Training Center

3-B Draft Report Explanation

Ministry of Fisheries and Marine Resources

Mr. Kan Kondi	Permanent Secretary
Dr. J. D. Jurgens	Director, Directorate of Resource Management
Dr. B. W. Oelofsen	Acting Director, Directorate of Resource Manager
Dr. Gert Cloete	Chief Marine Researcher
Mr. David Boyer	Principle Marine Biologist
Mr. E. Klingelhoeffes	Principle Marine Biologist
Dr. Michael O'Toole	Seniore Fisheries Biologist
Mr. V. Helgason	Consultant, Fisheries Biologist, (ICEDA)

Appendix-4. Minutes of Technical Discussions
(Requests on the specifications of the vessel)

MINUTES OF A MEETING HELD BETWEEN SCIENTISTS OF THE MINISTRY OF FISHERIES & MARINE RESOURCES AND MEMBERS OF THE BASIC DESIGN TEAM OF JICA

SWAKOPMUND 31 AUGUST 1992

SPECIFICATIONS FOR THE PROPOSED FISHERIES RESEARCH VESSEL TO BE BUILT BY JAPAN : AMENDMENTS AS REQUESTED BY THE NAMIBIAN DIRECTORATE OF RESOURCE MANAGEMENT

Reference is being made to the following document :

"Outline Specifications : Fisheries Research Vessel for the Republic of Namibia" : Japanese International Cooperation Agency, August 1992

The amendments to the above report for a Research Vessel, are proposed by the Ministry of Fisheries and Marine Resources (Namibia) below.

It has become clear during the discussions that it will be very difficult if not impossible to fit all our needs into a vessel of 43,5 m. Certain additions to the basic design that were tabled by the Basic Design Team are needed as is listed below.

MAJOR AMENDMENTS

- Fish laboratory needed
- Size of acoustic/electronic laboratory to be increased
- Stern deck too low for trawling in rough weather
- Two net trawl drums : pelagic and demersal nets
- Changing room : for crew and scientific team working on deck
- Provision for female scientists : toilet and shower
- Communal bathroom : more showers, toilets and wash basins
- Facility for long lining : crab research
- More single cabins for officers

DETAIL DISCUSSION

1. **Main Dimensions**

The proposed size of the vessel, namely 43,5 m, seems to be the major stumbling block. However, should all the needs be met as put forward by the Namibian and Icelandic delegation, the proposed size would be acceptable.

2. **Hold and Refrigeration**

To include a blast freezer : 50 kg capacity for biological samples.

3. **Outfitting & Deck Machinery**

The stern is deck is too low : propose a double deck construction.

4. **Accommodation**

(a) **Crew, Scientists & Technicians**

Crew :

1 Captain	1 x cabin (single)
1 Chief Mate	1 x cabin (single)
1 Chief Engineer	1 x cabin (single)
1 2nd Officer	1 x cabin (single)
1 2nd Engineer	1 x cabin (single)
1 3rd Engineer	1 x cabin (single)
12 Deckhands	6 x cabins (double)

Note : Engineers use their cabins as offices

Scientists/Technicians :

1 Chief Scientist	1 x cabin (single)
1 Senior Female/Male Scientist	1 x cabin (single)
2 Female/Male Scientists	1 x cabin (double)
4 Technicians	2 x cabin (double)

Note : Female scientists : separate ablution facilities preferred

Communal bathroom to include at least :

4 Showers
4 WC's
4 Wash basins

(b) **Air Conditioning**

Not necessary to have a cooling system for all rooms. In the electronic/acoustic laboratory a stable temperature of 21°C is to be maintained.

5. **Fishing Gear / Tools & Oceanographic Research**

(a) **Fishing Gear and Tools : Trawl**

During pelagic and demersal surveys both mid-water and bottom trawl nets are required. Thus two net drums are essential. Net sonde to be included, thus an auto-trawl not absolutely necessary, but is preferred.

(b) **Oceanographic Equipments and Tools**

- CTD specifications : SBE 9 Plus
- Digital salinometer : Portasal 8401
- 2 x Wire-out indicators (m) to be installed on each hydrographic winch
- Need space for storing Nansen bottles and CTD equipment

6. <u>Navigation Aids & Fishing / Oceanographic Electric / Electro Equipment</u>

(a) **Namibian Aids & Communication Equipment**

Speed log to be provided.

(b) **Fishing / Oceanographic / Electric Equipment**

ACOUSTIC / ELECTRONICS LABORATORY

The following is a list of the equipment and facilities which will be in the acoustics/electronics laboratory once the new research vessel is fully operations **(items marked * can be transferred from the R/V Benguela).**

EK 500 echosounder and integrator

B E I post-processing system

* EK 400 echosounder and QD integrator

* ES 400 echosounder

Sonar - master unit and display

SST thermograph

SST salinograph

CTD data-logger and control unit

Rosette sampler control unit

Video plotter

* GPS display

* Trip counter

Fish measuring data-logger

* 2 x PC's

Photocopier

* Oscilloscope

Mapping/drawing table (with light table)

Telephone

Intercom

Spare parts/tools

Drawing/scratch board

Book-rack

Much of this equipment will be mounted in standard floor to ceiling 19" racks. It is estimated that four racks will be required. If the PC's are also mounted in racks, a fifth would be required. These should be free-standing with access to front and rear.

Other equipment such as the photocopier will be on cabinets or working desks.

A space of at least 4 m x 3 m will be required to accommodate this equipment. If working space for analysis of echo-sounder rolls, planning routes, writing reports, mapping, etc, is to be provided the space will need to be increased to about 4 m x 5 m.

7. <u>Painting</u>

Accepted as recommended.

8. <u>Machinery</u>

(a) **Main Engine, Generators & Electricity**

<u>To be installed</u> :

1 x Generator with main engine

1 x Generator with auxiliary engine

1 x Generator (small) for use in harbour

(b) Power source to be 380 vaults (50Hz) : 3 phase.

(c) A control room in the engine room is seen as a priority : noise levels must be reduced.

(d) **Systems : Lubricating Oil System**

To install an oil purifier.

(e) **Cooling Water System**

To install a cooling system which uses as little sea water as possible, due to corrosion factor.

(f) **Fresh Water, Hot Water and Sanitary Water Supply System**

It is recommended that the hot water be heated by the 'exhaust system' and not electrically. However, the electric heater to be kept as a backup.

(g) **Pollution Prevention Measures**

Space to place a container for non-degradable garbage. Garbage compactor a necessity : to minimize space problem.

(h) **Machine Tools, etc.**

A workshop is necessary.

A metal cutting circular saw (circular arm saw) to be provided. The welding machine of 150 Amps seems to be too low.

GENERAL

Reference should also be made to the minutes of the meeting held on 27 and 28 August 1992, at Swakopmund, with the Japanese Delegation and Namibian and Icelandic representatives.

Appendix-5. Minutes of Discussions

5-A At the Field Survey

MINUTES OF DISCUSSIONS

THE BASIC DESIGN STUDY

ON

THE PROJECT OF BUILDING A FISHERIES RESEARCH VESSEL

FOR

THE REPUBLIC OF NAMIBIA

Based on the result of the Preliminary Study, the Japan International Cooperation Agency (JICA) decided to conduct a Basic Design Study on the Project of Building a Fisheries Research Vessel (the Project).

JICA sent to Namibia a study team, headed by Mr Akira Kuroiwa, Senior Fishing Boat Inspector, Fishing Boat Division, Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, and is scheduled to stay in the country from August 26 to September 6, 1992.

The team held discussions with the officials of the Government of Namibia and conducted a field survey at the study area.

As a result of discussions and the field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed with further studies and prepare the Basic Design Report.

Windhoek, September 04, 1992

黒岩 穆

Mr Akira Kuroiwa
Leader
Basic Design Study Team
JICA

Dr R Kankondi
for Permanent Secretary :
Ministry of Fisheries
& Marine Resources

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance Namibia's capability for stock assessment and research on the fisheries resources in the Namibian EEZ to facilitate the proper management of the resources on a sustainable basis.

2. Project Area

The vessel will operate within Namibia's 200 nautical mile EEZ.

3. Registration and Home Port of the Vessel

The vessel is registered in Lüderitz (Annex 1).

4. Responsible Organization, Executing Organization

(1)	Responsible organization :	Ministry of Fisheries & Marine Resources (MFMR)
(2)	Executing organization :	Directorate of Resource Management, MFMR

5. Project Components Agreed by Both Parties

Main project components agreed through discussions between the Namibian side and the team are shown in Annex 2.

6. Japan's Grant Aid System

(1) The Namibian side has understood the Japanese Grant Aid system as explained by the team.

(2) The Namibian side will take all necessary measures described in Annex 3, for the smooth implementation of the Project on the condition that the Government of Japan decides to extend the Grant Aid for the Project.

7. Further Schedule

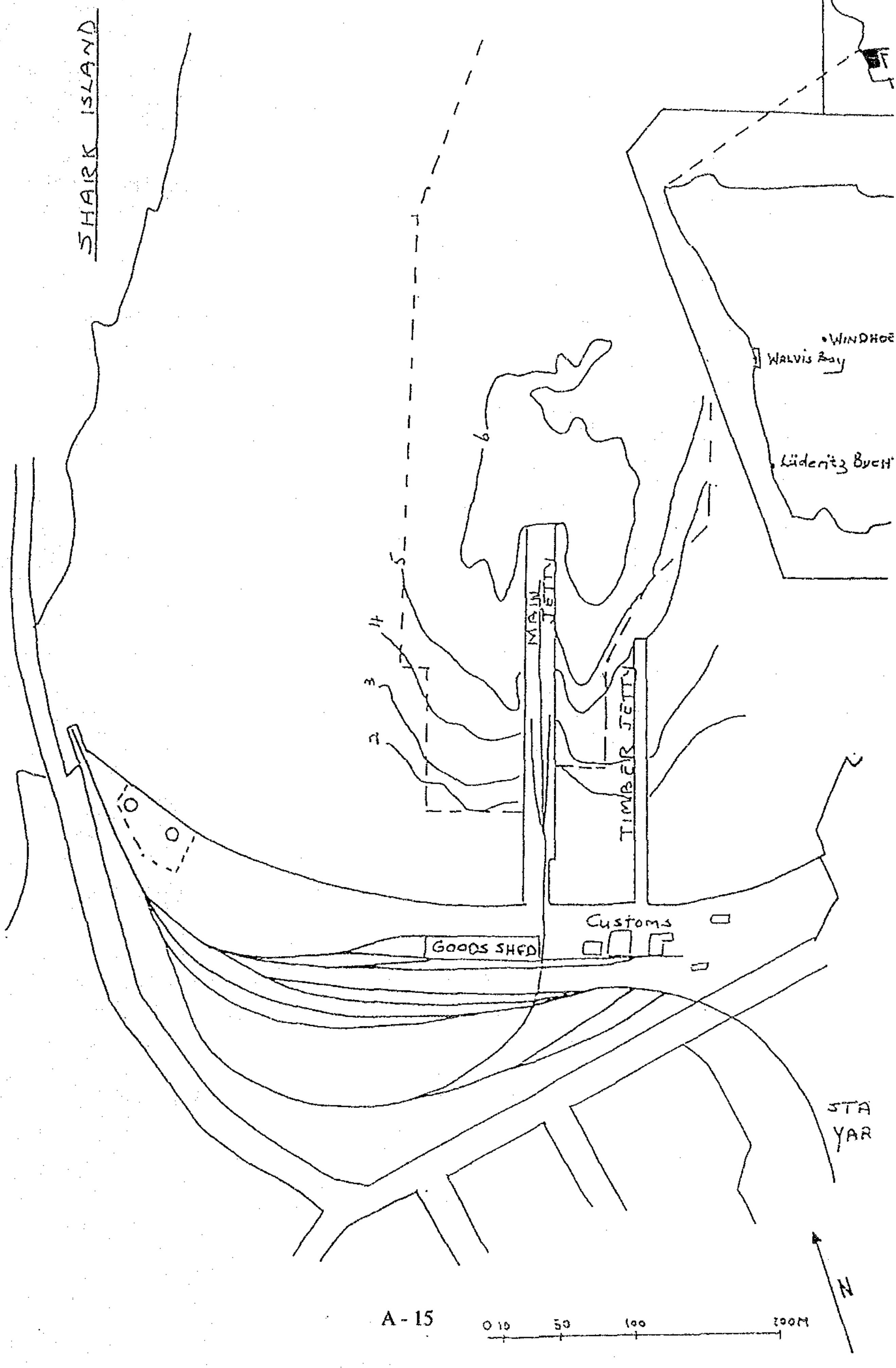
The team will draft the Final Report in compliance with the confirmed items through detailed study in Japan and send it in draft form for confirmation to the Government of Namibia by the end of October 1992. The Final Report will, after it has been approved in Japan, be submitted to the Namibian Government by the beginning of January 1993.

8. Appointment of Officer and Crew for Vessel

In order to properly operate and maintain the vessel, the Government of Namibia will appoint the necessary number of duly qualified officers and crew before arrival of the vessel in her home port.

ANNEX I

LUDERITZ HARBOUR



ANNEX 2

1.	Purpose of Vessel	:	To conduct surveys on fisheries resources by scientific echo sounding and trawl fishing.
2.	Type of Vessel	:	Fisheries research vessel with single screw and long forcastle.
3.	Principal Dimensions		
	Length overall	:	Approximately 43,50 m
	Depth moulded	:	Approximately 4,00 m
	Draft designed moulded	:	Approximately 3,10 m
4.	Gross Tonnage	:	Approximately 426 t
5.	Capacity (F O tank)	:	Approximately 150 m^3
6.	Cruising Speed	:	Approximately 11,5 knots
7.	Rules Applied for Construction	:	Nippon Kaiji Kyokai (NK)
8.	Compliment	:	26 persons

ANNEX-3: Necessary obligations to be taken by the Government of Namibia in case Japan's Grant Aid is executed.

1. To conclude Banking Arrangement (B/A) with an authorized foreign exchange bank in Japan and open the account after signing of the Exchange of Note on the Project(E/N).

2. To bear commssions to the Japanese foreign exchange bank for the banking services, such as issue of Authorization to Pay(A/P),based upon the B/A.

3. To provide necessary permissions, licenses and other authorizations for smooth implementation of the Project.

4. To accord Japanese nationals whose services may be required in connection with the delivery of the vessel and services under the verified contract such facilities as may be necessary for their entry into the Namibia and stay therein for the performance of their work.

5. To excempt Japanese Nationals from custums duties, internal taxes and on the fiscal levies which may be ipmosed in the Namibia with respect to the implementation of the Project and services under the verified contracts.

6. To ensure the immediate entry of the vessel to the home port on her arrival from Japan and prompt custums clearance, registration, and other necessary procedure s for the vessel at the home port in Namibia.

7. To maintain and use properly and effectively that the vessel constructed and equipment purchased under the Grant.

8. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment.

9. To coordinate and solve any matters which may arise with third party and inhabitants living in the Project area during implementation of the Project.

ANNEX 4

ABSTRACT OF POINTS DISCUSSED BETWEEN SCIENTISTS OF THE MINISTRY OF FISHERIES & MARINE RESOURCES AND THE JICA BASIC DESIGN TEAM ON WHICH COMPROMISES COULD NOT BE REACHED

The three major issues are :

1. The size of the vessel. It is the opinion of the Namibian Ministry of Fisheries and Marine Resources that, after having gone through the exercise of trying to fit the needs stipulated by the Namibians into the 43.5 m vessel proposed by the Basic Design Team, that the vessel is too small. It is strongly motivated by Namibia that the size should be reconsidered in spite of the fact that the Basic Design Team maintains that an increase in size is not possible.

2. The number of net drums. The request from Namibia to have two net drums and the difficulty to fit this on the vessel is closely linked to (1) above.

3. The free board on the trawl deck. The proposal by the JICA team to redesign the stern and trawl deck to increase the free board <u>may</u> solve the problem of too little free board. Namibia, however, strongly urges Japan to reconsider this aspect of the design and to allow for an alternate design which will offer more free board on the trawl deck.

Reference is being made to three documents, namely :

1. "Outline Specifications : Fisheries Research Vessel for the Republic of Namibia" : Japanese International Co-operation Agency, August 1992.

2. Minutes of a meeting held between scientists of the Ministry of Fisheries and Marine Resources and members of the Basic Design Team of JICA.

3. "Comments on outline of specifications of the Fisheries Research Vessel for the Republic of Namibia" prepared by the team and dated 4 September 1992.

5-B At the Draft Report Explanation

MINUTES OF DISCUSSION

BASIC DESIGN STUDY ON THE PROJECT OF BUILDING A FISHERIES

RESEARCH VESSEL FOR THE REPUBLIC OF NAMIBIA

(CONSULTATION ON DRAFT REPORT)

In September 1992, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on the Project of Construction a Fisheries Research Vessel for the Republic of Namibia (hereinafter referred to as "the Project"). Through a series of discussions, field surveys, and technical examination of the results in Japan, has designed the appropriate plan for the Project and prepared the draft report of the Basic Design Study.
In order to explain to and consult with the Government of Namibia the components of the draft report, JICA sent to Namibia a study team, headed by Mr. Tsuneo Kokubu, Assistant Director, Office of The Overseas Fisheries Cooperation, Fisheries Agency, Ministry of Agriculture, Forestry, and Fisheries, scheduled to stay in the country from November 15 to 20,1992.
As a result of the discussions, both parties confirmed the main items described on the attached sheets.

Windhoek, November 19 ,1992

MR TSUNEO KOKUBU
LEADER
DRAFT REPORT EXPLANATION TEAM
JICA

pp DR R KANKONDI
PERMANENT SECRETARY:
MINISTRY OF FISHERIES AND
MARINE RESOURCES

ATTACHMENT

1. Components of Draft Report

The Government of Namibia has fully agreed to and accepts the components of the draft report compiled and proposed by the Team.

2. Japan's grant aid system

(1) The Government of Namibia has understood the system of Japanese Grant Aid as explained by the Team.

(2) The Government of Namibia will take the necessary measures, described in Annex I for the smooth implementation of the Project on condition that the Grant Aid assistance is extended to the project by the Government of Japan.

3. Further schedule

The team will make a Final report in accordance with the confirmed items, and sent it to the Government of Namibia around January, 1993.

ANNEX-1

Necessary measures to be taken by the Government of the Republic of Namibia to facililate the complementation of the grant aid from Japan should the project be approved.

1. To conclude Banking Arrangement (B/A) with an authorized foreign exchange bank in Japan and open an account after the signing of the Exchange of Note on the Project (E/N).

2. To bear commissions to the Japanese foreign exchange bank for the banking services, such as issue of Authorization to Pay (A/P), based upon the B/A.

3. To provide necessary permissions, licenses and other authorizations for smooth implementation of the Project.

4. To accord Japanese Nationals whose services may be required in connection with the delivery of the vessel and services under the verified contract such facilities as may be necessary for their entry into the Namibia and stay therein for the performance of their work.

5. To exempt Japanese nationals from customs duties, internal taxes and on the fiscal levies which may be imposed n Namibia with respect of the implementation of the Project and services under the verified contracts.

6. To ensure immediate entry of the Vessel to her home port on her arrival from Japan and prompt customs clearance, registration, and processing of necessary procedures for the vessel at her home port in Namibia.

7. To effectively and properly operate and maintain the vessel constructed and the equipment purchased under the Grant.

8. To bear all the expenses other that those to be borne by the Grant, necessary for construction of the facilities as well as the transportation and the installation of the equipment.

Appendix-6. Current Conditions of R/V Benguela

R/V Benguela is the only large, steel-made fishery resources research vessel currently owned by the Government of Namibia. Constructed in 1968 in Durban, South Africa, it was used to conduct fishery resources surveys off the Namibian and South African coasts by the Government of South Africa until it was handed over to the Government of Namibia in 1990. Between January and March, 1991, the Benguela underwent full-scale maintenance and repair at the dry dock in Walvis Bay and has since been used for fishery resources surveys by the Directorate of Resources Management of the Ministry of Fisheries and Marine Resources with the technical cooperation of Iceland. The main specifications of the Benguela are as follows.

Ship Type	:	long forecastle and double deck for stern trawling	
Dimensions	:	overall length	44.2m
		moulded breadth	9.45m
		moulded depth	3.96m
Gross Tonnage	:	494 tons	

The current conditions of the Benguela are outlined below.

1) Hull Construction

The Benguela is generally well maintained for a vessel of 24 years of age and its appearance is far better than that of an average Japanese ship of the same age. However, deterioration of the deck planks, the maintenance of which is difficult, and the steering house where there is a strong likelihood of drainage water can be observed. Repair work at these sections relies upon the discovery of water leakage.

As the vessel still has Lloyds' classification, all the outside planks, the single bottom and double bottom below the waterline must have passed inspection.

2) Stability

The trim calculation results of the centre of gravity of the Benguela indicate that it has extremely poor stability. It does not satisfy the IMO's stability criteria when the fuel load is less than half full, making use of the anti-rolling tank with a superior free surface effect very difficult. In short, the Benguela has a stability problem. The failure of the vessel to conduct bottom trawling due to the lack of sufficient trawl winch power and other technical problems are of a secondary nature. In fact, the inability to conduct bottom trawling is one of the reasons why the vessel has been operating without any accidents so far.

As it is possible that the passing of 24 years has resulted in an increase of weight which is unaccounted for and which worsens the stability, the Study Team advised the Namibian side to conduct expair medal inclining tests to check the centre of gravity of the vessel.

3) Freeboard

With a full load, the freeboard of the Benguela is some 400mm and no special consideration is given to rough sea conditions.

4) Accommodation

The present cabin and common room sizes of the Benguela are much larger than standard vis-a-vis the size and type of the vessel. The same observation is also valid for laboratory space. The deck cabins on the upper deck are too large to allow sufficient deck space for fishing work, resulting in poor workability on the fishing deck and a higher positioning of the centre of gravity. With regard to the berth dimensions, the width is narrower than the standard berth width for Japanese vessels.

5) Laboratories

The provision of a scientific sounder (fish finder) and equipment installed in the CTD rack in the acoustic laboratory suggests a fairly high fishery resources survey technical standard. In contrast, hardly any equipment is provided in the biology laboratory and the wet laboratory. The CTD is currently under repair.

6) Oceanographic Winch and Others

The Benguela is equipped with 2 general-purpose winches and an additional winch for exclusive use with the CTD which is currently out of order. The davit capacity of 0.3 tons for use by the scientific equipment is too small to be effective.

7) Trawling Gear

As the length of the fishing deck is only 10% of the length between the perpendiculars, full-scale fishing work is very difficult for safety reasons. In fact, the Benguela is only capable of surface trawling with a small net.

It is reported that bottom trawling is beyond the scope of the Benguela because of insufficient winch power. As the hydraulic motor for the winch appears to be capable of a net handling power of upto 3 tons for each of the 2 winches, the lack of power seems to originate from a shortcoming of the hydraulic unit.

8) Nautical Instruments

The gyrocompass, radar and scientific sounder (fish finder) have been renewed from time to time but other instruments and equipment are the originals.

9) Boats on Board

Life boats are provided but have hardly been used due to the difficulty of moving them. A rubber boat which is easy to handle is currently used for any of the vessel's transportation requirements.

10) Main Engine

Although the main engine is well maintained, it is somewhat difficult to obtain spare parts for it.

11) Power Generator

Obtaining spare parts for the power generator is also difficult and the output of the main power generator is below the rated output, making operation of the bow thruster at full power impossible.

12) Seawater Pipes

As marine life rapidly grows inside the seawater pipes, damaging their efficiency, a marine life repellent unit has been mounted to the seawater pipes.

In short, it is extremely difficult for the Benguela to perform its research function except for acoustic survey and its stability appears to be below the minimum standard. Its urgent replacement is, therefore, necessary and proper care must be given in the operation of the Benguela while awaiting the introduction of a replacement vessel.

JICA