Chapter 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

Fishing is an important industry throughout the ASEAN region in terms of generating employment, foreign exchange earnings, food supply and providing incomes for local communities. In the less developed ASEAN countries (Cambodia, Indonesia, Myanmar, Philippines, and Vietnam) in particular, marine products are a vital source of foodstuffs and nutrition. It is expected, however, that ASEAN fishery production will not be sufficient to meet local demand, which is expected to grow rapidly in the near future. Fishery resources and the marine environment are not only being pressured by increases in population and fishing capacities but are also being victimized by imprudent aquaculture as well as irresponsible fishing. Thus, in order to maintain sustainable fisheries, there is an urgent need to strengthen both fishery and resource management. SEAFDEC fisheries research and training plan is intended to disseminate appropriate technology for utilizing fishery resources through the assessment of fishery resources and development of human resources in its member countries. As part of this overall plan, the objectives of the subject project are to assess the utilization of fishery resources in Cambodia, Indonesia, Myanmar, the Philippines, and Vietnam by means of an extensive scientific survey of their coastal resources as well as to implement a fishery training program for resource management targeted at their personnel in fisheries.

In order to achieve these objectives, it is called for to build a fisheries research and training vessel capable of conducting coastal fishery stock surveys while providing training in fishing and catch handling operations. This vessel will be used to implement fisheries research and fishery training programs in coastal waters off Cambodia, Indonesia, Myanmar, the Philippines, and Vietnam. Based on these activities for these countries, it is expected that there will be an expansion in resource survey areas, increase in the number of research days devoted to coastal fishery stocks, increase in the number of sailing days for fishery training, and increase in the number of trainees accommodated from these countries.

The target cooperation programs intended in this project comprise building of a fisheries research and training vessel to acquire scientific fishery resource data and to conduct fishery training, along with procurement of the necessary equipment and materials.

2-2 BASIC DESIGN OF THE REQUESTED JAPANESE ASSISTANCE

2-2-1 Design Policy

(1) Compatibility between the Survey and Training Functions

While the Plan Vessel is a replacement for MV. PLATOO and MV. PLALUNG, owing to size constraints and superannuation, neither vessel has been capable of carrying out the fishery research function. The Plan Vessel, accordingly, must provide capability in both fishery research duty and fishery training duty, and must be designed to achieve full compatibility between these twin duties.

(2) Adaptability to meteorological and oceanographic conditions in ASEAN coastal waters.

The Plan Vessel is intended to operate within ASEAN coastal waters, which belong to the tropical and sub-tropical zones, where consideration will have to be given to the living environment, as well as consideration to stability and safety as the vessel to operate out to 200 nautical miles offshore and to cope on its own with rough weather though small in size.

(3) Consideration of refueling, and maintenance

In Cambodia, Indonesia, Myanmar, Philippines, and Vietnam, which will constitute the primary operating areas for the Plan Vessel, fuel price is generally high and spare parts are not always readily available. In the circumstance, the Plan Vessel usually fills up fuel oil at the homeport or other advantageous ports in the vicinity, then sail out to operation sea areas. The design then will give adequate consideration to refueling and maintenance logistics.

(4) Consideration on operation and maintenance costs economy

While SEAFDEC will be responsible for operation and maintenance costs for the Plan Vessel, these costs will be sourced from the member countries. SEAFDEC is also considering an arrangement whereby a portion of the survey and training costs will be defrayed with beneficiary countries. Taking into account the fact that the beneficiaries of the Plan Vessel will be less developed countries, the design will seek to reduce, wherever possible, operation and maintenance costs.

(5) Consideration on working friendly gear layouts

The Plan Vessel will be equipped with a variety of fishing gears, e.g. trawl and longline

fishing, together with a variety of research equipment, e.g. a scientific echo sounder, and CTD. Besides, living facilities for many peoples who work and/or are trained on board must be provided.

In order to fit this extensive array of equipment into a small hull and demonstrate these functions individually, it is essential that the equipment be laid out harmoniously across the entire vessel so as to avoid interference each other. And the design must also give particular consideration to safety, since the training activities will involve many trainees who are not familiar with shipboard operations.

In designing the equipment layout, fishing operation will generally focus on one fishery per voyage. The presumption is that, prior to each departure for fishing trip, the specific fishing gear equipment needed will be prepared and installed while the vessel is along the quay and exchanging with gears and equipment used in the last trip.

Furthermore, with respect to the fishing equipment, consideration shall be given to make equipment common with other fishing purpose wherever possible to avoid creating a congestion of equipment aboard the vessel.

(6) Trawl vessel type

MV. PLATOO and MV. SEAFDEC presently attached to SEAFDEC are both purse seiner type vessels, but the Plan Vessel will be a stern trawler type. In the ASEAN area, since 1990's, the orientation was toward purse seine fishing directed at skipjack tuna, and so many fishery research and training vessels have been built in this style. However, with the supply of this type boat now quite adequate, there is a distinct appreciation within SEAFDEC that there is no reason to build up this fleet any further.

In the case of the Plan Vessel, who lays importance on fishery resource survey using a scientific echo sounder which is the main approach at present in scientific resource studies, needs to take sample by towing trawl frequently. For frequent and speedy sample collection, stern trawling must be appropriate and purse seining method is not suitable. From these standpoints the Plan Vessel will be built in a trawler style.

MV. SEAFDEC, donated by Japan in 1993, was built as a replacement for MV. PAKNAM, a 386-ton trawl type survey/training vessel donated by Japan in 1969. The captain of the present MV SEAFDEC, as well as its crew and researchers, were thoroughly versed in trawl fishing methods on the old MV. PAKNAM. As this crew would constitute the required complement on the Plan Vessel, there would be no hindrance to its resuming trawl operations.

Since MV. PAKNAM conducted only bottom trawl operations, but never engaged in mid-water trawling, it will be necessary even for the experienced PAKNAM crew to

develop mid-water trawling skills, but this transition should not be difficult for experienced bottom trawler personnel.

(7) Countermeasures against mid-water noise radiation

On the Plan Vessel, scientific echo sounder for hydro-acoustic survey is the important tool to enable continuous and efficient fishery resource survey. The hulls of fishery survey vessels carrying scientific echo sounder must be designed so as to minimize the noise mingled with echo signal from the sea bottom. Suitable countermeasures will be incorporated into the vessel design, such as minimizing propeller cavitation, rubber mount main engine to isolate engine noise, etc

Waterborne noise decreases when engine loads is reduced, i.e. when speed is reduced. While it is desirable that the surveys proceed quickly at fast speed, ship speed for hydro-acoustic survey for the Plan Vessel has been set at 9 knots from permissible maximum speed of cavitation free propeller operation. In large vessels, the hydro-acoustic survey speed is usually set at 11 knots but, in ships comparable to the Plan Vessel, it is normally set at 9~10 knots.

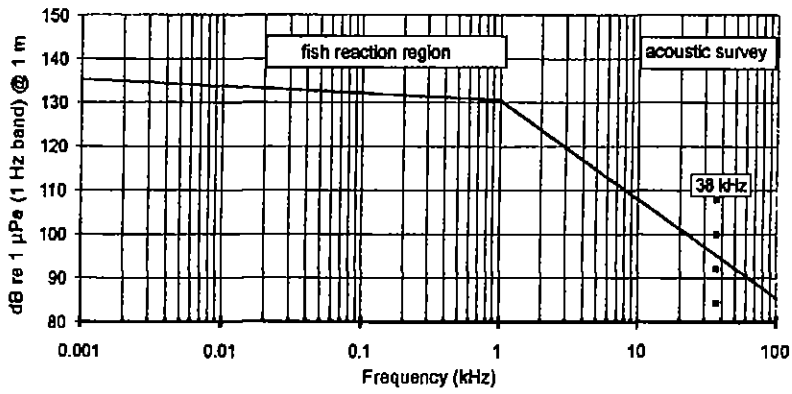


Figure 1 Proposed underwater radiated noise specification at 11 knots free-running for all vessels in fisheries research

Guideline proposed by ICES (International Council for the Exploitation of the Sea) for maximum permissible waterborne noise level will be referred to as target value in designing the Plan Vessel.

(8) Rules to apply and Classification

Since the Plan Vessel will be registered in and fly the flag of Thailand, it will be necessary to satisfy national regulations and carry certificates of compliance from the Thai government. Upon consultation with the Harbour Department of the Ministry of Transport and Communications, the administration responsible for ship inspection and registration in Thiland, it was learned that the Plan Vessel will not fall under a fishing vessel but fall under a special-purpose vessel, which will, therefore, have to comply

with the SOLAS (International Convention for the Safety of Life at Sea). Since this convention rule applies to passenger vessels engaging on international voyage and cargo vessel of 500 gross tons and over engaging on international voyage, it will be technically difficult for the Plan Vessel, of only 200 GT, to fully comply with many of the SOLAS requirements. Accordingly, after discussions with the Harbour Department, a document was drafted outlining the "Exemptions to be granted in case to apply SOLAS Convention", and approved by the Director of the Marine Department. Vessel design hereafter will have to proceed while confirming the complete SOLAS text.

Apart from SOLAS, the Harbour Department pointed out other International Conventions should apply to the Plan Vessel, i.e. International Convention on Tonnage Measurement of Ships, International Convention for Load Lines, International Conference for Preventing Collision at Sea, and International Convention for Preventing Pollution from Ships. While many parts of these conventions generally apply even to small-sized vessels, it is found no technical problems in complying with their provisions.

Further to above, Japan's maritime regulations will be referred to for matters not covered by international conventions and will ensure that there are no omissions with regard to safety criteria.

The Marine Department examines design drawings and inspects vessel under construction at keel laying, launching and at completion. However, the Marine Department entrusts most of the inspections at site to a Classification Society giving authorization to inspect on behalf of the Marine Department. In the process of building the Plan Vessel from the preliminary plan, necessary procedure will be taken for the application for the said authorization to the Marine Department, and close contact will be maintained with the Classification Society.

(9) Hull and engine longevity

As a general rule, after vessel's commissioning, repair work will gradually increase with vessel age, as corrosion of steel materials, abrasive wear of engine, and lowering insulation of electrical and electronic equipment steadily accelerate, leading to equipment breakdowns and inevitable repairs.

Although the phenomenon of deterioration is to some extent unavoidable, the situation can be considerably improved by effective daily maintenance and the use of appropriate materials in the hull and equipment. In order to insure a long service life for vessels provided from Japan under grant-aid cooperation, a policy to emphasize a long economic life for hulls and materials will be followed, for example, by using plastic

coated seawater pipes in the engine room, rather than relying excessively on higher-priced materials.

2-2-2 Basic Plan

2-2-2-1 Factors to determine hull capacity

(1) Complement capacity

(i) Crew

SEAFDEC/TD plans station of crewmembers as follows.

	Deck part	**Engine part**
Officer	Captain Chief Officer 2nd Officer	Chief Engineer 2nd Engineer 3rd Engineer
Petty officer	Boatswain	Fitter
Rating	Sailor x 2 Cook x 1 Ship boy x 1	Oiler x 2
Other	Fishing assistant	
Sub total	9 persons	6 persons
Total	15 persons	

Among various duties of the Plan Vessel, trawl fishing needs maximum workload, when all crewmembers except for off-duty crew work. Station of trawl fishing work will be as follows.

Station	**Crew**
Bridge	Captain, 2nd officer, Chief engineer
Engine room	2nd engineer, Oiler x 1
Trawl deck aft	Chief officer, Fishing assistant, Boatswain, Sailor x 2
Trawl winch	Fitter
Galley	Chief cook
Assistant	Ship boy
Off-duty	Duty crew at 0000-0400: e.g.3rd officer, Oiler x 1
Total	15 persons

According to the above, it is concluded that the number of crew be total 15 persons.

(ii) Instructor/Scientist

In the fisheries training voyages, two deck part instructors and two engine part instructors are on board.

In the fisheries research voyages, about ten scientists are needed, but no trainees are on board then and scientists can use trainees' accommodation.

According to the above, it is concluded that the instructors/scientists capacity be 4 persons.

(iii) Trainees

Record of MV. PLATOO's training voyage during 1993 - 2000 in ASEAN region is shown on the graph below. Average duration of voyage and number of trainees are 9.6 days and 19.9 persons respectively, and medians are 7 days and 20 persons respectively.

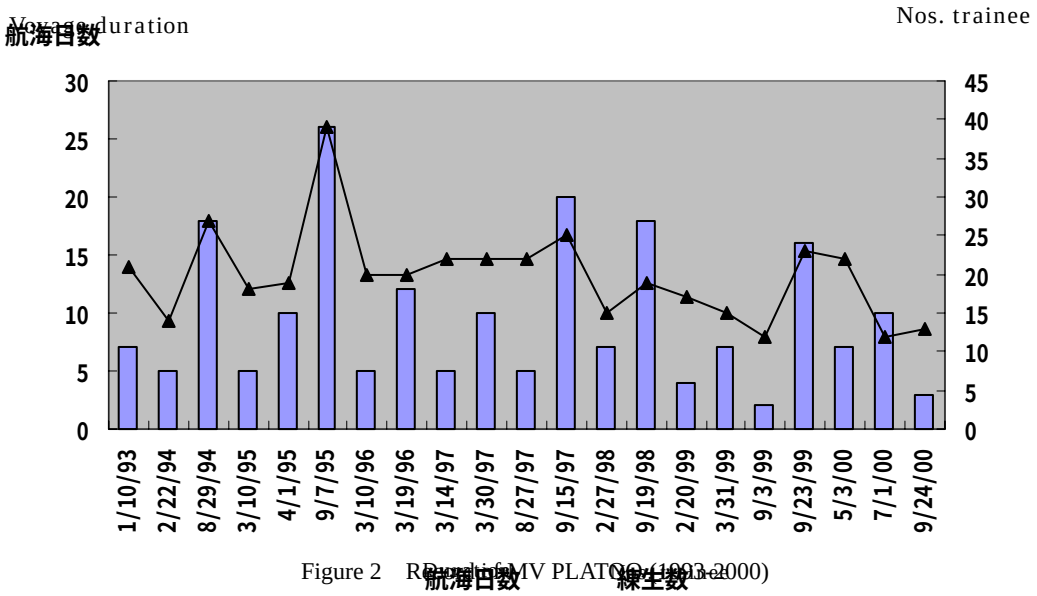


Figure 2 Results of MV PLATOO (1993-2000)

In addition to the ASEAN regional training course, MV. PLATOO has been undertaking training course for Thailand waters and special training program, of which average voyage length and number of trainees are 7.2 days and 46.7 persons respectively, and medians are 7 days and 46 persons respectively.

SEAFDEC requests trainee capacity of the Plan Vessel being 18 persons, from the consideration of 4 trainees from each of 5 countries where the Plan Vessel will be operating but a few decreases in some countries may be envisaged.

Finding above reasonable, it is concluded that the trainee capacity be 18 persons.

(2) Speed, engine horsepower and type of propeller

SEAFDEC's GA application referred to Kort nozzle propeller. Advantages and disadvantages of Kort nozzle propeller compared with ordinary propeller are as follows.

Free running speed	About 0.2 knot slow in Kort nozzle prop.
Trawl net towing force	About 15 % stronger in Kort nozzle prop.
Cavitation and waterborne noise	A little lower in Kort nozzle prop.
Hull vibration	A little lower in Kort nozzle prop.
Operation	Susceptible to catch drifting net/line and difficult to remove in Kort nozzle prop.
Cost	Expensive in Kort nozzle prop.

The Plan Vessel navigates in wide ASEAN areas, e.g. 1,415 nautical miles from Bangkok to Manila taking 4.9 days running at speed of 12 knots. Although Kort nozzle propeller is advantageous in trawl towing force, disadvantage in sailing long distance is considerable. From the simulation of fuel oil consumption as shown below, the ordinary propeller is found more advantageous than the Kort nozzle propeller in overall fuel oil consumption.

From the above discussion, it is concluded that the type of propeller be of ordinary type. Besides, the propeller shall be of controllable pitch type to cope with different propeller loads of free running condition and trawl towing condition.

Table 2: Simulation of fuel oil consumption

	speed kn.	hours h	times n	M/E load %	M/E FOC kg/h	G/E load %	G/E FOC kg/h	total FOC kg/h	FOC /day kg/h	Do. lit/d
Research voyage (Kort nozzle)										
Acoustic survey	9	3	6	56	80.0	64	16.0	95.9	1,727	
Pelagic trawl	5	1	3	58	82.8	64	16.0	98.8	296	
Oceanographic survey	0	1	3	0	0	64	16.0	16.0	48	
Total fuel oil consumption									2,071	2,408
Research voyage (ordinary propeller)										
Acoustic survey	9	3	6	51	72.8	64	16.0	88.8	1,598	
Pelagic trawl	5	1	3	65	92.8	64	16.0	108.8	326	
Oceanographic survey	0	1	3	0	0	64	16.0	16.0	48	
Total fuel oil consumption									1,973	2,294
Free running	12	24	1	85	121.4	64	16.0	137.3	3,296	3,833

As the result of speed calculation, theoretical service speed of 12.1 knots was obtained with main engine of 736 kW maximum rating running at 85 % load, with ordinary type propeller, and with 15 % sea margin.

According to this speed calculation, it is concluded that the main engine horsepower be 736 kW.

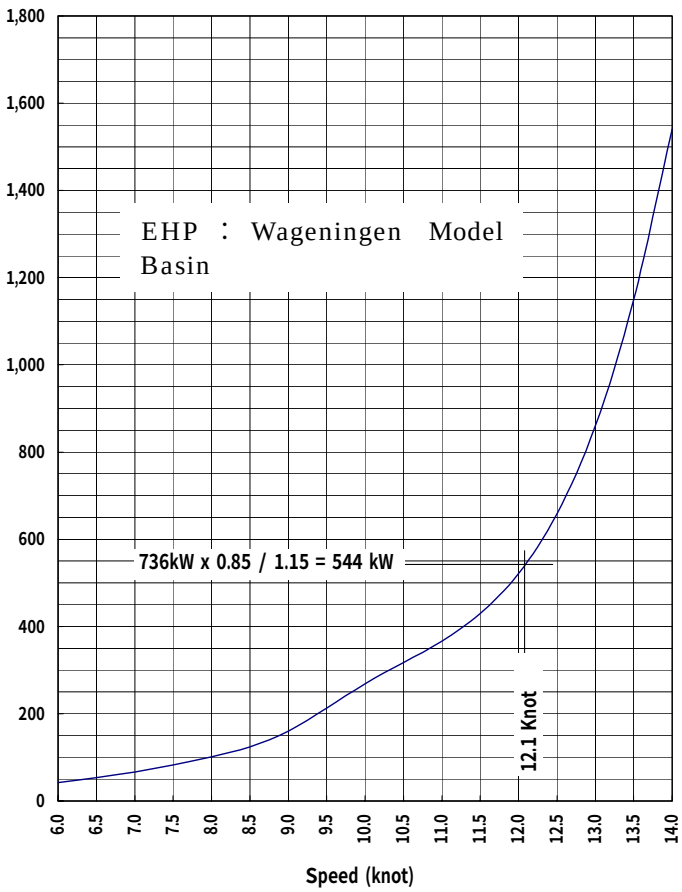


Figure 3 BHP CURVE

(3) Fuel oil tank capacity

MV. SEAFDEC has conducted fisheries research voyages in the Philippine waters and Vietnam waters for following duration.

Table 3: Record of MV. SEAFDEC

	Philippine waters					Vietnam waters		
Refuel, preparation, data analyze	-	2 day	1 day	2 day	1 day	2 day	3 day	2 day
Research voyage	5 day	8 day	10 day	10 day	10 day	5 day	7 day	13 day

Considering above, appropriate duration of fisheries research and training voyages in ASEAN waters for the Plan Vessel will be about 10 days normally and about 15 days as maximum.

Fuel oil consumption in the program, as the longest, sailing from Bangkok to Manila, 1 day from Manila to site sea area, 12 days at sea, and 1 day back to Manila, is estimated as follows.

Table 4: Fuel consumption of the Plan Vessel (case 1)

Voyage	Mileage n.miles	Speed knot	Duration days	FOC kl/d	FOC kl
Bangkok - Manila	1,415	12.0	4.9	3.83	18.8
Manila – Site sea		12.0	1	3.83	3.8
At sea			12	2.29	27.5
Site sea - Manila		12.0	1	3.83	3.8
Total			19		53.9

Fuel oil consumption in the program, sailing 1 day from base to site sea, 8 days at sea, and 1 day back to the base, is estimated as follows.

Table 5: Fuel consumption of the Plan Vessel (case 2)

Voyage	Mileage n.miles	Speed knot	Duration days	FOC kl/d
Base – Site sea	12.0	1	3.83	3.8
At sea		8	2.29	18.3
Site sea - base	12.0	1	3.83	3.8
Total		10		25.9

As fuel oil prices in the Plan Vessel operating countries are generally higher than that in Bangkok, the Plan Vessel fills up fuel oil tank in Bangkok before departure to minimize refilling in the operating country.

Considering the situation, it is concluded that the fuel oil tank capacity of the Plan Vessel be of such quantity as covering long distance voyage, e.g. to Manila, and continuing about 10 days research/training voyage, and also covering two times of 10 days research/raining program, i.e. 53.9m^3 and 25.9 x 2=51.8m^3, i.e. about 55 m^3 fuel oil tank including some allowance remaining at arrival

(4) Fresh water tank capacity and fresh water generator

General standard of fresh water consumption on board ships is about 110 lit/day including 5 – 10 lit/day consumption for drinking water. In vessels working in tropic seas, fresh water consumption is generally higher due to frequent showers, as seen in the record of MV. SEAFDEC.

Fresh water consumption of the Plan Vessel is estimated as follows.

Standard FW consumption = 110 lit/d.p x 37 p = 4,070 lit/d

Extra consumption by frequent showers = 40 lit/d.p x 37 = 1,480 lit/d

FW washing of deck equipment = 150 lit/d

Total consumption per day = 5,700 lit/d

Interval of FW refill = 20days

Total FW consumption = 5.70 m^3 x 20 days = 114 m^3

Fresh water tank of more than 13 m^3 cannot be assigned in the hull of the Plan Vessel, so that the balance has to rely on fresh water generator.

FW tank capacity = 13 m^3
Necessary capacity of FW generator = (114 – 13) / 20 day = 5.05 m^3/day

According to above, it is concluded that the fresh water tank be 13m^3 and fresh water generator be of capacity about 5 m^3/day.

(5) Fish hold capacity

Fishes caught by fishing operation being in general all stowed on board without disposing, all fishes except for those dissected and/or kept as sample in laboratory are stowed in the fish hold. The maximum catch is made by trawl fishing.

Catch per one trawl operation = 200 kg - 400 kg
Trawling in a day = 3 times
Operation days = 8day
Total catch = 4,800 kg - 9,600 kg
Stowage factor in fish hold = 450 kg/m3
Necessary fish hold volume = 11m3 - 21m3

According to the above, it is concluded that the fish hold capacity be about 20 m3.

(6) Hull dimensions and gross tonnage

From aforementioned conclusions on factors to determine hull capacity, hull dimensions shall be as follows.

Length overall	32.50 m	
Length between perpendiculars	27.00 m	
Breadth, molded	7.20 m	
Depth, molded	3.00 m	
Designed draft, molded	2.70 m	
Block coefficient（Cb）	0.644	
Displacement at designed draft	347 t	
Lightship weight	230 t	
Deadweight capacity	117 t	(Displacement－Lightship weight)

Speed performance based on water resistance of the above hull satisfies the requirement, and the deadweight capacity covers the loading weights, i.e. fuel oil, fresh water, fishing gear, etc. so that the freeboard requirement is satisfactory.

Layout design was developed based on the above hull and size of superstructure/deckhouse was decided. Finally gross tonnage measured according to the international measurement system has become 208 tons.

2-2-2-2 Hull part design

(1) Inspection and certificate of compliance

(i) Rules to apply

Following rules apply to the Plan Vessel, as the “Special Purpose Vessel” as directed by the Marine (then Harbour) Department, Ministry of Transport and Telecommunication, Thai Government.

International Convention for Safety of Life at Sea, 1974
International Convention on Tonnage Measurement of Ships, 1969
International Convention for Load Lines, 1966
International Conference for Preventing Collision at Sea, 1972
International Convention for Preventing Pollution from Ships, 1973
Rules of Classification Society
Maritime Rules of Japan for interpretative and supplementary purpose

Extensive exemption from SOLAS regulations are to be granted as referred to in the EXEMPTIONS TO BE GRANTED IN CASE TO APPLY SOLAS CONVENTION, which has been approved by the Marine Department.

Further to the requirements of the Marine Department, Japanese maritime rules and regulations will be referred to for the purpose to supplement those safety items not covered by the international instruments and also for the purpose to interpret such SOLAS provisions as not specifying definitely but leaving decision for each Administration.

Navigation area of the Plan Vessel is “Extended Near Coastal voyage”, which is beyond the “Near Coastal Voyage” of Thai regulation as shown on the area map below, but limited to within 200 nautical miles offshore the Philippine, Indonesia and Myanmar waters.

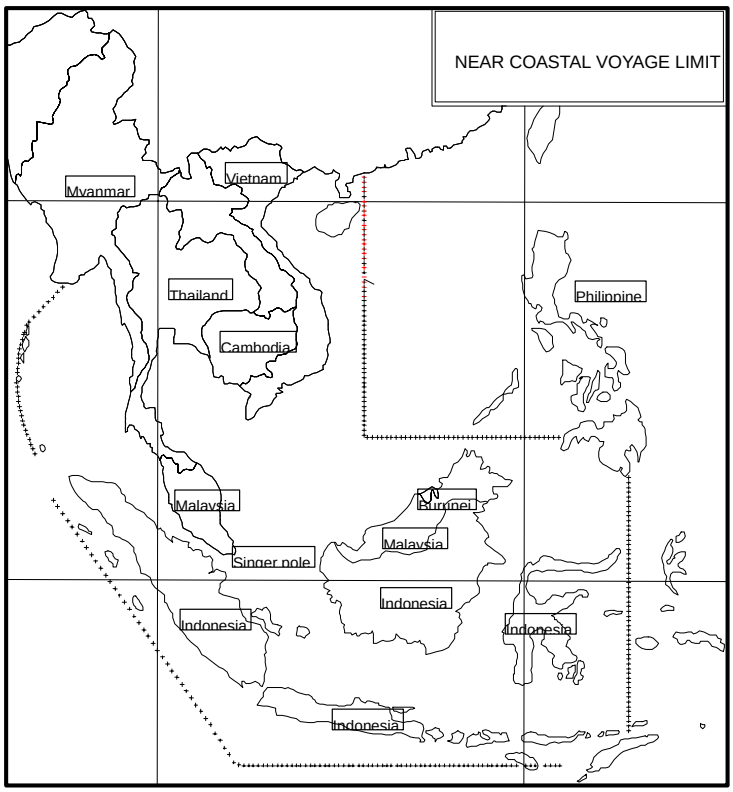


Figure 4 "Near Coastal Voyage" by Thai regulation

(ii) Classification Society and statutory inspection

The Plan Vessel has to have assignment of Classification through the newbuilding survey of the Classification Society, and has to maintain the Classification through annual inspection. The Classification Society shall be Nippon Kaiji Kyokai (ClassNK) who has the largest share in Thailand and is convenient for SEAFDEC/TD.

ClassNK undertakes not only Classification's own survey but also undertakes statutory matters having authorization to inspect and issue international certificates on behalf of the Thai Government.

During construction of the Plan Vessel, Thai Government examines construction drawings; dispatch an inspector to shipyard on keel laying launching and before delivery to inspect at site. Inspection before delivery will be the most important inspection to obtain the provisional national certificate finally.

(2) Hull structure

Hull structural scantling and arrangement shall be determined according to ClassNK rules.

Hull structural material shall be mild steel approved by ClassNK, except for the bridge deckhouse structure and the radar mast on bridge top which shall be aluminum alloy

material

AS various equipment will be installed on deck for the Plan Vessel's multi-purpose duties, it is important to ensure adequate stability avoiding high center of gravity. By using aluminum alloy for bridge structure, about 3.5 tons of weight can be saved and contribute to lower the center of gravity. Clad steel material shall be used to connect the aluminum alloy structure to the steel deck to avoid galvanic corrosion at connecting parts.

(3) Accommodation

Accommodation of the Plan Vessel shall generally satisfy the standard of Fisheries Agency (FA), Japanese Government.

(i) Sleeping rooms

Sleeping rooms of followings shall be provided.

Rooms	Capacity	Bed
Captain	1 pers.	Single bed x 1
Crew's room-1	4 pers.	Double bed x 2
Crew's room-2	4 pers.	Double bed x 2
Crew's room-3	6 pers.	Double bed x 3
Trainer/scientist	4 pers.	Double bed x 2
Trainee-1	14 pers.	Double bed x 7
Trainee-2	4 pers.	Double bed x 2

To allow boarding of female scientist/trainee, one separate female trainees' room is offered for 4 persons. According to the record of SEAFDEC sea training, average number of women on board, when women are on board, is 3.2 persons.

Size of beds shall be 2.00 m x 0.60 m.

(ii) Shower and toilet

FA standard requires 3 WCs and 3 showers for 37 persons.

In the Plan Vessel, a separate additional toilet facility is necessary for women, in addition to the said standard to maintain necessary toilets for men as women toilet is exclusively used by women.

FA does not specify laundry facility for vessels below 500 tons, but the Plan Vessel works in tropic sea where laundry facility is important.

According to the above, following sanitary facility shall be provided.

Gents toilet:	2 x Toilet booth (Japanese style WC)
	1 x Toilet booth (Western style WC)
	1 x Urinal
	2 x Shower booth
	1 x Sink
Ladies toilet:	1 x Toilet booth (Western style WC)
	1 x Shower booth
	1 x Wash basin
Laundry equipment:	1 x washing machine with spin extractor

(iii) Mess room

The seating capacity of Plan Vessel's mess room shall be 20 persons, considering FA standard of 19 persons. Table for 6 persons shall be for crew use and can be separated from other part by curtain. A cold water fountain and an ice cube machine shall be provided in the mess room.

(iv) Galley

Next to the mess room, galley shall be arranged. A LPG cooking range, a rice steamer, a fridge, a water boiler, a sink, etc. shall be fitted in the galley.

Next to the galley, there shall be a dry provision store, a vegetable chamber ($3.6m^3$ $+3^oC$), and a meat chamber ($2.2m^3$ $-20\ ^oC$).

Capacity of refrigerated provision chambers are determined according to Ship Designer's Handbook (Kansai Society of Naval Architects, Japan). FA does not specify refrigerated provision chamber.

(v) Navigation bridge

Navigation bridge shall be fitted out with steering control, main engine and propeller control, navigation equipment, radio apparatus, etc. Steering and propeller remote control shall be available from the bridge top for maneuvering while longline fishing.

(vi) Laboratories

Wet lab, dry lab and acoustic lab shall be provided.

A working table, a sink, a freezer, a thermo-salinometer processor, etc. to process collected seawater, mud, fish and plankton shall be in the wet lab.

The dry lab shall be arranged next to the wet lab to receive sample from the wet lab. The dry lab shall be air conditioned, and fitted out with precise equipment which is not suitable to be in wet atmosphere.

Another precise equipment, e.g. processor for scientific echo sounder, which needs air-conditioned atmosphere shall be in the acoustic lab. As operation of scientific echo

sounder is related to vessel maneuvering, the acoustic lab shall be placed next to the wheelhouse.

(4) Deck machinery

(i) Rudder and steering gear

Type of rudder shall be of high lift flap type, considering importance of quick operation in fishing operations. Emergency steering shall be by means of manual hydraulic steering wheel operation from the wheelhouse.

(ii) Bow thruster

Bow thruster shall be fitted considering safer and easier operation at sea.

Control of ship's position is necessary especially when hanging underwater units, e.g. CTD rosette sampler. Quick maneuvering with bow thruster and flap rudder will reduce risk of damage of underwater units.

Capacity of the bow thruster shall be determined considering CTD underwater unit operation being conducted at wind speed below about 15 knots. The bow thruster shall be powered by central hydraulic power source driven by the main engine.

(iii) Windlass

Windlass shall be fitted to lift anchor and anchor chains according to the ClassNK rule.

The windlass shall be powered by the central hydraulic power source driven by the main engine.

(iv) Capstan

Winch is necessary to tow mooring ropes. The winch shall withstand mooring rope force of about 14 kN when wind force is 30 knots which is the maximum operable wind force in the harbour. The type of winch shall be capstan, as compact to install. They shall be installed port and starboard of aft deck.

The capstan shall be used also for fishing operations.

The capstan shall be powered by the main engine driven central hydraulic power source.

(v) Crane

Crane is necessary to transport heavy items in fishing operation and research operation.

There are two types of cranes: derrick crane and jib crane. Though hook point circle of derrick crane is almost fixed so that lifting/and landing at any location is impossible, jib crane can bring its hook point at any locations within its jib length.

In the operation at sea and wharf, various heavy items must be lifted and placed at each specific location. Therefore the type of crane must be of jib crane. Further, equipment directly hung at jib crane hook can reach close to sea surface so that unfavourable situation of swinging cargo fallwire rope will be avoided.

Jib crane shall be placed at about center of the aft working deck to cover all areas, including the stern deck where otterboards will be handled by manually extended jib.

Lifting capacity of the crane shall be 10 kN considering weight of fishing gears, portable fishing machines and engine parts which are below 1 ton.

(vi) Hydraulic power source

Central oil hydraulic system driven by the main engine shall be adopted to drive the deck machinery and fishing machinery.

Electric system requires electric source of about 200 kW generated by large generator, and special system to facilitate speed control.

Speed is easily controlled by hydraulic system, and hydraulic oil pump can be driven by the main engine, as the main engine load is always low when the deck machinery and fishing machinery are working. From the hydraulic oil pump in the engine room, oil piping is led to all machineries on deck.

To allow operation of the hydraulic machinery when the main engine is not running, e.g. crane operation at the wharf, or to use only small hydraulic machinery not depending on big oil pump driven by main engine, a compact electric motor driven hydraulic oil pump shall be installed and the oil piping shall be connected to the central hydraulic system.

Oil hydraulic pump shall be of a type not producing vibration and noise giving adverse effect on research work.

(5) Ventilation

For the engine room, motor driven fans shall be installed to supply air for diesel engine combustion, air change and cooling.

For the galley, a motor driven fan shall be installed to exhaust cooking smoke and heat from the cooking range top.

For toilets, a motor driven fan shall be installed to exhaust smell and moisture.

For the wet lab, a motor driven exhaust fan shall be installed to exhaust moisture and chemical gas and not to recirculate the air in the lab to the central air conditioning system.

As sea-going vessels need to close external openings to maintain watertightness and cannot obtain natural ventilation through open windows, the accommodation space of

the Plan Vessel shall be lagged with insulation material on bulkheads and decks exposed to weather and shall be air-conditioned. Air-conditioning shall be cooling only and shall have capacity to cool accommodation inside to a temperature lower than outside by 7 degrees Celsius considering severe tropical conditions. The request from SEAFDEC/TD for the air-conditioning plant to control temperature individually at each room was found too complicated to install on board the Plan Vessel.

(6) Lifesaving, fire-protection and fire-fighting

These safety equipment must be fitted out according to SOLAS requirements. The Thai Government allows exemptions from SOLAS for such equipment as difficult to install on board small vessels. Followings are the important items difficult to comply fully with SOLAS requirements.

- Engine room fixed fire extinguishing arrangement
- Fixed emergency fire pump
- Non-combustible accommodation structure
- Capacity of life rafts
- Rescueboat and its launching device

Among them, engine room fixed fire extinguishing system and non-combustible accommodation structure are exempted subject to installation of automatic fire detector;
Though Rescueboat is provided in place of a workboat originally requested, rescueboat launching device is exempted and handling by crane is allowed; and
Fixed emergency fire pump is exempted and replaced by a portable engine driven pump.

(7) Refrigeration plant

The Plan Vessel stays at sea for more than 10 days and therefore needs freezing arrangement for preserving fish catch. Fishes caught 4 – 5 days before arriving port can be kept in ice as fresh fish, but earlier catches must be frozen to preserve. All catches may be frozen just for preservation, but ice preservation system shall be installed aiming at practicing ice preservation for valued fresh fish.

For ASEAN coastal fishing boats, generally small and lack of freezer, ice-preservation is important as ice preserved fresh can be got better price at auction, therefore income for fishermen could be increased.

To practice fish preservation on board, following equipment shall be provided.

(a) Quality frozen fish by quick freezing

Semi-air freezing chamber with freezing shelves and blast fans shall be installed for common use of round freezing for big tunas and of pan freezing for small fishes.

(b) Quality fresh fish in ice

An ice plant shall be installed to practice fresh fish preservation. Ice plant shall be of seawater ice type.

Fish hold to stow frozen or iced fish shall maintain temperature adjustable between 0^{o}C and -30^{o}C.

Refrigerating compressors and the ice plant shall be installed in the engine room.

Since fish preservation technique affects fish price considerably. It is considered worthwhile to conduct training not only on fish catching technique but also on fish preserving technique.

(9) Outfitting material

(a) Wooden deck: As trawl deck of upper deck aft is subject to sliding heavy fishing gears and subject to wet/slippery. On the f'cle deck abaft windlass, many peoples work for fishing and research duties on wet deck, and slippery steel deck should be avoided in view of safety. Accordingly, wooden plank shall be laid on the trawl deck of upper deck and the f'cle deck abaft windlass, so that steel decks are protected and safer deck work can be secured for trainees who are generally unfamiliar with deck work. Wooden plank for the Plan Vessel shall be of Oregon pine, 50 mm thickness.

Upperdeck outside trawl net coaming where trawl winches are installed and the wet lab floor are also subject to slippery. As there are too many narrow places to lay wooden plank, deck sheathing with anti-slip pattern shall be provided for the safety of work.

(b) Stainless steel material: SEAFDEC requests stainless steel material for hawse pipes, slipway deck plating, slipway doors, handrails and storm rails on exposed deck, deck ladders, air pipe heads, mushroom ventilator heads, wearthertight door and door frames, fresh water pipes, radar mast and radar scanner platform, exposed hatchcovers (aluminum for fish hold hatchcovers), and bolt/nut to fix exposed pipes.

These stainless steel material makes hull maintenance work, i.e. de-rusting, easier, but generally not adopted in the Japanese shipbuilding standard because of material cost and difficulty to handle stainless steel at work site. Proper maintenance by SEAFDEC crew can keep these parts properly even without these stainless materials applied.

However, followings shall be of rust free or lightweight material in response to the SEAFDEC's requests.

- Hawse pipes and slipway deck of stainless material considering quick rusting and wear due to sliding of anchor chain and heavy trawl gears respectively.
- Fresh water pipes of stainless steel or plastic material, considering difficulty to remove rust inside fresh water pipes and avoiding risk of contaminated fresh water in future.

(c) Aluminum material: Fish hold hatchcovers shall be of aluminum alloy material considering frequent open/close operations so that lightweight is important for safety operation.

2-2-2-3 Machinery part design

(1) Main engine

Main engine shall be of medium speed diesel engine with maximum continuous rating of 736kW (1,000ps). Considering that large low speed engine running at about 400 rpm or slower is difficult to accommodate in the limited engine room space, medium speed engine running at about 1,000 rpm shall be adopted.

The main engine shall spin propeller via reduction gear and also drive an oil hydraulic pump for deck machinery via the step up gear taking power from the main engine front.

The main engine shall be mounted on rubber to isolate the hull from engine vibration and noise. As the reduction gear and step-up gear shall be rigidly mounted, highly elastic coupling to accept eccentric rotation shall be inserted between the engine and gears.

(2) Reduction gear

Gear ratio shall be carefully determined at detailed design stage to obtain the optimum propeller diameter and better efficiency.

(3) Propeller

The propeller shall be ordinary open propeller, not Kort nozzle propeller. The propeller shall be cavitation free at the acoustic survey speed (target at 10 knots), adopting optimum highly skewed blade profile, aerofoil blade section, and pitch distribution. Not only back cavitation at fast running condition, face cavitation at slow running condition shall also be minimized.

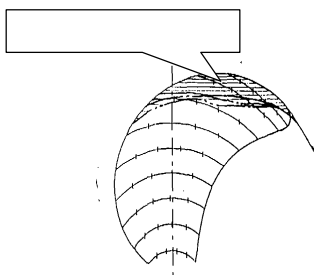


Figure 5 Cavitation zone

(4) Electric genset

According to NK rule, requiring safe uninterrupted navigation even in case of failure in one generator, 2 sets of diesel gensets shall be installed in the engine room. Two gensets on board the Plan Vessel shall be identical, each of which can cater ordinary sea loads.

Generated voltage shall be 380 V in 3 phase, and secondary voltage shall be 220 V in 3 phase or in single phase through step down transformer. Electric frequency shall be 50 Hz which is adopted in the Plan Vessel operating countries except in the Philippine.

As two gensets must run in parallel while changing over from one to another, an automatic synchronizing device for parallel running shall be fitted. Automatic load sharing device is not necessary, as two gensets do not run in parallel for long time.

(5) MARPOL equipment

The Plan Vessel is required to be a model vessel against ship originated environmental pollution as a fisheries training vessel aiming at sustainable fisheries while preserving fishing ground environment.

As ship originated pollutions are dealt with by the International MARPOL Convention rules, specifying handling of pollution substances by crew and onboard equipment to process pollution substances, the Plan Vessel shall be fitted out to comply with MARPOL. Thai Government, still not ratifying the MARPOL Convention, however, requires compliance with MARPOL. The certificate of compliance with the MARPOL issued by the Thai Government is valid also in other ASEAN ports as the international convention certificates must be mutually valid in all countries.

Following MARPOL equipment shall be installed on board.

(i) Oily water separator to prevent oil pollution from ship: Equipment compulsory for vessels of 400 gross tons and over. Though MARPOL allows the Plan Vessel of about 200 gross tons to deal with oily water on board by the control of crewmembers without separator equipment, considering risk of oil discharge and training of engine part trainee, a separator equipment shall be installed on board the Plan Vessel.

(ii) Tank to collect sewage from toilet: Equipment compulsory for vessels with 10 persons or more. The tank shall be installed on board the Plan Vessel with 37 persons.

(iii) Garbage comminuter: To be installed on board the Plan Vessel to avoid stowing of all garbage on board from many peoples.

(iv) Diesel engine with controlled exhaust gas emission: Diesel engines of 130 kW and over are subject to NOx control. The main engine of the Plan Vessel must comply with the requirement. As most of marine diesel engines are now complying with the NOx criteria, there will be no difficulty to select a type of diesel engines.

2-2-2-4 Electric part design

(1) Navigation equipment

Magnetic compass: As the equipment to obtain vessel's bearing even when main source of power is lost, the SOLAS rule requires to install.

Gyro compass: Precise bearing from the true North is obtained by the equipment. Data are used for navigation and for oceanographic survey. Bearing signal input is required by many navigation equipment, e.g. radar, autopilot, wind meter, GPS plotter, etc.

Autopilot: Equipment to control the steering gear automatically to sail along pre-set course referring to gyro compass bearing. Autopilot is indispensable for long distance voyage and repeated straight runs in fisheries research operation.

Radar: Important equipment required by the rule to avoid collision. To recover failure of the main radar, sub radar shall be installed.

GPS: Precise latitude and longitude are necessary to navigate safely to a destination. In the Fisheries research work at sea, research sea area must be precisely located. GPS must be installed as the only means to show the ship position.

Radio direction finder: Equipment to receive radio signal from radio buoy (common with GPS buoy) for pelagic longline and to find direction to the buoy.

Weather FAX Equipment to receive weather chart, which is important for voyage plans.

Wind meter: Navigation plans are determined collecting information including wind data, wave data, weather chart data, etc. In longline fishing and drift gillnet operation, direction to cast line or net must be determined considering wind direction and force. Drifting of fishing gear must be estimated from wind data. Wind speed is also used to check if wind speed is exceeding work limit or not. From the above requirements a wind meter shall be installed.

Public addressor: Equipment to announce general information, work order or to muster in an emergency from the bridge. All persons on board vessels have to follow order of the Master in working and in emergency case, and the public addressor is the mean of conveying these orders. Thai Government deems the equipment a part of safety item, and requires to install it.

Inboard telephone:	Equipment as a part of safety item to communicate in the vessel.
Searchlight:	Equipment to search at night for long distance. In longline fishing, pot fishing and drift gillnet fishing, fishing lines or nets are collected from the sea. After sunset, line or net must be found by searchlight. When longline is cut and lost, search need be made widely. Two sets of incandescent lamp searchlights shall be installed on the bridge top.

(2) Radio apparatus

In terms of GMDSS, “Near Coastal Voyage” is subject to A-2, and seas beyond the “Near Coastal Voyage” limit are subject to A-3, according to the Thai Government. However, considering that the Plan Vessel navigates beyond the “Near Coastal Voyage” limit but limited to within 200 nautical miles offshore the ASEAN waters, the Thai Government exempts from the GMDSS A-3 requirements on duplication of the radio apparatus but allows to apply A-2 requirements on shore-based maintenance.
Accordingly, following radio apparatus shall be installed.

INMARSAT C	With EGC x 1
INMARSAT mini M	Telephone, FAX and data communication x 1
MF/HF radio telephone	With DSC and DSC WRx 1
VHF radio telephone	With DSC and DSC WRx 1
Narrow band direct printing	1
Two-way VHF radio telephone	2
NAVTEX	1
Radar transponder	1
EPIRB	1

As INMARSAT C is for telex communication and not for telephone/FAX, INMARSAT mini M shall be installed to use telephone and FAX to facilitate communication with the shore. INMARSAT C must remain as the GMDSS equipment, as INMARSAT mini M is the apparatus not according to the GMDSS standard.

2-2-2-5 Equipment plan

(1) Priorities

The two principal operations in research activities of the Plan Vessel will be fishery resource and marine environment surveys. Fishery resource surveys may be divided into

two categories: fishery resources assessment and primary production research. Marine environment surveys relate to oceanographic structure, nutrient salts, and bottom sediments. In addition to the above, the Plan Vessel will undertake pilot fishing operations for purposes of stock evaluation and development of underutilized resources.

In order to evaluate the appropriateness of the requested equipment items, an interview was conducted with TD to determine the relative priorities perceived by respondents for each item. The priorities assessed by TD are as follows:

In the fishing gear category, the priority rankings (from high to low) were: trawl (2 kinds), bottom longline, pelagic longline, drift gillnet, squid jigging, and deep sea pot.

With respect to the research equipment, priorities were generally high for all of the main items: scientific echo sounder, portable reflectance radiometer, fluorometer (2 kinds), quantum sensor for Photosynthetically Active Radiation (PAR), CTD, XCTD, water samplers, bottom samplers (2 kinds), auto analyzer, weather satellite information receiver, and ship data server.

(2) Fishing Gear Plan

1) Methods of Pilot Fishing Operations

Following shows the target areas and required fishing methods for the pilot fishing operations to be conducted by the Plan Vessel.

Target area		**Required fishing**
Stock assessment	Pelagic fish resources	To compare the echo of the target fish school and known TS (Target Strength) of individual fish, a pilot catch from fish schools will be required, using pelagic trawl, and Catches will be taken, using surface longline, which will yield data on catch rates providing clues to migrating fish stock assessment.
	Demersal fish resources	Catches will be taken, using mainly bottom trawl, bottom longline, and pot, which will yield data on catch rates providing clues to demersal stock assessment.
Development of Underutilized Resources	Squid stocks in offshore waters west of the Philippines	Jigging and drift gillnets for flying squid
	Shrimp, crab, and bottom fish stocks in the Andaman Sea off Myanmar	Pot, bottom trawl, bottom longline

The pilot fishing operations conducted by the Plan Vessel will have two aspects: fish stock assessment and the development of underutilized resources. In the case of pelagic fish and other resources for which hydroacoustic survey can be utilized, sample catches will have to be taken from fish schools, using mainly pelagic trawl in order to compare the echo of target fish school with known TS for individual fish. But, with demersal fish, which would be difficult to assess from hydroacoustic survey, the sample catches will be taken mainly via bottom trawl, bottom longline, and pot, which will yield data on catch rates and provide clues to resource evaluation. SEAFDEC pays attention to squid stocks west of the Philippines, along with shrimp and crab stocks in the Andaman Sea off Myanmar, as underutilized potential resources, and is planning to study their exploitation by means of squid jigging, drift gillnet and deep sea pot. All of the requested gear items are highly relevant to this objective, therefore the Plan Vessel will be equipped with the fishing equipment and gears with which pelagic trawl, bottom trawl, surface longline, bottom longline, deep sea pot, squid jigging and drift gill net fishing operations can be operated.

2） Gear Size Evaluation

Followings are discussion on scale of the fishing gears necessary for each method of pilot fishing operations which are found adequate to be conducted with the Plan Vessel. The requests and findings of the assessment, by gear and net item, are discussed below:

(i) Bottom trawl

Followings are requested.

	Shallow water		**Deep water**
Sea depth	100 m and below		150 – 400 m
Seabed condition	Soft bottom, muddy sand, sandy	Hard bottom	Hard bottom
Target fish	Demersal fish, squid, scads, Indian mackerel	Demersal fish, squid	Demersal fish, deep sea shrimp,
Mesh size	30 – 40 mm		25 mm

One set of bottom trawl while interchanging 2 cod ends with different net mesh sizes will be used. The ground gear is usable on both hard bottom and flat bottom sea beds.

Knotted nets of ordinary polyethylene fiber will be used to facilitate local sourcing of materials and repair services after the delivery.

Net scale will be determined considering net resistance standing for a towing power

(about 77 kN) at towing speed of 3 knots and about a 70% (515 kW) load of the main engine.

(ii) Pelagic trawl

Followings are requested.

Sea depth	200 m or deeper
Target fish	Chub mackerel, Indian mackerel, scads. Little sardine, squid, bonito, little tuna
Mesh size	40 mm

One set of pelagic trawl will be employed.

Knotted nets of ordinary polyethylene fiber will be used to facilitate local sourcing of materials and repair services after the delivery.

Towing speed will be set at 5 knots, based on the swimming speed of mid-water fish. With regard to net scale, to maximize the catch potential for pelagic fish, the mouth opening will be 20m x 20m, with a net resistance suitable for a towing power of about 66kN at about a 70% (515kw) load of the main engine.

(iii) Pelagic longline

Followings are requested.

Sea depth	200 m or deeper
Target fish	Tuna, marlin
Mainline	Length of 50 km; monofilament with diameter as Japanese commercial fishing
Nos. hook	1,000

According to the surveys conducted by SEAFDEC in the South China Sea, catch rates of surface longlines are below 2%, so 1000 hooks might be necessary for catching several fishes in one operation. The main line length of 50 km, hanging 1,000 hooks, is close to the gear specifications used on Japanese coastal longliners. Figuring 12 hours from line casting to completion of line hauling operations, the crew workload will not be excessive and so this figure is deemed to be generally appropriate. The Plan, therefore, will follow the requested scale.

The monofilament line diameter used by Japanese fishing vessels ranges between 2.2mm - 3.2mm. Since thin monofilament line breaks easily, its use requires handling experience. Following the most Japanese long liners' practice, diameter of 3.2mm size is recommended.

(iv) Bottom longline (vertical longline)

Followings are requested.

Sea depth	100 – 300 m
Target fish	Grouper, red snapper, emperor, seabream, sweetlips, etc
Mainline	Length 6,250 m x diameter 6 mm
Nos. hook	250 branch lines, each with 8 hook lines

The requested bottom longline require setting the main line close to the bottom and connecting it to branch lines that extend further to several hook lines. Thus, these branch lines have an appearance similar to vertical lines.

With regard to fishing operation scale, the mainline of 6,250m is wound around about 5 cassette reels, and the 250 branch lines are arranged in about 10 baskets. Crew workload will be reasonable and thus the scale is found appropriate. The Plan, accordingly, will be in line with the requested scale.

(v) Deep water pot

Followings are requested.

Sea depth	20 –50 m	50 – 300 m
Target fish	Swimming crab	Deep sea crab, shrimp
Mainline	Length 6,000 m x 22 mm diameter	
Nos. pot	For crab x 200; for shrimp x 200	

In pot fishing, particularly in deep water, since a large number of traps must be hauled up, the tensile force of the main line must be high, necessitating the use of lines as thick as 22mm.

However, with a 6,000m main line length, the space required to accommodate coiled lines can be high as 5m3. Moreover, the pots, even when folded, will take up 5m3 each for crab and shrimp, which would be difficult to stow appropriately on board. Accordingly, gear scale will be set at about half the requested scale-- i.e, a main rope length of 3,000m, with 100 crab traps set 30m intervals, together with another 100 shrimp traps.

(vi) Drift gillnets

Followings are requested.

Target fish	Skipjack	Spanish mackerel, flying squid	Chub mackerel, round scads, flying squid
Mesh size	180 mm	100 mm	40 – 50 mm
Net size developed	3,000m length x 20 m deep	3,000 m length x 15 m deep	3,000 m deep x 10 m deep

Even in Japanese commercial fisheries, net depth over 10m are seldom used, but very deep nets of 10 – 20 m at hanging are requested. When using this large a net, hauling requires a severe workload, likely creating operational problems on the narrow bow deck.

Drift gillnets are positioned at a low level in TD's priority for purposes of both the fishing surveys and training activities. Of the 3 types of drift gillnets requested, the 100mm mesh size used for catching squid is found important, but the others are relatively less so.

Based on the above, it is suggested to adopt only the gillnet intended for squid catches. The net depth will be, however, about 8m, following the example of Japanese fishing vessels.

(vii) Squid jigging

Followings are requested.

Jigging machine	4 sets
Lure lamp	2 kW x 6
Parachute sea anchor	Fitted

This is the method used in Japan for squid jigging, which employs fish lure lamps and automatic jigging equipment. The layout of this gear will pose no problem on the Plan Vessel and so the scale is deemed appropriate.

(viii) Spare fishing gears

Regarding extent of spare fishing gears to be kept, it is considered reasonable to keep to a extent anticipated to have damage in one fishing trip.

(3) Fishing Machinery Plan

All fishing machinery considered for this project will be used to drop and retrieve the fishing gear included in the Fishing Gear Plan in Section (2) into and from the sea. In other words, fishing machinery capacity should be planned on the basis of gear scale.

The fishing machinery will generally be powered by oil hydraulic motors, fed from the hydraulic power source piped from the main engine driven oil pumps. Seating will be prepared to bolt detachable/removable machinery/equipment at each designated position. Hydraulic oil piping will be led to the vicinity of the machinery and connected to the machinery after seated.

(i) Trawl fishing

The fishing machinery, for use in both bottom and pelagic trawl operations, will require the following equipment.

Trawl winches	Winches to tow two lines of trawl warp. Each winch will be of capacity to wind trawl warp wire of 1,500 m to tow trawl at 400 m deep, i.e. warp length = depth x 3 + allowance, and installed at port and starboard sides of the vessel.
Net drum	Winch to wind trawl net. One set with a capacity to wind either bottom trawl or pelagic trawl net will be provided.
Cod winch	Small winch for lifting the cod end from the sea to deck. Two sets will be required for alternate use.
Slipway door	Door to close the stern slipway to prevent accidental falls and to prevent shipping water. Speedy operations are required with an oil hydraulic system.

(ii) Surface longline fishing

Fishing system patterned after Japanese coastal fishing vessels, with the following equipment to be carried:

Line hauler	Winch for hauling the main monofilament line. One set will be installed in the bow.
Buoy line reel	Winch to haul buoy line. In the longline operation aiming at big-eye tunas, longline is set at deep sea depth therefore buoy line is 50 m or longer, and requires power equipment to save manpower and time.
Branch reel	Equipment to wind branch line. One set will be installed in the bow. Branch lines in pelagic longline fishing are over 15m long, so that a power equipment is required to wind them in a circular pattern.
Main line reel	Reel to stow the main monofilament line of 50 km. Cassette reel system will be adopted, which is used widely in Japan on coastal and offshore tuna longliners. Since one reel can

wind 2,500m of monofilament, a total of 20 cassette reels will be needed to take in a mainline of 50 km.

Line caster	Equipment to cast off mainline from the stern. One set will be installed at the stern end.
Interval timer	Equipment to indicates the timing for attaching branch lines to the mainline. One set will be provided.
Toripole streamer	Streamer from of the vessel stern to avoid seafowl catching cast bait. A set of Toripole will be provided in line with the international policy.

(iii) Bottom long line fishing

Line hauler	Same unit as planned for the pelagic longline operation
Main line reel	Same unit as planned for the pelagic longline operation. About 5 cassette reels for exclusive use to wind 6,250 m mainlines will be needed.
Interval timer	Same unit as planned for the Pelagic longline operation

(vi) Deep sea pot fishing

Capstan	Winch to wind up the mainline. One set of capstan will be placed on the bow. Since a high power capacity (about 25kN) is required, other winch, e.g. line hauler, cannot fulfil the requirement for lifting rope of deep sea pots.

(v) Drift gillnet fishing

Net hauler	Winch to haul up sinker rope of drift gill net. One set will be installed in the bow. The diameter and shape of a drift gillnet sinker rope is quite different from longline mainline so that line hauler cannot be used hauling gill net.
Net transfer pipe	About 350mm diameter pipe to transfer gill net from the bow to the working area in the stern.
Power roller	Small winch to pull gill net from the end of transfer pipe.
Net stowage	Gill net will be regularly stowed in a bin formed by portable poundboard at aft deck, and prepared for next net casting.

(vi) Squid jigging:

Squid jigger	4 electronically controlled jigging machines (double) will be provided.
Fish luring lamp	2 kW x 6 lamps will be suspended at the bridge top.

In principle, fishing for both fishery research and training will be directed at one fishery per trip. Prior to each sailing, the fishing machinery will be set and prepared with the

designated gear and nets for that voyage on the wharf side.

For trawling operations: - Exchange trawl nets, gears and otter boards

For pelagic longline operations:
- Branch line reel to install and to connect hydraulic oil pipe
- Buoy line reel to install and to connect hydraulic oil pipe
- Main line reel to install and to connect hydraulic oil pipe
- Line caster to install and to connect hydraulic oil pipe
- Main line guide pipe and tension equipment to install

For bottom longline operations:
- Buoy line reel to install and to connect hydraulic oil pipe
- Main line reel to install and to connect hydraulic oil pipe
- Line caster to install and to connect hydraulic oil pipe
- Main line guide pipe and tension equipment to install

For deep sea pot fishing operations:
- Placement of poundboard in the bow to form a bin to stow the main line and traps.

For drift gill net fishing operations:
- Setting up the net transfer pipe
- Placement of poundboard in the bow to form a bin to stow grill net.

For squid jigging fishing operations:
- Setting up the jigging machines and overhang net
- Setting up the fish lure lamps
- Power connections

(4) Electronic Fishery Equipment Plan

In order to obtain necessary sample collection during pilot operations using the fishing gear outlined in Section (2), the following fishery electronics items are planned with a with a view to detecting fish schools prior to casting the gear as well as a view to gaining information on sea depth and fish school distribution.

(i) Fish finder

Ultrasonic waves are beamed at the area directly below the hull to search for fish schools. This, therefore, is the most important equipment on the vessel for detecting schools and is compatible with all fishing methods. This equipment will be of CRT or

LCD color monitor, and of a type widely adopted in commercial fishing vessels.

Three frequencies will be available to use: about 200kHz for pelagic and demersal fish species, about 110kHz for squid and about 50kHz or wide range.

A sub-monitor will be installed in the dry lab so that oceanographic observations can be made while getting a grasp of fish school conditions.

(ii) Scanning Sonar

Ultrasonic waves are beamed to all 360^{o} direction around the hull to scan distant fish schools. Information on fish school size, distance, and water depth of pelagic schools are available by the scanning sonar. On the Plan Vessel, this equipment will be used mainly for trawl operations. As an important tool to search remote schools, the scanning sonar is commonly adopted by the most of trawlers and purse seiners.

The scanning sonar will be of 360 ^{o} scanning type with CRT or LCD monitor.

(iii) Trawl Monitor

Hydroacoustic sensors are installed at the head line of trawl net and at the otter boards to measure trawl net depth, distance to the bottom, fish schools passing the net opening, and distance between the otter boards. Measured data are then sent by wireless to the vessel to allow observation of trawl net condition in the bridge so that taking the trawl net mouth right to the fish school. In order to improve the accuracy of catch rate surveys, it is highly desirable to clarify the condition of trawl net deployment. This monitor helps in the development of fishing techniques as well, since, a determination can be made as to how net openings and trawling speed vary, based on changes in currents and vessel speed, after net casting.

(iv) GPS Buoys

Four units will be provided, of which 3 units will be in use and the remaining unit kept in reserve. This request was intended to observe the deployment of pelagic longline gear in the water. Buoys are attached to both ends as well as the middle of the line. They are used to establish the present position of the long line and to observe how the main line deploys (spreads out) after casting under the influence of such factors as current and wind direction. It is also essential when searching for severed lines en route.

Buoys shall be attached with self-calling radio equipment.

(v) Underwater TV

A TV camera is set at the mouth of the trawl net, and a timer is set to start operating,

when trawl net is cast. After the net is hauled in, the TV images are collated with actual catches, fish finder images, and the trawl monitor to provide understanding of fish behavior.

Study of Aberdeen Marine Institute, UK for observing trawl using TV camera is known. Interesting facts, e.g. movement of trawl net, movement of otterboards and reaction of fishes, situation of fish school led into or escape from net, and effect of JTED, are reported.

TD is taking various actions related to the regionalization of the Code of conduct for responsible fisheries, which includes promotion of fitting TED (Turtle Excluder Device) and JTED (Juvenile and Trash Excluder Device), as very little is known about fish school activity, an underwater video camera was requested to develop understanding of their behavior.

The equipment shall be of recording pre-set type, battery driven, suitable for sea depth 100m.

(vi) Items not included in the Plan

The following requested items will not be included in the Plan:

Recording Fish Finder	This equipment records echo of fish school and seabed on recording paper. SEAFDEC request the equipment to use its recorded paper in classroom after the vessel returns to port. However, video cassette picture taken from the color fish finder included in this Plan can be replayed in classrooms, thereby eliminating the need for a fish finder with recording paper.
Portable Fish Finder	This equipment was requested for use in detecting squid schools. However, it was found that no such device exists. Since echoes from squid cannot be detected by frequency of about 200kHz, which is the frequency generally used for finding ordinary fishes, it is planned to add a supplemental frequency of about 110kHz, by which echoes from squid are detected, on the fish finder. Accordingly a portable fish finder for squid will not be included.

(5) Research Equipment

(i) Fish Stock Assessment

Scientific echo sounder	The reason why so great a weight is placed on fish stock assessments by scientific echo sounder is that this makes possible direct quantitative evaluations for which the survey vessel can take continuous acoustic observations running along the course, and the fish stock assessment can be speedily conducted over a wide area. In the resource survey

program in Cambodian and Vietnamese waters, which is the first program planned just after the Plan Vessel's commissioning, the length of the survey line is estimated to reach 2,000 ~ 3,000 nautical miles, so that the resource survey must be done quickly. In this sense as well, it is considered appropriate to equip a scientific echo sounder on the Plan Vessel.
Scientific echo sounder shall transmit 2 frequencies, 38kHz and 120kHz.

(ii) Primary Production Research

A portable reflectance radiometer, fluorometers (2 kinds), and a quantum sensor for Photosynthetically Active Radiation (PAR) have been requested for the primary production surveys in target waters. Target areas of the primary production surveys and required survey equipment are shown below.

Target area	Equipment
Chlorophyll distribution	Portable reflectance radiometer
	Fluorometer (for continuous sea surface observations)
	Fluorometer (for underwater levels)
Primary Production Volume	Quantum sensor for Photosynthetically Active Radiation (PAR)
Analysis of Nutrient Salts	Water quality analyzer (Auto analyzer)

Data on chlorophyll distribution delivered by satellites is indispensable to primary marine production research. Satellites equipped with sensors measuring sea color, such as the technical satellite "Midori" (the ADEOS satellite, NASDA), and SeaWiFS satellite (NASA), are indispensable in the area of primary production research, since they deliver chlorophyll distribution data on a global scale. At SEAFDEC as well, where MFRDMD in Malaysia has been registered as the SeaWiFS receiving center, considerable interest has developed in obtaining chlorophyll information.

Portable reflectance radiometer:
It is necessary, before using data on chlorophyll distribution delivered by satellite, to do field measurements of ocean color and correct the satellite data accordingly, thus the equipment shall be provided on the Plan Vessel.

Fluorometer (for continuous sea surface observations):
The degree of cloud coverage and satellite orbit conditions may occasionally influence data on chlorophyll distribution on a particular area of waters. It is essential, therefore, that continuous data be obtained on the Plan Vessel.

Fluorometer (for underwater levels):
As the chlorophyll distribution data from the satellite is limited to the surface layer, a Fluorometer which can acquire

data on underwater levels will be installed on the Plan Vessel.

Quantum sensor for Photosynthetically Active Radiation (PAR):
In order to learn the vertical distribution of radiation in the wave band (350 – 700m), which is photosynthetically active, this instrument will be carried on the Plan Vessel to observe the seasonal variation of horizontal and vertical chlorophyll distributions as well as to estimate carbon sequestration.

Auto analyzer: Measuring the distribution of nutrient salts is a basic requirement for understanding the variation of marine primary production. TD is planning to measure the distribution of nitrite, nitrate, phosphate, and silicate. Considering that some 36 bottles will be generated at one 12-layer measurement point (at a rate of 3 bottles per layer to minimize measurement error) as well as the requirement to take prompt measurements aboard the vessel due to rapid decomposition of nutrient salts, we have recognized the need for the water analyzer. The equipment on board the Plan Vessel shall be an automatic analyzer for measurement of nitrite, nitrate, phosphate, and silicate.

(iii) Oceanographic Surveys

Target areas of the oceanographic surveys and required survey equipment are shown below.

Target area	Equipment
Oceanographic Structure	CTD
	XCTD
	Water samplers; reversing thermometers
	Thermosalinometer
	Weather satellite information receiver
	Doppler current profiler
Fishing Methods	Water temperature and depth recorder for long line use
Seabed mapping	Seabed mapping sonar
Bottom sediment surveys	Ekman barge, core sampler
	Sieve

The Request calls for observations down to 500m (12 layers). TD has explained that there is no need to go beyond this depth. Their comments support the fact that the oceanographic environment survey is intended to inform us about the fishing ground environment, which is understood to represent their practical attitude.

CTD By observing the conservative concentrations of each layer (e.g., water temperature, salinity and DO), an examination is made on the oceanographic structure (such as water mass

analysis). This is a basic survey procedure for studying the fishing ground environment. In the case of the first planned collaborative resource survey through Cambodia and Vietnamese waters, it is estimated that as many as 60 observation points will be established. From the twin standpoints of survey accuracy and speed, CTD observations are superior to previous methods based on water samplers and reversible thermometers. The equipment on board the Plan Vessel shall be equipped with water temperature, salinity, DO, pH, fluorescence sensor, PAR sensor and carried 12 rosette samplers of 1.7 lit capacity.

XCTD — XCTD will be used as a supplementary measure in cases when the vessel stops and CTD observations become impossible, due to bad weather or passage through straits or innocent passages. 12 units of XCTD probe shall be provided for the Plan Vessel.

Water samplers; reversing thermometers

Water samplers and reversible thermometers will be used as an alternate method at observation points that are inappropriate for suspending CTD, such as those close to shore. 10 units of Niskin water samplers with 10 sets of reversing thermometers (protected and unprotected) shall be provided on board the Plan Vessel.

Thermosalinometer — A supplemental method for use in areas where it is difficult to estimate distributions between stationary observation points by interpolation. When obtaining horizontal distributions of conservative concentrations, the gaps will be filled by interpolation, but, when the distributions within these intervals change as a result of eddies and the similar factors, it may be impossible to cope with the situation. To deal with such circumstances, it is found necessary to equip the Plan Vessel with instrument for continuous observation of water temperature and salinity. The apparatus shall be of direct sampling from non-contaminated seawater supply system.

Weather satellite information receiver:

Based on the past SEAFDEC surveys, observation points have been established at 30-60 nautical mile intervals. To obtain water temperature data on areas outside the observation line, it is found necessary to equip the Plan Vessel with the weather satellite information receiver. The receiver shall be of 14” display unit type.

Doppler current profiler — An 11-layer Doppler current profiler, which provides a rough idea of vertical current distribution as one of the elements determining oceanographic structure. A current observation unit of Doppler, 11 layers type shall be installed on board the Plan Vessel.

Water temperature and depth recorder for long line use:

A recorder for water temperature and depth for longline use has been requested to permit local observations. This will provide data on actual depths of the positions of branch lines and will be used to study their relationship to fish catch rates via comparisons with oceanographic structure, such as the distribution of thermocline. This type of survey is found as being oriented to fishing technique development rather than fishing ground environment. The cost effectiveness of the recorder is outstanding, and so it is deemed appropriate for this Plan. The apparatus shall be of fitted type to pelagic longline fishing branch lines, and 4 sensors will be provided.

Seabed mapping sonar — Seabed mapping sonar measures seabed geography employing sonar technology and shows the result in perspective view or in depth contour map, which will be useful to study formation of fishing. There are two types of the seabed mapping sonars, i.e. towed underwater transducer type and keel transducer type. In the Plan Vessel the latter, which des not require any preparation, shall be adopted. The sonar shall be able to emitt ultrasonic cross-fan-beam from the transducer, 150 degrees of sweeping width as maximum.

Bottom sediment sampler

Gathering sedimentary pebbles, sand, and mud, distribution of sea bottom sediments can be derived as part of an oceanographic study. Also, after bringing back the sample materials, trace metals and petroleum hydrocarbons can be detected in the sediment, thereby contributing to environmental research. The Plan Vessel will carry a Ekman barge sampler and a core sampler.

Sieve — For measuring the distribution of particle diameters, the Plan Vessel shall carry a set of sieve.

(iv) Fish Biology Survey

In the Fish Biology Survey, for studying distribution of zooplankton and their taxa, plankton net is required for collecting zooplankton and larvae samples. A bongo net will be provided for the Plan Vessel.

(v) Laboratory Equipment and utensils

For laboratory work on the Plan Vessel following laboratory equipment and utensils are necessary.

Biological microscope — For plankton identification, a set of microscope shall be provided.

Balance — Balances of 200g and 200kg weighing capacity shall be provided.

Small refrigerator	For storage of chlorophyll and other specimens, a refrigerator shall be provided.
Glass utensils	A set of glass utensils shall be provided for specimen treatment and titration.

(vi) Data Processing

For processing, analyzing and recording, following data processing apparatus are necessary on board the Plan Vessel.

Computers	Those computers attached to CTD, XCTD, Fluorometer, Thermosalinometer, Water Analyzer for downloading and recording data outputted from the measurement equipment, while not operating the equipment, might be used commonly to compile and edit survey data on board the Plan Vessel.
Ship Data Server	To process data of GPS information, wind direction and velocity, air temperature, water temperature, water depth, etc. for output to observation data, a ship data server shall be provided aboard the Plan Vessel. The server shall have LAN connection with other onboard computers.

(vii) Spare parts

Spare parts attached to each equipment shall be prepared in a scope to cover media of records and consumable items necessary for one research voyage.

(viii) Deleted Items

The following equipment in the Request will not be included in this Plan:

Turbid meter	While a turbid meter would be required when the objective is to conduct water quality inspections as a part of coastal environmental management, this activity properly belongs to shore-based or shore-oriented surveys. It is, therefore, difficult to link this Request with the operations of the Plan Vessel.

2-2-3 General Arrangement and Outline Specification

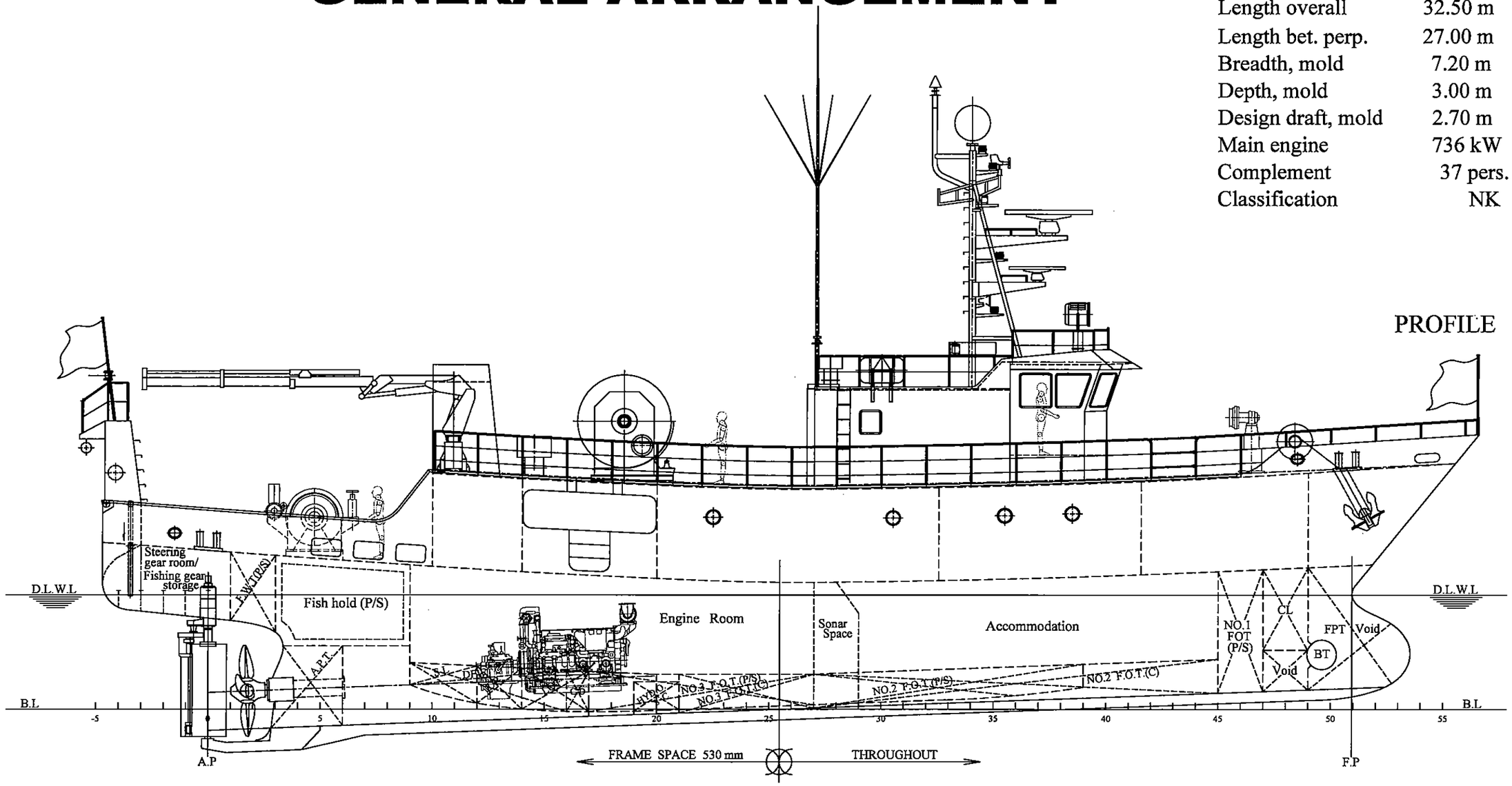
2-2-3-1 General Arrangement

GENERAL ARRANGEMENT

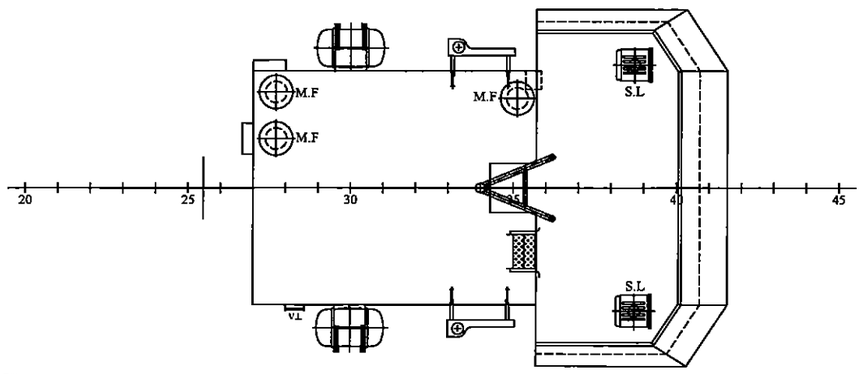
Principal Particulars

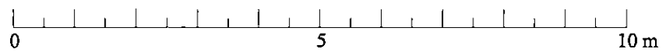
Length overall	32.50 m
Length bet. perp.	27.00 m
Breadth, mold	7.20 m
Depth, mold	3.00 m
Design draft, mold	2.70 m
Main engine	736 kW
Complement	37 pers.
Classification	NK

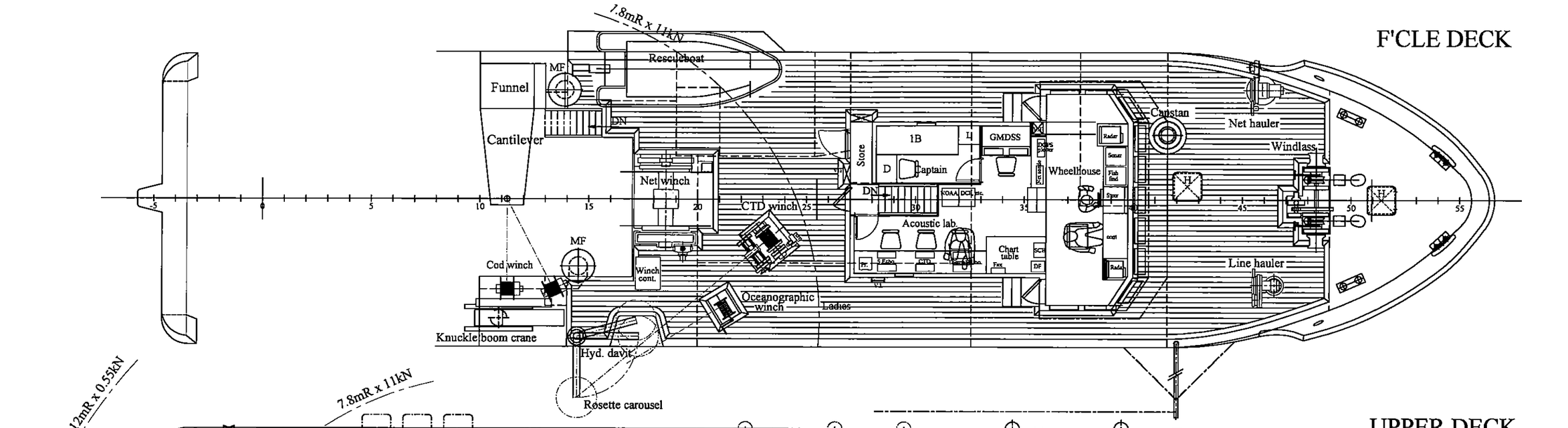
PROFILE



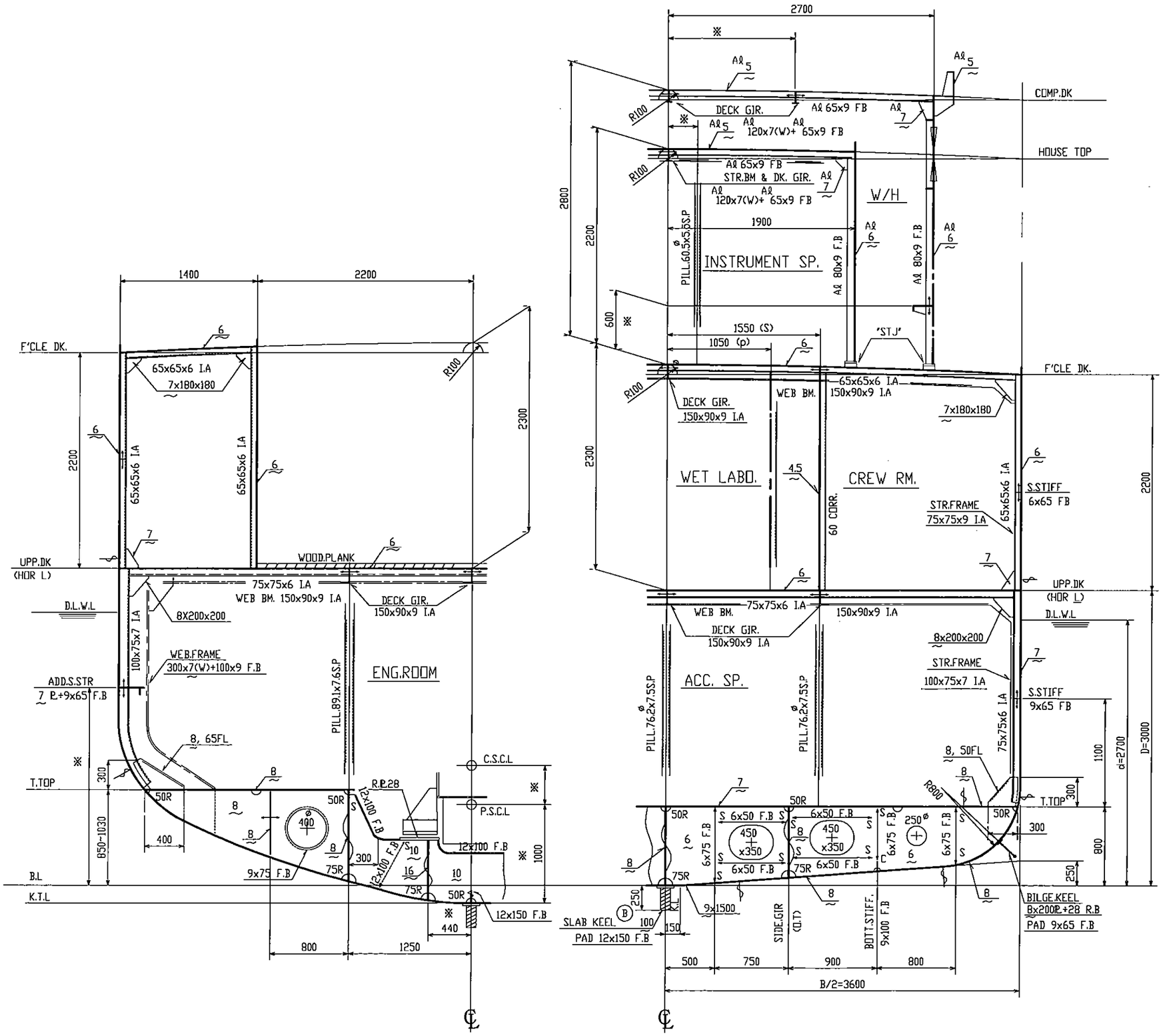
COMPASS DECK






F'CLE DECK
1.8mR x 11kN
Rescueboat
Funnel
MF
Cantilever
DN
Net winch
CTD winch
Store
1B
GMDSS
D
Captain
Wheelhouse
Capstan
Net hauler
Windlass
Acoustic lab.
Chart table
Line hauler
Cod winch
Winch cont.
Oceanographic winch
Ladies
Knuckle boom crane
Hyd. davit
Rosette carousel
12mR x 0.55kN
7.8mR x 11kN
UPPER DECK
Funnel
Blast freezer
Capstan
Trawl winch
WC
Lady WC
Gents
Ur
Shw
Washing machine
Sink
Shelves
Freezer h=1.7m
Working table
Wet lab.
Dry lab.
Auto analy.
2B
Crew (4)
Table
C.R
Galley
Dry prov.
Veg. prov.
Meat prov.
Bos'n store
Mess room
Ref.
A/C
Storage
Trainer/Scientist(4)
Engine Casing
Shipside opening
Platform
TANK TOP
Fishing gear storage
Steering gear room
FWT
Fish hold
GFWT
CD
NO.3 FOT (P)
Engine Room
HYD.O.
NO.3 FOT (C)
MSB
NO.3 FOT (S)
SL
DR
BOT
LOT
Monitor room
NO.2 FOT (P)
Crew (6)
Crew (4)
NO.2 FOT (C)
Trainee (4)
Trainee (14)
NO.2 FOT (S)
NO.1 FOT (P)
NO.1 FOT (S)
FPT
0
5
10 m
— 45 —

MIDSHIP SECTION PLAN



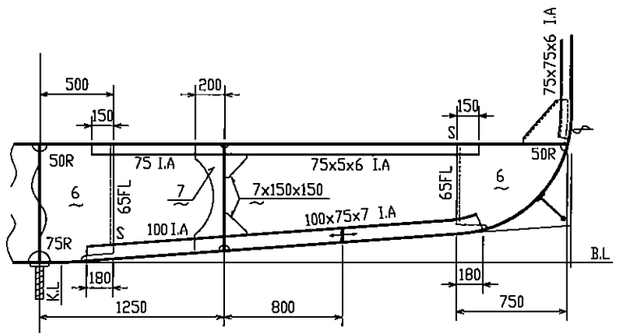
PRINCIPAL PARTICULARS

LENGTH (B.P.P)	27.00	m
LENGTH (0.96xLWL)	28.18	m
BREADTH (MLD.)	7.20	m
DEPTH (MLD.)	3.00	m
DRAFT (MLD.) DESIGNED	2.70	m
FRAME SPACE (THROUGHOUT)	0.53	m
CLASS	NK NS* MNS*	

MATERIAL NOTE

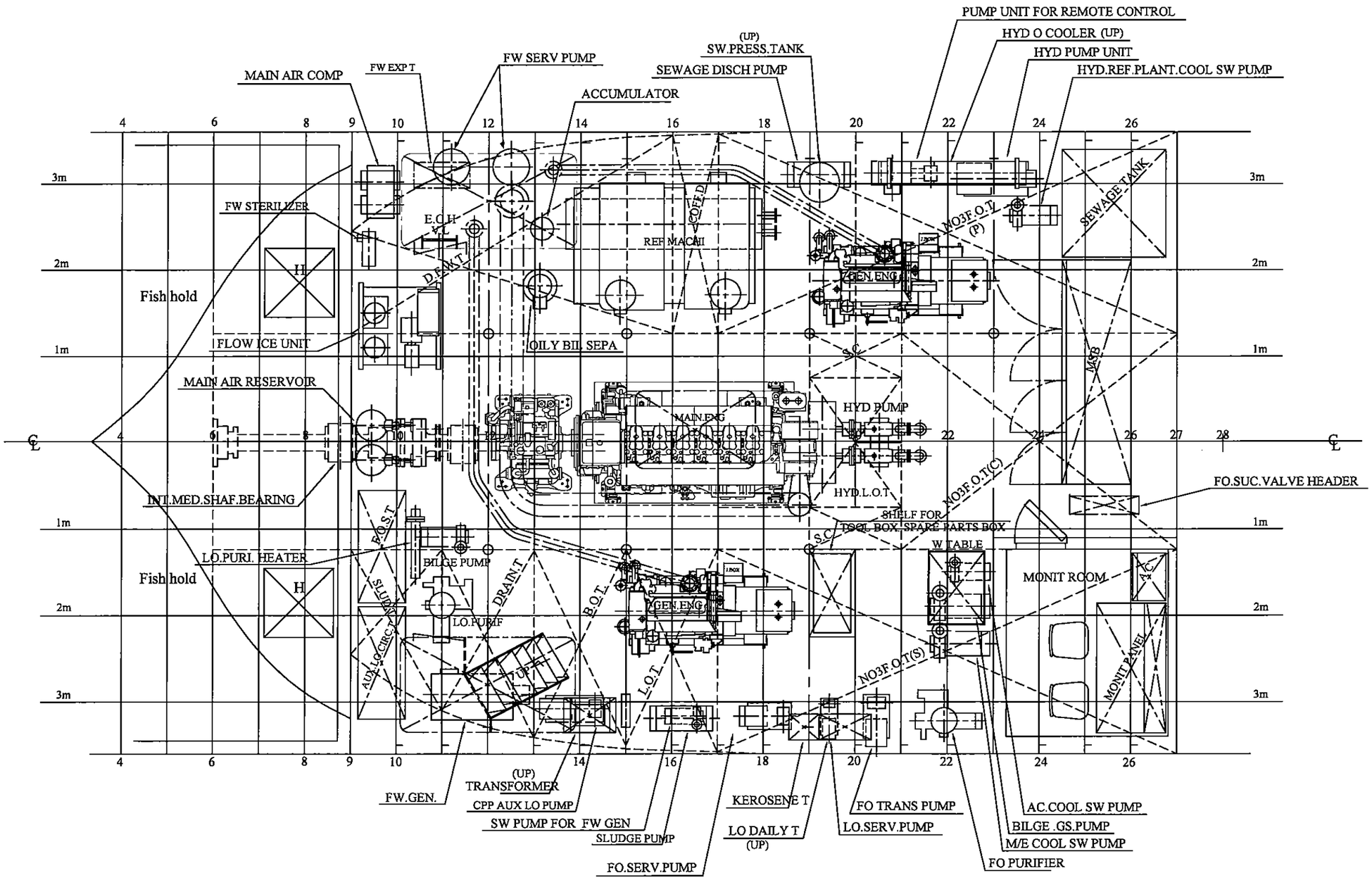
NO MARKED	"KA"
(B) MARKED	"KB"
AL MARKED "JG" ALUMINUM ALLOY	
PLATE	A5083P-O
SECTION	A5083S-H112

OPEN FLOOR



SCALE 1/40

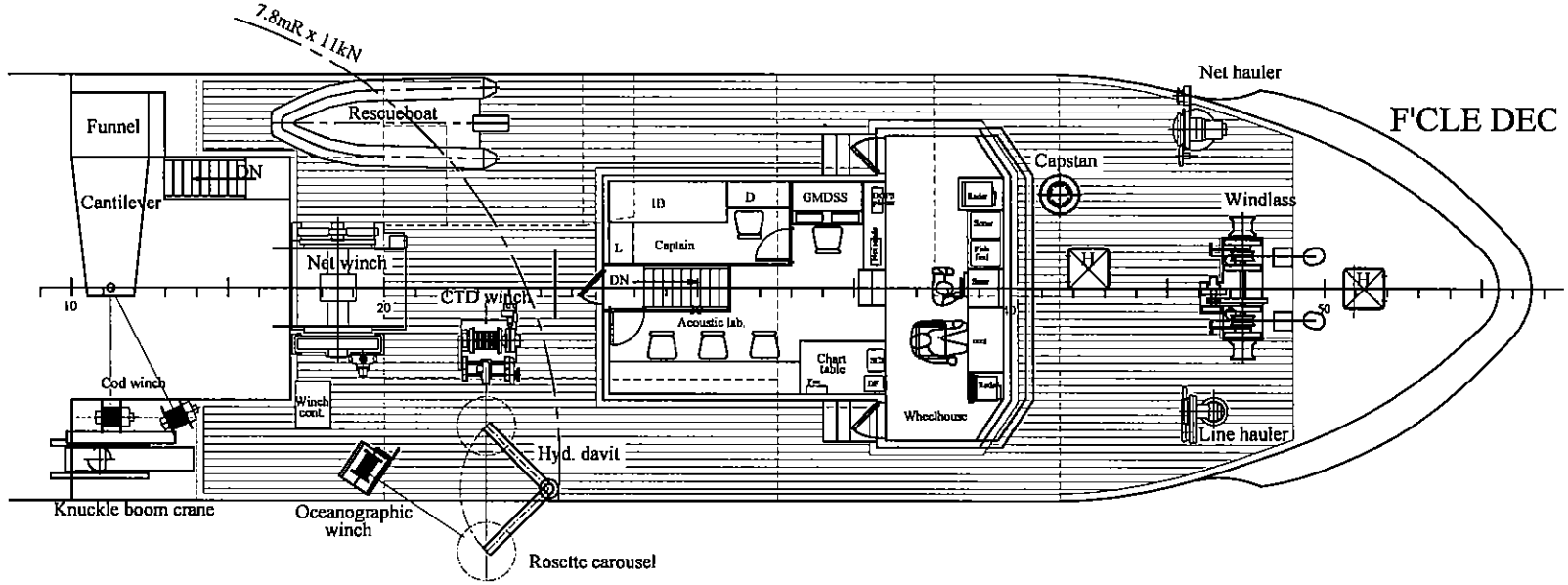
ENGINE ROOM ARRANGEMENT PLAN

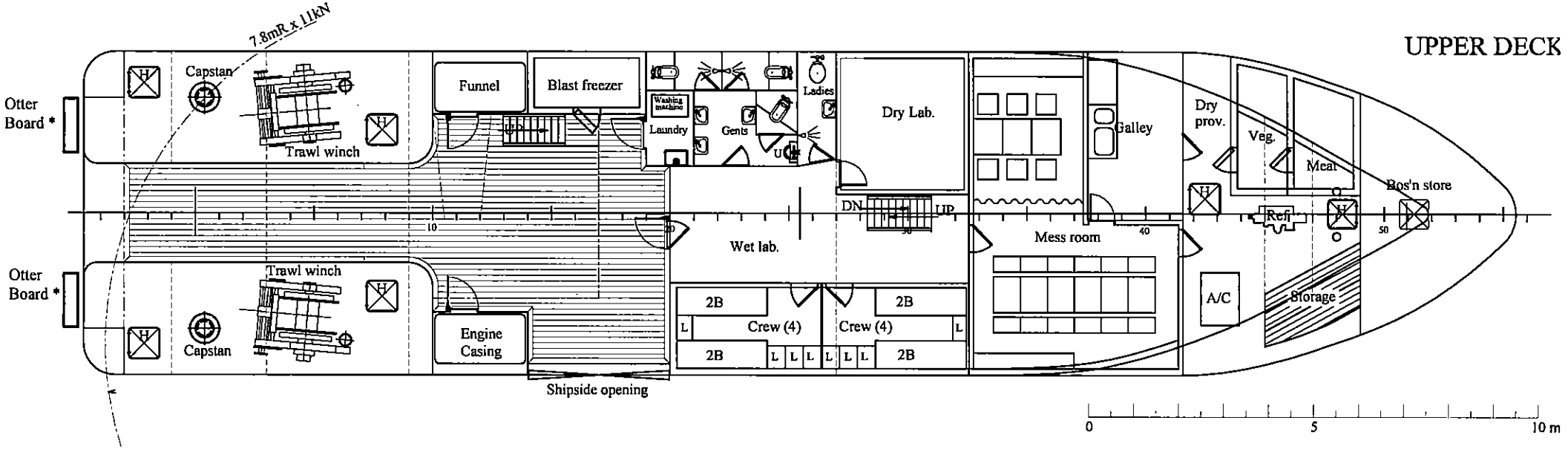


— 49 — SCALE : 1/50

TRAWL FISHING

Fixed equipment: Trawl winch, net drum, cod winch, etc.
Equipment to be installed before sailing (marked with*): Bottom or midwater trawl net to wind on net drum, bottom or pelagic trawl otterboard to hang on stern, various blocks/tackles to set.



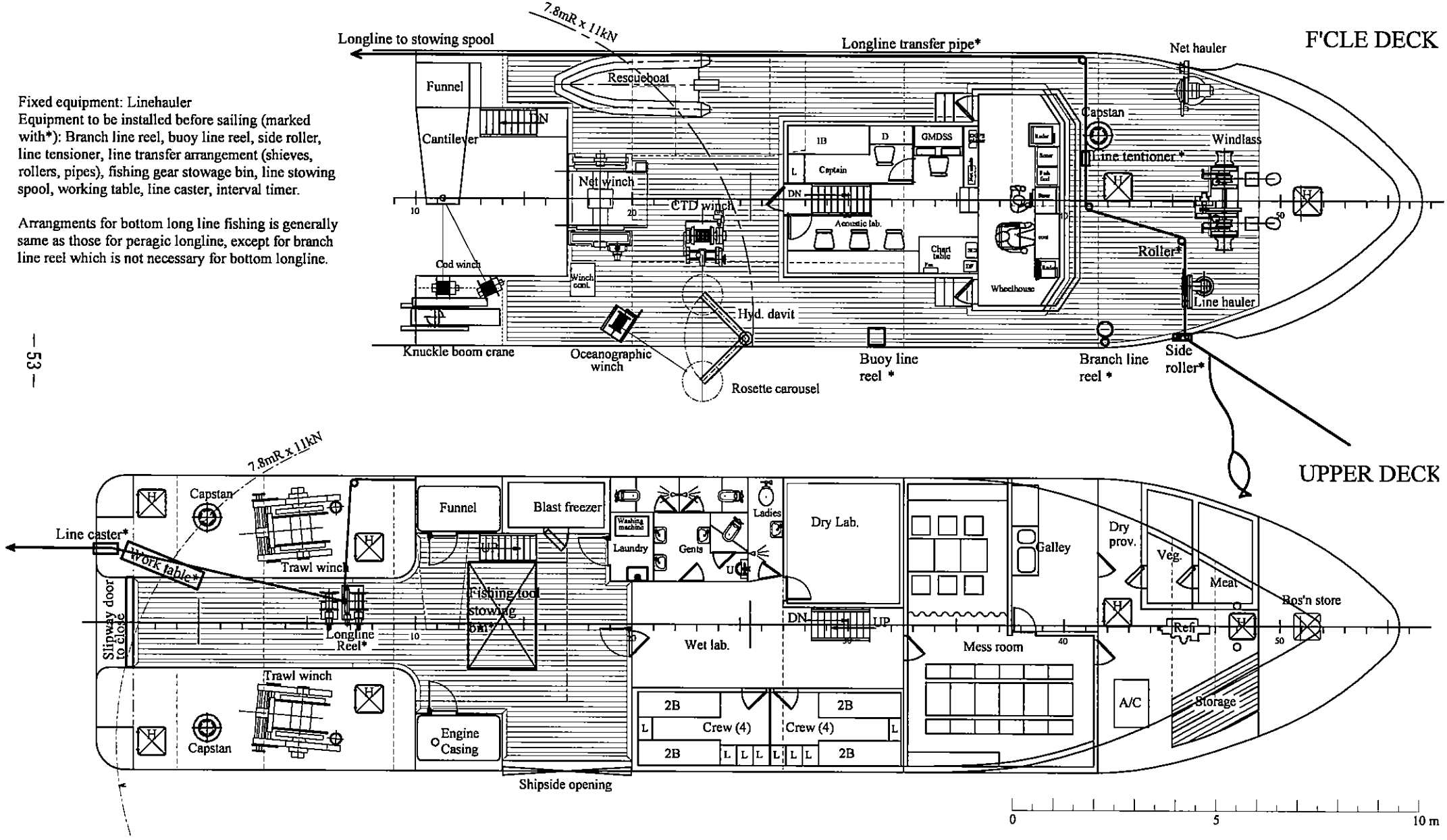


Scale = 1/125

PELAGIC AND BOTTOM LONGLINE FISHING

Fixed equipment: Linehauler
Equipment to be installed before sailing (marked with*): Branch line reel, buoy line reel, side roller, line tensioner, line transfer arrangement (shieves, rollers, pipes), fishing gear stowage bin, line stowing spool, working table, line caster, interval timer.

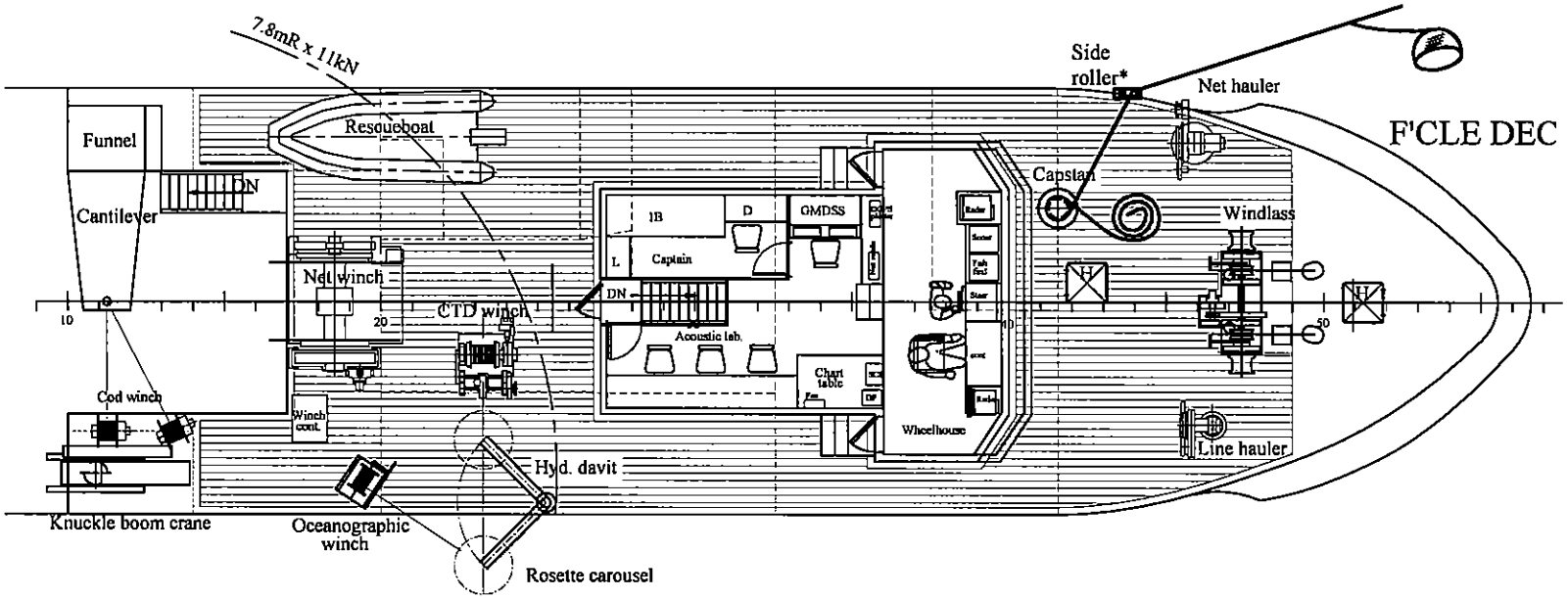
Arrangments for bottom long line fishing is generally same as those for peragic longline, except for branch line reel which is not necessary for bottom longline.

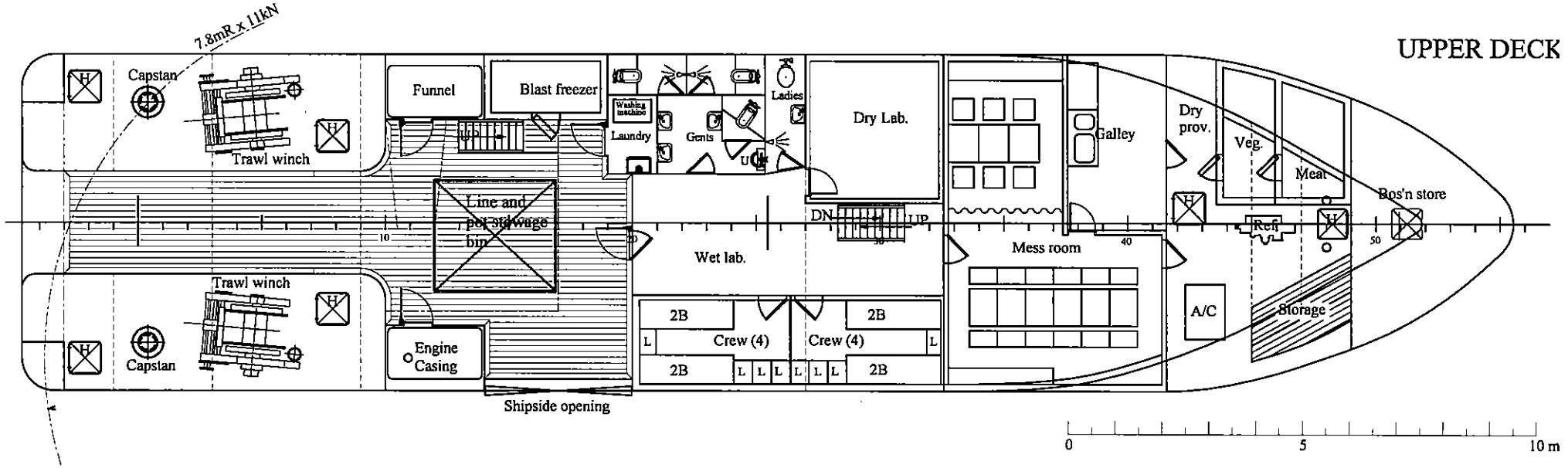


Scale = 1/125

DEEP SEA POT FISHING

Fixed equipment: Capstan (bow)
Equipment installed before sailing (marked with*): Side roller, line and pots stowage bin.





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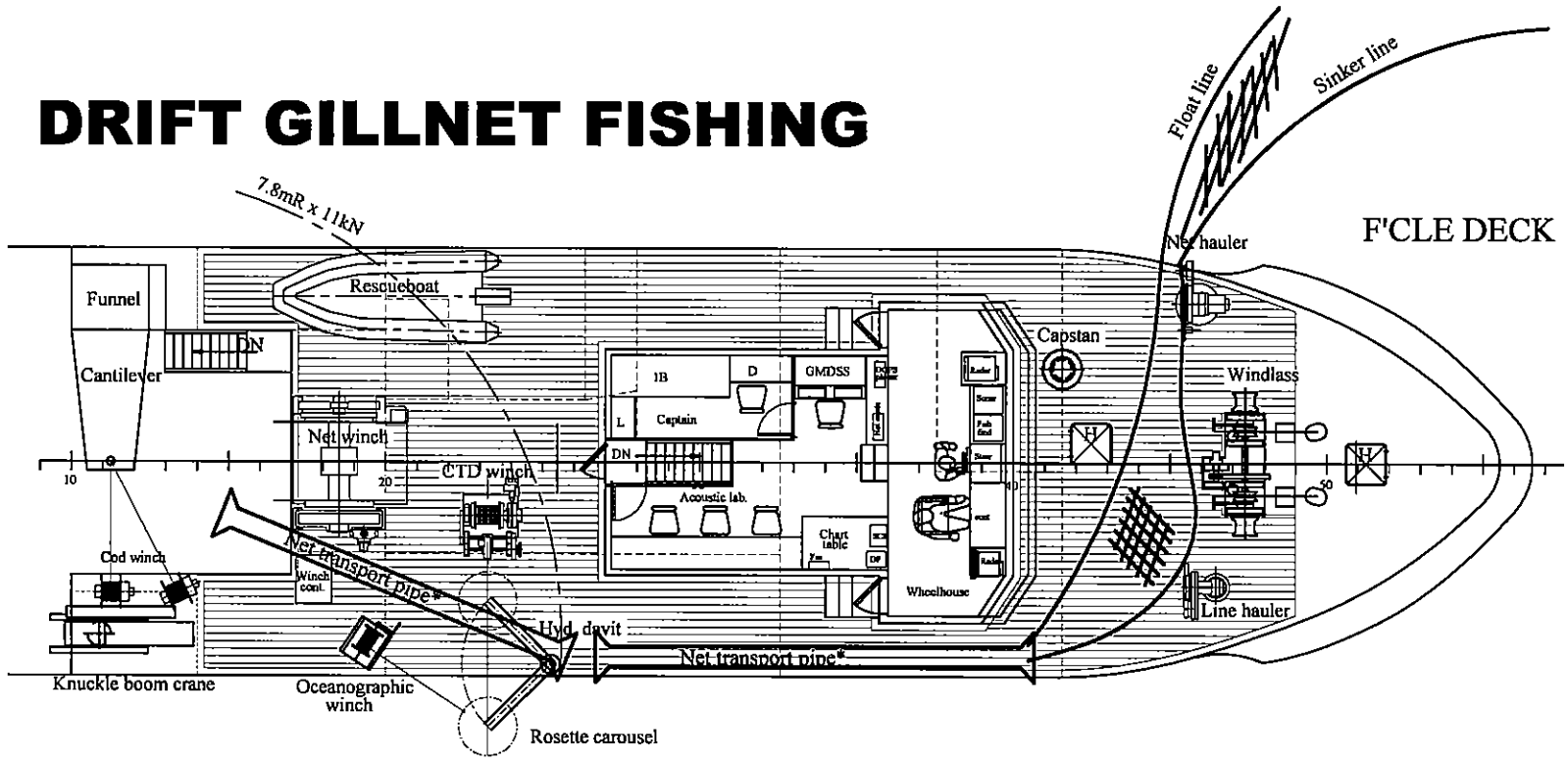
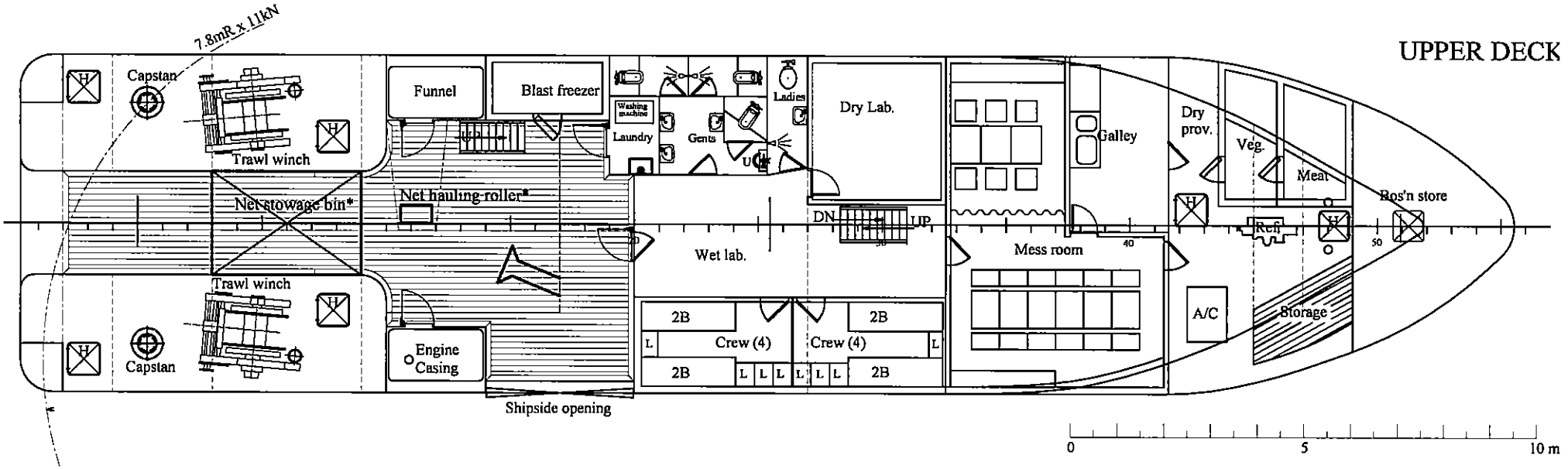
DRIFT GILLNET FISHING

Fixed equipment: Net hauler
Equipment to be installed before sailing (marked with*): Net transport pipe (about 350 mm dia.), net hauling roller, net stowage bin.





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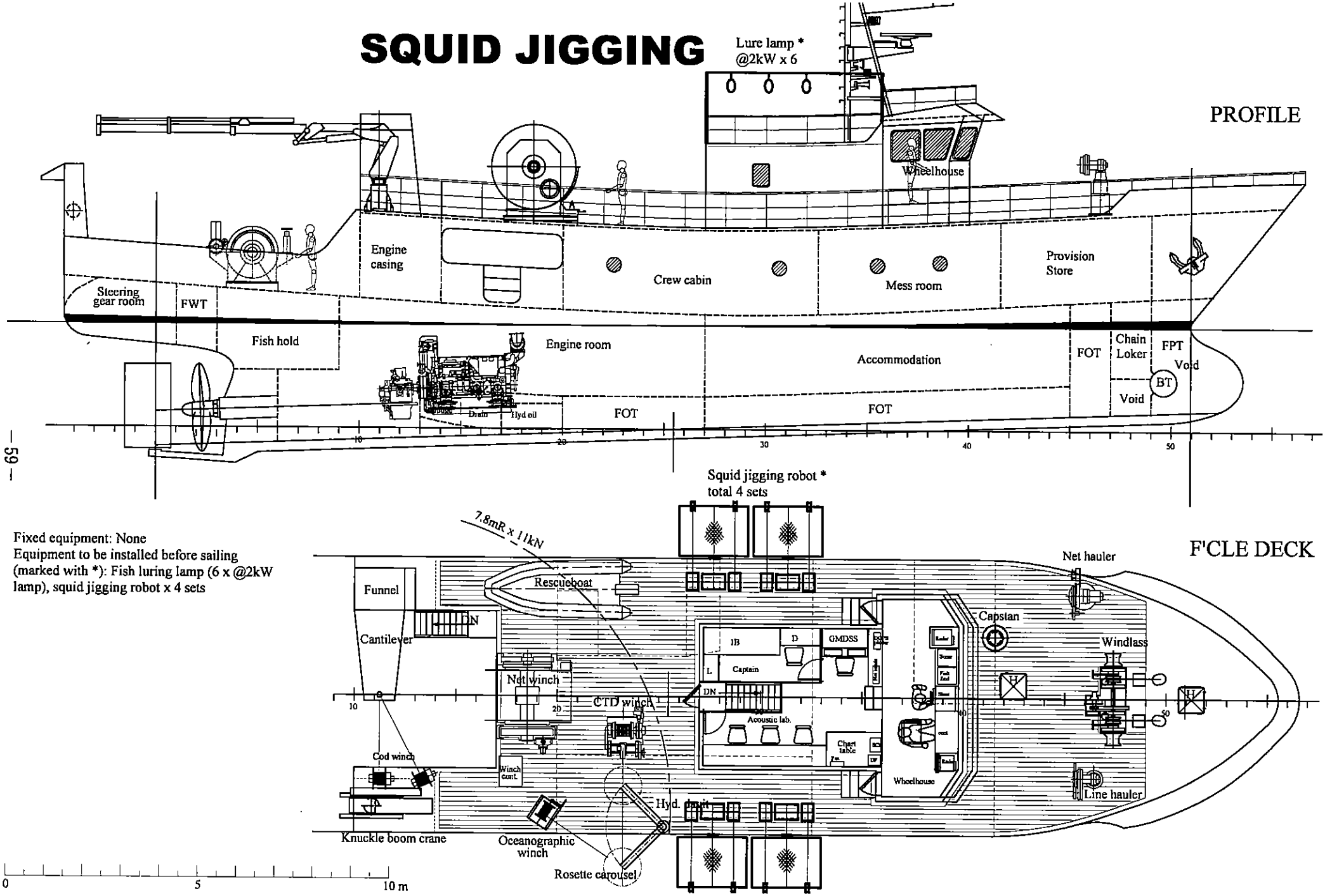
SQUID JIGGING



Fixed equipment: None
Equipment to be installed before sailing (marked with *): Fish luring lamp (6 x @2kW lamp), squid jigging robot x 4 sets

Scale = 1/125

2-2-3-2 Outline Specifications

1. Duty of the vessel

(1) Fishing for research and training

Trawl fishing (bottom trawl and pelagic trawl)

Longline fishing (pelagic and bottom)

Deepsea pot fishing

Drift gill net fishing

Squid jigging fishing

(2) Oceanographic survey for fisheries

Water sampling survey

Plankton and larva collection survey

Acoustic sea resource survey

(3) On-board navigation training

Navigation training

Marine engine training

Marine electric/electronic training

2. Navigation area

International: ASEAN EEZ waters[1]

3. Flag, Classification and Rules to apply

Flag:	The Kingdom of Thailand
Classification:	Nippon Kaiji Kyokai (NK) NS* MNS*
Rules to apply:	Maritime Rules of Thailand
	Rules of Classification Society
	International Convention for Safety of Life at Sea, 1974 (limited application)[2]
	International Convention on Tonnage Measurement of Ships, 1969
	International Convention for Load Lines, 1966
	International Conference for Preventing Collision at Sea,

[1] "Near Coastal Voyage Limit" according to Thai regulation and ASEAN waters but limited to 200 nautical miles or less from shore.

[2] Originally, Torremolinos Convention 1993 and Asian Regional Guidelines 1997 were considered as the international rules to apply for the Plan Vessel. However, it was concluded that SOLAS Convention should apply as "Special Purpose Vessel", not as "Fishing Vessel", through discussion with Harbour Department, Thai Government. To apply SOLAS regulation to the Plan Vessel, exemption from SOLAS regulations must be granted extensively. Refer also to the Minutes of Understanding between SEAFDEC and the Marine Department.

1972
International Convention for Preventing Pollution from Ships, 1973
Maritime Rules of Japan for interpretative and supplementary purpose

4. Principal particulars

Length overall	32.50 m
Length bp	27.00 m
Breadth, molded	7.20 m
Depth, molded	3.00 m
Designed draft, molded	2.70 m
Gross tonnage	207 tons international
Main engine	736 kW x 1 set
Speed	Service About 12.0 knot, when loaded to designed draft
Towing bottom trawl	About 3 knot
Towing Pelagic trawl	About 5 knot
Acoustic survey	About 9 knots at deep sea

Capacity	
Fish hold	20 m^3
Fuel oil tank	55 m^3
Fresh water tank	13 m^3
RO fresh water tank	3 m^3
Lub oil tank	2.3 m^3
Hyd. oil tank	1.1 m^3
Sludge tank	1.0 m^3
Drain tank	1.3 m^3

Complement:	
Crew	15 persons
Instructor/scientist	4 persons
Trainee	18 persons
Total onboard	37 persons

5. Hull structure

Structural scantling	According to NK class rule, and additional strengthening in way of areas subject to heavy fishing gear loads.
Material	NK class mild steel for hull structure of f'cle deck and below NK class aluminum alloy for bridge deck structure and outfitting above

6. Hull preservation and painting

Bottom hull	Tar epoxy A/C and tin-free A/F at 2 years life
Shell above waterline	Epoxy undercoat and epoxy finish
Superstructure	Modified epoxy undercoat and epoxy finish
Exposed deck	Modified epoxy undercoat and epoxy finish
Hull interior	Oleoresinous
Engine room bottom	Tar epoxy
Fresh water tank	Pure epoxy
Zinc anode	In way of propeller, on bilge keel, and in bowthruster tunnel

7. Deck covering

Wooden deck plank	50 mm Oregon pine on trawl deck of upperdeck and on working deck of f'cle deck
Anti-slip deck covering	Upperdeck outside net coaming, and wet lab.
Accommodation	Latex deck composition and vinyl flooring
Sanitary space and galley	Cement and tile

8. Material of hull outfitting

Stainless steel	Hawse pipes, slipway deck plating, fresh water piping (alternatively plastic material), hydraulic oil piping (exposed part), bolt to fix exposed outfitting (nut being of brass)
Aluminum alloy outfitting	Fish hold hatchcovers

9. Deck machinery

Windlass	Hydraulic motor drive, 12.8 kN x 12 m/min x 1 set for bower anchor 2 x @420 kg and anchor chain 17.5 mmD x 275 m (U2)
Capstan	Hydraulic motor drive, 14kN×15m/min x 2 set

Crane	Knuckle boom crane, about 11/25kN×7.8/3.8mR by hydraulic extension and max radius 12 m x 5.5 kN to handle trawl doors by manual extension
Rudder	High lift type (flap type)
Steering gear	Electric hydraulic, 20 kN-m x 28”/65o x 1.5 kW x 1 set Emergency steering by hydraulic steering wheel from wheelhouse
Bow thruster	Fixed pitch, 8 kN x 50 kW hydraulic motor drive (capacity to withstand 15 knots wind)
Hydraulic oil source	Main engine driven pump for all Electric motor driven pump to allow crane operation alongside quay and limited operation at sea Hydraulic oil distribution by constant pressure system

10. Ventilation

Mechanical ventilation	Engine room (1.5 kW x 2), toilets (0.4 kW), galley (0.2 kW), wet laboratory (0.4 kW)
Air conditioning	Accommodation (served by central unit of 3.7 kW compressor and 2.2 kW fan), from 32oC outside to 25oC inside Engine monitor room (0.75 kW compressor and 50 W fan)

11. Lifesaving and fire fighting

Lifesaving equipment	Inflatable liferaft 20 p x 2, 5 lifebuoy, distress signals, etc.
Rescue boat	Inflated type, with outboard motor, handled by ship crane
Fire fighting equipment	Fire pump and hydrant, portable fire extinguishers, automatic fire detector in accommodation and engine room, portable engine-driven emergency fire pump

12. Accommodation

Crew accommodation	Captain Single bed cabin Crew 2 double beds cabin x 2, and 3 double beds cabin x 1
Instructors/scientists	2 double beds cabin x 1
Trainee	7 double beds cabin x 1 2 double beds cabin x 1
Public rooms, etc.	Wheelhouse, acoustic lab, galley combined with mess room,

lavatory, dry laboratory, wet laboratory

Galley	LPG range with oven, rice cooker, fridge, water boiler, ice cube machine, sink, cooking table, dry provision store, cold provision store
Ref provision store	Meat room, –20oC, 2.2 m3 Vegetable room, 3oC, 3.6 m3 Ref. Compressor, two units
Toilet	Gents: 2 toilet booths with Japanese style WC and shower 1 toilet booth with Japanese style WC 1 urinal 3 wash basins Ladies: 1 toilet booth with European style WC, shower and wash basin All WCs to be fitted with FW washing arrangement.
Laundry	With washing machine

13. Fishing gears

Trawl fishing

Bottom trawl gears	1 set, with otter board and gears With two cod end nets of different mesh sizes to exchange With ground gear suitable for flat bottom and hard bottom
Pelagic trawl gears	1 set, with double blade aluminum otter board and gears
Split trawl winch	Hydraulic motor drive, 35 kN x 50 m/min x 20mmD SWR x 1,500m warp drum x 2 set
Trawl net drum	Hydraulic motor drive, 30 kN x 30 m/min x 4.5 m3 x 1 set
Cod winch	30 kN x 25 m/min x 16mmD SWR x 30m x 2 sets
Slipway door	Hydraulic cylinder operated, at aft end of working deck
Winch control	Remote control for trawl winch and net drum (speed and brake control) from aft end of f’cle deck Local control for all

Pelagic longline fishing

Lines and gears	50 km x 3.2 mmD monofilament mainline, 1,000 branches + hooks, buoys, etc.
Line hauler	Hydraulic driven x 1 set

Line caster	Hydraulic driven x 1 set
Branch line reel	1 set
Buoy line winch	1 set
Line spool	2 sets to stow main line, to use cassette spools 20 x @2.5 km monofilament

Bottom longline fishing

Lines and gears	6 mmD x 6.25 km polyethylene/vinyl strand main line, 250 branch lines, 2,000 hooks, two buoys, two anchors
Main line hauling	By same line hauler for pelagic longline
Gear stowage	Main line to stow in line spool for pelagic longline, branch line to stow in basket

Deep sea pot fishing

Pot gears	22 mmD x 3.0 km polypropylene main line, two buoys, two anchors 100 x shrimp pot, 100 x crab pot
Main line hauling	By capstan x 1 set x 20 kN x 15 m/min
Gear stowage	Main line and basket to stow in stowage bin at bowdeck

Drift gillnet fishing

Gill net and gears	For squid: 100 mm mesh x 3,000 mL x 8 mH x 1 set
Net hauler	Net hauler x 1 set
Net transfer	Through 350 mmD pipe from f'cle to stern
Net transfer roller	Hydraulic, to pull net from net pipe x 1 set
Net stowage	In net bins formed by insert boards at stern

Squid jigging fishing

Jigging machine	Electrolnically controlled automatic machine with circle line spool, 4 sets
Fishing lights	2 kW x 6
Gears	Lines, lures, 18 mD parachute anchor

Fishing electronic equipment

Trawl monitoring	To monitor trawl condition (height between head rope and seabed, height between head rope and foot rope, distance

	between otter boards, and fish echo passing through trawl mouth) by acoustic sensors fitted on trawl net and monitor in wheelhouse, wireless data transfer from sensor to ship
Fish finder	2 wave (200 kHz, 110 kHz and 50 kHz), 2000 m, color 14 inch CRT or LCD x 1 Slave monitor in dry laboratory With VTR recording system
Scanning sonar	360 o, about 4000 m range, color 21 inch LCD
Underwater TV	Recording pre-set type, battery driven, suitable for sea depth 100m
GPS Buoy	4 sets (3 working and 1 spare) with self-calling radio equipment

14. Fish preservation

Fish hold	Two compartments: -30 oC and 0 oC, adjustable, direct expansion cooling coil
Freezing room	-30 oC, cooling coil shelves suitable for tuna, intermediate flats for pan freezing, with blast fan, 290 kg tuna/36 hors, 280 kg pans /24 hors, with agitating fan 0.4 kW x 2
Slurry ice system	1 ton/day ice (about 5 ton/day of ice plus seawater)
Fish processing	Fish pond to accept fish from cod end, fish washing tub and sorting table, weight balance
Refrigeration plant	11 kW motor driven R-22 compressors (single stage reciprocating) x 2 and ice slurry plant in engine room

15. Fisheries research facility

CTD system	Carousel, with 1.7 lit x 12 rosette sampler, CTD,DO, pH, fluorescence sensor, PAR sensor Real-time survey through armored cable to onboard computer
Digital XCTD	Hand launcher, interface device, XCTD probe x 12 units
Plankton / larva net	Bongo net, 1 set
Water sampler	Niskin water sampler x 10, reversing thermometers (protected and unprotected) x 10 sets each
Reflectance Radiometer	Portable type for underwater use
Core sampler	89mm x 1m
Bottom sampler	Ekman-Berge, 20 x 20 cm

Ship Data Sever	Ship data acquisition system
Scientific echo sounder	38 kHz and 120 kHz with onboard calibration and analyzing system
Current observation unit	Doppler, 11 layers
Laboratory Equipment	Microscope, weighing balance (2 kinds), freezer, glassware, sieve shaker, vacuum pump (1/8 hp)
Auto Analyzer	Analyzing nutrient (nitrite, nitrate, phosphate, silicate)
Thermosalinograph	Direct sampling from non-contaminated seawater supply system
Fluorometer	ditto
Temp and depth recorder	Fitted to pelagic longline fishing branch lines, 4 sensors
NOAA Information Receiver	With display (14”) unit
Seabed mapping sonar	Transducer fixed at ship bottom, 3D seabed map
Onboard computers	To allow data reference from other onboard computers on LAN, with MO
CTD winch	6.4 mmD x 700 m armored cable with data core cable, hydraulic drive (working sea depth of max 500 m)
Oceanographic winch	4 mmD x 700 m stainless steel wire rope, hydraulic drive (working sea depth of max 500 m)

16. Engine room machinery

Main engine	736 kW x 950 rpm, medium speed diesel engine, with turbocharger, 6-cylinders, resiliently rubber mounted, NOx emission control
Gearbox	For reduction, i=about 250/950
Propeller	Controllable pitch, 4 blades, highly skewed
Diesel generator	2 set x 120 kVA x 50 Hz x 220 V, about 110 kW x 1,500 rpm diesel driven
Hydraulic power drive	1 set x main engine front drive through stepup gear and clutch, to power bow thruster, trawl winches, net winch, cod winches, capstan, windlass, line spool, oceanographic winch, CTD winch, and crane
	1 set x electric motor driven pump, suitable to power carne at quayside and to power small equipment at sea
Main air compressor	Air cooled, 20m3/h x 3 MPa x 3.7 kWe
Aux air compressor	Hand driven pump
Fuel oil purifier	Centrifuge purifier, 400 lit/h
Lube oil purifier	Centrifuge purifier, 400 lit/h

Oily bilge separator	0.25 m3/hr, automatic discharge, with bilge pump
Sewage handling	Sewage collecting tank about 2 m3
Water maker	5 ton/day, reverse osmosis type, nylon spiral module
FW sterilizer	UV ray type x 1 for drinking water line
Pumps	
	M/E cooling SW pump E.motor driven x 1
	M/E LO pump M/E driven x 1
	M/E aux LO pump E.motor driven x 1
	CPP st-by LO pump E.motor driven x 1
	FO transfer pump E.motor driven x 1
	Bilge GS pump E.motor driven x 1
	Bilge pump E.motor driven x 1
	A/C cool pump E.motor driven x 1
	Hyd & ref cool SW pump E.motor driven x 1
	FW service pump E.motor driven x 1
	Sanitary water pump E.motor driven x 1 (hydrophore)
	SW pump for water maker E.motor driven x 1 (high pressure)
	Bilge pump for oil separator E.motor driven x 1
	Sludge pump E.motor driven x 1
	Sewage discharge pump E.motor driven x 1
Engine control and monitoring	
	Bridge control console
	Engine watch room monitoring console
	Engine watch local panel

17. Navigation Aids

Magnetic compass	Reflector type, 150mmD
Gyro compass	Master compass built in steering stand and repeaters
Autopilot	Automatic steering
Radar	1 set x X band, 25kW, 96mile, 14 inch CRT or LCD
	1 set x X band, 10kW, 96mile, 14 inch CRT or LCD
Direction finder	200kHz - 30MHz
Search light	2 kW x 2 set
Anemometer	Wind, direction and speed
Digital seawater thermometer	1 set

Digital ambient thermometer	1 set
GPS receiver	1 set , with color plotter including data recorder
Weather facsimile	1 set
Laboratory repeater	In dry lab and lab behind wheelhouse: GPS, heading and speed repeat indicator
Clear view screen	2 sets
Wiper	2 sets
Public address system	1 set
Inboard telephone	1 set, auto exchange

18.	Radio equipment3
INMARSAT C	With EGC x 1 set
INMARSAT Mini-M	Telephone and facsimile (not a part of GMDSS)
MF/HF Radio telephone	With DSC and DSC watch receiver x 1 set
VHF Radio telephone	With DSC and DSC watch receiver x 1 set
NBDP	1 set
Two-way VHF tranceiver	2 sets
Navtex receiver	1 set
Radar transponder	1 set
EPIRB	1 set

[3] GMDSS sea area is A-2+, being beyond A-2 zone of “Near Coastal Voyage Limit” according to Thai regulation but within 200 nautical miles from shore of ASEAN countries.
GMDSS radio apparatus to be equivalent to those for A-3, but one method of maintenance is allowed as A-2, i.e. shore-based maintenance only is allowed.

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

In case this Plan were carried out on the basis of a grant-aid from the Government of Japan to a developing country's government, construction of the Plan Vessel will proceed, in principal, in the following sequence:

1) Exchange of Notes between the Government of Japan and the government of the recipient country.

2) Conclusion of a Consultant Contract between a Consultant recommended by the Government of Japan and the government of the recipient country or its designated authority.

3) Verification of the Consultant Contract by the Government of Japan.

4) The Consultant will undertake the Detail Design and prepare draft tender documents for approval by the government of the recipient country. These will include methods of pre-qualifications, technical specifications, general and engine room arrangements, midship sections and other plans, project cost estimates, and (a) draft(s) of contract(s).

5) With the approval, the Consultant will assist the government of the recipient country to make (a) Notice(s) of Tender public in Japan, to pre-qualify applicants for the Tender(s), who shall be Japanese Nationals, and to call for the Tender(s) for the Project in accordance with the JICA's "Guideline for Procurement under the Japanese Grant".

6) After opening of the Tender(s) in the presence of the authority of the government of the recipient country, the Consultant will prepare (a) Tender Evaluation Report(s), in which tenders will be evaluated financially and technically, and (a) successful tenderer(s) will be recommended to the government of the recipient country for awarding the contract(s) for the Project.

7) The Consultant will assist in contract negotiations between the government of the recipient country and the successful tenderer(s) and will witness the Contract(s).

8) Verification of the Contract(s) by the Government of Japan.

9) Based on the Contract(s), the Contractor(s) will build, conduct trial runs for, and deliver the Plan Vessel and the equipment. The Consultant will, in accordance with the Consultant Contract, provide supervision of construction and procurement, conduct tests, and be present at the hand-over of the vessel and the equipment.

10) The Contractor takes charge of transportation of the Plan Vessel delivered, from the berth of the shipyard to the wharf designated by the government of the recipient country.

In case the Plan were carried out in accordance with the said procedure, the following basic items must be carefully considered in connection with project implementation.

a) The Main Project Implementing Bodies :

The agency responsible for this Project within the SEAFDEC is the Secretariat, while the implementing agency is the Training Department. In connection with project implementation, the Secretariat with technical support of TD will review bidding qualifications, approve tender plans, technical specifications, and contract documents, receive monthly reports on construction supervision, and take delivery of the Plan Vessel and equipment. TD on behalf of the Secretariat will also serve as the liaison window in all dealings with concerned agencies of the Thai government with regard to such matters as the issuance of a Provisional Certificate of Nationality and import procedures.

b) The Consultant

Assuming that this Plan is carried out under a grant-aid from the Government of Japan, following the Exchange of Notes, a Consultant Contract will be signed between a Consultant company, recommended by the Government of Japan, and the SEAFDEC Secretariat. As the proxy for SEAFDEC, the Consultant will prepare tender documents, including technical specifications, and assist, as required, in the bidding and contract phases, while also inspecting the construction work in the Ship Builder's yard. In the course of carrying out this inspection function, responsible engineers will be dispatched to the shipyard/factories at appropriate intervals during the construction/manufacturing period.

c) Ship Builder/Contractor:

The Ship Builder/Contractor will be selected in accordance with the following process.

After evaluating the tender qualifications of companies of Japanese nationals responding to Tender Notice(s), competitive bids will be solicited, based on bidding and contractual procedures established in advance. The successful bidder(s) under this process will sign (a) Building/Procurement Contract(s) with SEAFDEC. The Ship Builder/Contractor will then build the Plan Vessel, conduct trial runs, sail the ship to SEAFDEC/TD for turnover and he will procure the equipment and deliver to SEFDEC/TD.

d) Construction Plan:

In connection with the vessel construction plan, the Ship Builder will, based on the Contract and attached technical specifications, design the hull and outfitting in a manner corresponding to conditions at its shipbuilding facilities.

The sequence of vessel construction stages, following preparation of the construction designs by the Ship Builder, will be as follows: hull construction, outfitting work (deck work, equipment work, electrical work), all tests, and sailing to SEAFDEC/TD. The followings points should be given careful consideration when examining the Building Plan.

①As this Plan is implemented on the basis of a grant-aid from the Government of Japan, scrupulous adherence to the construction schedule will be a major premise. The construction plan, therefore, must be prepared so as to fulfill all contract conditions within the term of validity stipulated in the Exchange of Notes.

②With regard to the delivery deadlines for engines and other equipment, careful consideration must be given to preventing disruption of the construction work flow by maintaining tight control of the equipment procurement and linking the hull and outfitting stages to the delivery schedules for the related equipment.

③Various tests are to be carried out, as determined by the Classification Society, on behalf of the Marine Department of the Thai Government and in accordance with the specifications. The required trial runs are to be performed upon completion of the construction phase to certify vessel performance.

④At the final stage of the construction phase, three engineers in charge of deck, engine and survey equipment respectively, will be invited from SEAFDEC/TD to be present during the trial runs and turnover inspection. Two engineers, deck and engine, will travel aboard the new vessel to SEAFDEC/TD, receiving appropriate guidance en route so as to acquire competence in and familiarity with new vessel operations.

e) Procurement Plan:

For procurement of the material and equipment, the Contractor will, based on the Contract and attached technical specifications, procure fishing gear and research/survey equipment and delivered to the Plan Vessel on the Shipyard as required.

f) Guarantee Engineers:

After handing over of the Plan Vessel on the wharf of SEFDEC/TD, for taking care of the initial troubles of engines and machineries during and after the sailing from the Shipyard and for readjustment of them, three engineers of the Ship Builder, in charge of deck/fishing gears, engines and scientific echo sounder/survey equipment respectively, will be dispatched to SEAFDEC/TD for one month. The engineers will also give advice for maintenance and repair of the hull and machineries and for establishment of the maintenance management system.

2-2-4-2 Implementation Conditions

In Thailand, Marine Department of the Ministry of Transport and Telecommunication is the responsible organization for ship inspection and registration, and conduct newbuilding inspection. However, giving authorization to inspect and issue certificate on behalf of the Marine Department, most of the work is entrusted to classification societies. The Marine Department examines construction drawings and visit shipyard at keel laying, launching and completion to inspect at site.

The Plan Vessel is classified as “Special Purpose Vessel”, and therefore required to apply International Convention for Safety of Life at Sea (SOLAS), according to the Mariner Department. However, the SOLAS being the convention for international passenger vessels and international cargo vessels of 500 gross tons and over, and owing to its small hull and special character as a fisheries research and training vessel, the Plan Vessel will find it difficult to meet certain SOLAS provisions. For those SOLAS provisions difficult to be applied on the Plan Vessel, the Consultant has discussed with the Marine (then Harbour) Department and has obtained approval on exemptions. Such conditions to apply SOLAS regulations shall be reflected on tender specifications and drawings to avoid excessive estimate of SOLAS by tenderers.

After the construction contracts are awarded, in view of the short construction period, the Consultant shall give appropriate guidance to the Builder to expedite drawing approval by the Marine Department and the Classification Society based on prior discussions with these authorities, for avoiding delay from the plan schedule. Since the Plan Vessel must satisfy the specification requirements, Classification requirements, and international

Convention requirements including SOLAS Convention, Loadline Convention, Collision Prevention Convention, MARPOL Convention, etc., it goes without saying that the vessel construction work should be entrusted to a highly experienced shipyard with an outstanding track record and superior engineering skills.

2-2-4-3 Scope of Works.

(1) Responsibilities to be assumed by the Government of Japan.

Assuming the Plan is carried out under a grant-aid from Japan, the Government of Japan will assume responsibility for the following phases :

① Construction of the Plan Vessel
② Procurement of fishing gear and materials on board the Plan Vessel
③ Procurement of research and survey equipment on board the Plan Vessel
④ Sailing the Plan Vessel to SEAFDEC/TD
⑤ Consultant services, including the Detail Design, assistance with the bidding process as well as building and procurement supervision

(2) Areas of responsibility to be assumed by the SEAFDEC:

As both building of the Plan Vessel and equipment procurement are carried out in Japan, SEAFDEC has no responsibility for these matters.

2-2-4-4 Consultant Supervision

(1) Basic Guidelines:

The Consultant will verify that the Contractor's construction and procurement processes have been designed in accordance with Japan's grant-aid system; prepare construction and procurement supervision plans on this basis; supervise the construction work to establish that it is being done in accordance with the designs, specifications, and quantities specified in the contract documents; and monitor construction progress. Following are the basic guidelines and special considerations governing construction and procurement supervision.

1) Validation of Plan and Specifications

The Consultant will validate and certify that the Construction Plan documents, progress schedule, construction and production plans, and production specifications submitted by the construction contractor conform to the contract plans and specifications. The

Consultant will reply promptly to questions from the Contractor so as to avoid any adverse impact on the construction schedule.

2) Construction Progress

The consultant will continually validate construction progress, issuing all necessary instructions to ensure completion of the work during the stipulated construction period.

3) Quality Inspections

Along with production progress, the supervisor(s) in charge of outfitting and equipment will be dispatched for necessary periods to workshops and the shipyard to check on construction accuracy, and establish that the machinery and outfitting work are in accordance with the contract plans, specifications, and approval documents. The supervisor(s) will conduct inspections of the equipment and outfitting work, based on the approved test procedure and the Contractor's in-house standards.

4) Vessel Turnover

After sailing the vessel to Thailand, the Consultant will be present at all inspections at the SEAFDEC/TD wharf and issue the certification documents required for local turnover.

5) Construction Reports

Monthly reports will be sent to SEAFDEC and Japanese Government containing an update on construction progress, the construction schedule for the following month, and construction photos.

(2) Supervisory System for Construction and Procurement

The Consultant will establish a project team consisting of project manager, naval architect, outfitting staff, machinery staff, electric staff, deck/fishing machinery staff, and fishing gear staff, and prepare implementing design and exercise supervision over the construction and procurement activities.

2-2-4-5 Procurement Plan

(1) Vessel Equipment and Outfitting

In recent years, Thailand has seen a major increase in the construction of large steel offshore fishing boats. Though production capacity has risen, capacity of the domestic

infrastructure of related industries is still lower, so that the shipbuilding industry is forced to rely on imports for marine-grade steel and other materials, vessel engines, and navigation equipment. Thus, it will not be possible to procure locally the required equipment for this project. The plan is to have the vessel constructed in Japan, with materials and equipment to be sourced from Japanese manufacturers. When selecting equipment and materials, weight will be given to manufacturers with agents and service networks in Thailand so as to be able to secure service and spare parts locally after the vessel is put into service.

(2) Fishing Gear

While the fishing gear to be used on the Plan Vessel will be relatively small compared with commercial fishing vessels, it will be designed within the parameters of vessel towing speed and fishing machinery. The fishing gear will be verified, via experiments in a model basin or the like, and confirm that the gear is suitable for the target species and survey objectives and that the gear works well underwater. Since this will entail close liaison with the manufacturing plants, it is appropriate that the fishing gear be sourced from domestic Japanese makers with strong technical ability.

(3) Research Equipment

Since the research equipment items are not produced in Thailand, they will, in principle, be procured from Japan. However, for items listed below will be subject to procurement from third countries.

Table 6: Reason of procurement from third countries

Equipment	Country of manufacturer	Reason
Portable reflectance radiometer	USA	The item is not produced in Japan
Scientific echo sounder	Japan or Norway	There is risk of unfair tender allegations if procurement is confined to Japanese products.
CTD	Japan or USA	Do.
Auto analyzer	Japan or Germany	Do.
Trawl monitor	Japan or Norway	Do.
Computer	Japan, ASEAN, EU or USA	Do.

These items all have sales offices in Japan, through which technical assistance can be given to the shipyard at the time of installation. Thus, no problems are anticipated in this connection.

With regard to equipment that SEAFDEC engineers are already using in their survey programs, or items with which they are becoming familiar through technical training, it will be planned, wherever feasible, to source products with similar specifications in the interest of such factors as continuity of research programs, data comparability, and access to technical service facilities.

(4) Spare Parts

1) Main engine and auxiliaries

To maintain machineries in good condition, it is important to establish Preventive Maintenance Policy (PMP) and conduct periodical checking of working condition and periodical overhaul under detailed program. To run PMP, certain number of spare parts need be prepared as follows.

a. Spare parts, which are replaced with working parts, adjusted/cleaned, and stowed for next replacement

b. Meters, whose sudden breakdown causes difficulty to continue operation

2) Fishing gear

Spare parts of fishing gear, to cover damage occurring in one fishing trip of ordinary operation, shall be supplied.

3) Research equipment

Spare recording media and consumable parts for each equipment, to cover consumption in one research trip, shall be supplied.

2-2-4-6 Implementation Schedule :

In preparing the construction progress schedule, it was necessary to examine the nature of each phase, determining those phases which must be finished in advance of the main construction work, those that can proceed simultaneously, and those which can be completed independently. After further consideration of equipment procurement, construction period, and construction costs, an optimum construction period has been established. It is presumed that the various outfitting items will be sourced in Japan.

The principal construction phases and the nature of the work involved in each may be broadly classified as follows.

① Hull work

As the structural core of the vessel, the hull construction phase is essential in terms of maintaining the requisite buoyancy as well as the strength to fully withstand wave action and other external pressures. This work generally comprises individual block assembly and final assembly of the various blocks on the dock.

② Outfitting

This phase follows completion of the hull work. It comprises mooring equipment, fishing gear, steering gear, laboratory, galley, sanitary fixtures and other amenities, air conditioning, lifesaving and fire-fighting equipment, and incidental construction.

③ Installation of Equipment phase

This phase will comprise rigging work on the main engine, generator engine and generator, and power pumps in the engine room, along with incidental facilities and piping work.

④ Electrical work

Board and wiring work will be performed to furnish and control power supply to the various outfitting items that have been installed during the above rigging and equipment phases.

⑤ Tests to be conducted during or following the construction process

Pursuant to the above construction phases, a series of tests will be performed, as required by the Classification Society and the Royal Thai Marine Department, along with speed trial runs, fishing trials and noise measurement trials. Inspections will also be made to certify the basic performance of the ship in motion, including sea worthiness, vibration, noise, safety, and speed and to assess the influence of the noise level for operation of the on board sounding equipment.

⑥ Sailing to SEAFDEC/TD

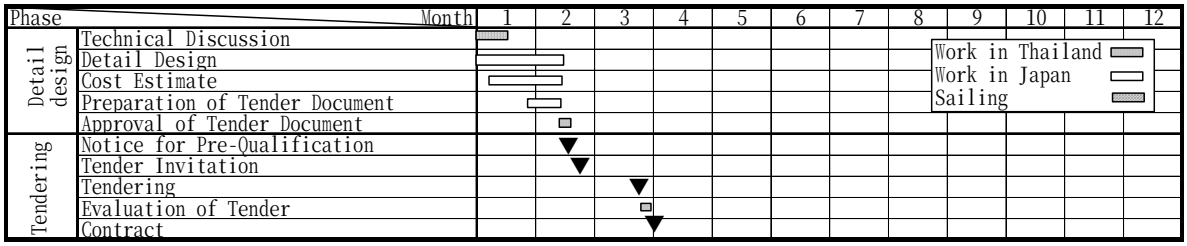
Following completion of construction at the shipyard and the trial runs, the Plan Vessel will be delivered to SEAFDEC. The Ship Builder is responsible under the contract for sailing the vessel from the shipyard to SEAFDEC/TD.

The time required for project implementation is estimated at about 3 months for the Detail Designs, including tender procedures, about 3 months from contract and hull design at the shipyard through the keel laying, 4 months from the start of steel plate processing through launching, and about 2 months from launching to trial test operations. The delivery period for equipment and fishing gears will be approximately 6 months, while sailing time is expected to take about 15 days

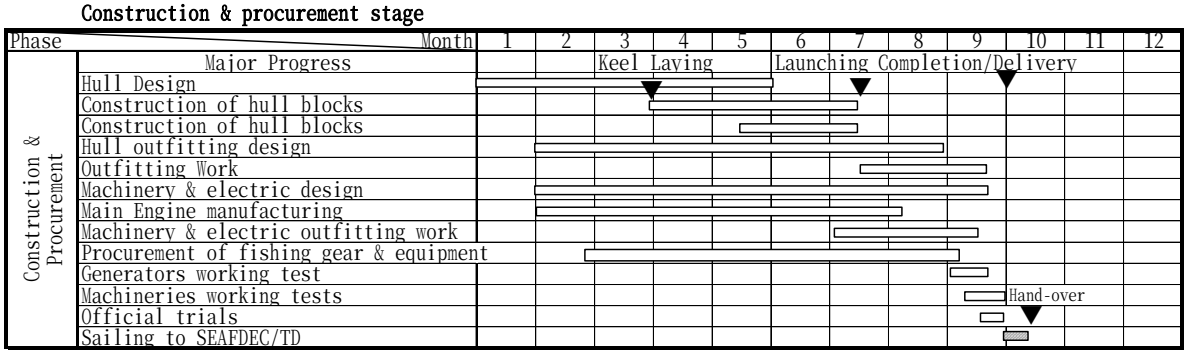
The implementation schedule is shown in the following table.

Table 7: Implementation schedule

Detail design stage



Construction & procurement stage



2-3 Obligations of SEAFDEC

Assuming that the Plan is carried out on the basis of a grant-aid from Japan, SEAFDEC will be responsible for the following items.

1) Maintenance of base facilities, water channels, berthing wharf, and mooring areas, as required for Plan Vessel operations.

2)Obtaining those permits and approvals that must be issued in the Kingdom of Thailand in connection with construction and sailing of the new vessel, such as a provisional certificate of nationality.

3)Duty exemptions and prompt customs clearance in connection with importation of the Plan Vessel and all related equipment and materials into the Kingdom of Thailand during project implementation.

4)Exemption from taxes and surcharges on Japanese nationals rendering project-related services in the Kingdom of Thailand.

5)Making banking arrangements with a foreign exchange bank in Japan and issuing Authorization to Pay in connection with project-related contracts verified by the Government of Japan.

6)Any other items required for Project implementation that are not specifically included in the areas of responsibility assumed by the Government of Japan.

2-4 Project Operation Plan

2-4-1 Operation plan

2-4-1-1 Vessel's operation plan

SEAFDEC will organize a committee so called the "Japanese Grant-aid Eligible Countries Committee (hereinafter called "Eligible Committee")" comprised of 5 SEAFDEC Member Countries eligible for Japanese Grant-aid, namely Cambodia, Indonesia, Myanmar, the Philippines and Vietnam. SEAFDEC will ensure through activities of the "Eligible Committee" that, if the Plan Vessel is provided to SEAFDEC under the Japanese Grant-aid Program, the primary benefit of the Plan Vessel will be given to the member countries of the "Eligible Committee" based on their needs.

The "Eligible Committee" will prepare a mid-term training and research plan of the Plan Vessel to ensure that the primary benefit of the Plan Vessel will be given to the member countries of the "Eligible Committee" based on their needs.

The "Eligible Committee" will consult with the Japanese Government in preparing the

mid-term training and research plan. The “Eligible Committee” will submit the mid-term training and research plan to SEAFDEC Council for its endorsement.

SEAFDEC will also establish a committee at SEAFDEC Training Department called the “Operation Committee” which will be responsible for the preparation of annual operation plan of the Plan Vessel and its operation. In developing the annual plan of operation, the operation committee will take into account the mid-term training and research plan of the “Eligible Committee”.

Tentatively proposed operation plan of the Plan Vessel is shown below.

Table 8: Tentative Research and Training Program of the Plan Vessel

Research and Training Plan of New MV PLATOO

1st Year Activities

Research/Training Items	Objectives	Survey Area/ Target Country	Schedule (Days)	Responsible Department/country
1) Collaborative Research Program on Fisheries Resources Survey and Marine Environment Study in Cambodia and Vietnam waters	- To investigate the situation of Marine Fishery Resources of commercial bottom fishes (such as Grouper, red sanpper), straddling fish stock and shared fish stock such as Indo-pacific mackerel and sardine in the Cambodia and vietnam waters during the pre and post monsoon seasons - To investigate for the marine environmental conditions in the coastal area - To practical training on research works and use of scientific equipments to Cambodia and Vietnamese fishery officers	Cambodia and Vietnam Waters (EEZ)	1st Cruise during the post monsoon season in April-May 2nd Cruise during the pre monsoon season in October-November (100 days)	TD, FMRDMD and Cambodia and Vietnam
2) Training Program on the Management of Coastal zone: "Operationa and Practice on Responsible Fishing Technology for Coastal Zone"	- To demonstate and promote responsible fishing gear and device to local fishermen and fishery extension officer	Cambodia	3rd Cruise for in June (25 days)	TD and Cambodia
		Vietnam	4th Cruise in September (25 days)	TD and Vietnam

2nd Year Activities

1) Collaborative Research Program on Fisheries Resources Survey and Marine Environment in the Andaman Sea	- To investigate the situation of Marine Fishery Resources of commercial bottom fishes (such as Grouper, red sanpper), straddling fish stock and shared fish stock such as Indian mackerel, sardine and Scad in the Myanmar, Thailand, Indonesia and Malaysia waters during the pre and post monsoon seasons - To investigate for the marine environmental conditions in the coastal area - To practical training on research works and use of scientific equipments to Myanmar fishery officers	Myanmar, Malaysia Indonesia and Thailand	1st Cruise during the pre SW monsoon season in Febuary-March 2nd Cruise during the post SW monsoon season in September-October (100 days)	TD, MFRDMD, Myanmar, Malaysia, Indonesia and Thailand
2) Training Program on the Management of Coastal zone: "Operationa and Practice on Responsible Fishing Technology for Coastal Zone"	- To demonstate and promote responsible fishing gear and device to local fishermen and fishery extension officer	MyanMar	3rd Cruise for in April (25 days)	TD and Myanmar
		Indonesia	4th Cruise in November (25 days)	TD and Indonesia
3) Exploration for the Under-Utilization Resources in the Southeast Asia Region : Andaman Sea	- To investigate the commercial fishes resources in the Continental slope Area and Deep Sea Shrimp in the Andaman Sea	Myanmar	5th Cruise for in December (25 days)	TD, MFRDMD and Mayanmar

The areas where the Plan Vessel will conduct research and training, and the survey areas by MV SEAFDEC are shown below.

Figure 6 Research, Training and survey area of SEAFDEC programs

2-4-2 Maintenance and Management Plan

To maintain machineries in good condition, it is important to establish Preventive Maintenance Policy (PMP) and conduct periodical checking of working condition and periodical overhaul under detailed program.

To start the PMP system, initial investment to prepare spare parts is necessary, but breakdown due to excessive wear and lack of maintenance will become minimum, and life of parts will be longer, so that purchase of spare parts will become less.

For establishment of PMP followings are important.

(a) Standard timetable for maintenance

Consultant and SEAFDEC shall jointly work out maintenance timetable consisting of weekly, monthly, yearly and long-term plan, referring to service manuals of machinery.

(b) Maintenance workshop

On board the small Plan Vessel, maintenance will be limited to minor maintenance work.

Major maintenance work including overhaul shall be carried out in the machinery workshop of SEAFDEC/TD, where machine tools are well equipped.

(c) Leader

As engineer officers of SEAFDEC/TD, also working as instructors of machinery section, have understandings on PMP and are versed in maintenance work, no problem is expected on human resources.

(d) Spare parts

Following spare parts shall be prepared to conduct PMP smoothly.

(i) Spare parts, which are replaced with working parts, adjusted/cleaned, and stowed for next replacement, e.g. Cylinder heads and accessories such as suction and exhaust valves, fuel injection nozzles, etc., attached water and oil pumps, fuel injection pump, propeller blade, sterntube bearing, O-rings, and packings

(ii) Meters, whose sudden breakdown causes difficulty to continue operation, e.g. pressure gauge, thermometer, and tachometer.

2-4-3 Operation Cost

Provided the Plan Vessel be operating 150 days per year in research and training, the projected annual operation and maintenance costs for the Plan Vessel is shown as follows.

Table 9: The projected annual operation & maintenance costs for the Plan Vessel
(The depreciation and the salary of the crew are not included.)

Item	Q'ty	Unit Price	Amount
Operation Costs			
Sea Allowance	1,500	400	600,000
Foreign Port Allowance	750	1,200	900,000
Food expenses	2,250	150	337,500
Supplies and expenses	150	11,180	1,677,000
Fuel & Lube oil	1		2,430,900
Fishing Gear repairs	100	1,000	100,000
Sub-total			6,045,400
Maintenance costs			
Dock Charge			220,000
Inspection Survey			100,000
Ship insurance			1,000,000
Checking for Liferaft			50,000
Paint & concern			240,000
Spare parts & general repairs			200,000
Sanitary & cleaning			6,000
Sub-total			1,816,000
Total		THB	7,861,400
		(USD	182,823)

Normally, maintenance costs of vessels increase year by year. We estimate the

maintenance costs of the Plan Vessel as follows;

Table 10: Estimated annual operation & maintenance costs of the Plan Vessel

	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year
Operation Cost	140.6	140.6	140.6	140.6	140.6	140.6	140.6	140.6
Maintenance Cost	42.2	69.7	83.6	97.1	110.9	124.6	138.5	152.0
Total O & M costs	182.8	210.3	224.2	237.7	251.5	265.2	279.1	292.6

(unit: US$1,000)

The projected annual operation and maintenance costs for the Plan Vessel is less than the surplus of Income and expenditure for SEAFDEC/TD during 1998-2000 as shown in the following table. The ratios of the annual operation and maintenance costs for the research and training vessels of SEAFDEC/TD to the revenue were 17.4% in 1998, 11.6% in 1999 and 7.3% in 2000 respectively, which did not represent an inordinate portion of the department budget. Both of MV. PLATOO and MV PLALUNG will be replaced with the Plan Vessel, and will be retired from the activities of SEAFDEC. Therefore, we feel that the SEAFDEC/TD will not be burdened with the operation and maintenance costs of the Plan Vessel.

Table 11: Income & Expenditure for SEAFDEC/TD

(in US$)

	1998	1999	2000(unaudit)
Revenue	2,661,193	2,875,594	1,654,762*
Expenditure	2,223,577	2,634,031	1,448,965
Surplus	437,616	241,563	205,797

*Excluded contribution in kind from Japan

2-5 Special Considerations Pertaining to Implementation of the Program

2-5-1 Preparation of a Medium-term Training and Survey Plan

Based on the provision of a Research and Training Vessel capable of conducting coastal fishery resource surveys and training programs at the SEAFDEC Training Department, it will be possible for SEAFDEC to implement fishery resource surveys, in cooperation with Cambodia, Indonesia, Myanmar, the Philippines, and Vietnam, in their respective coastal waters, with a view to strengthening technical training in proper utilization of fishery resources.

In order to make it unmistakably clear that the beneficiaries of the subject Plan are to be

limited to countries eligible to receive grant-aid cooperation from Japan, SEAFDEC will be required to set up, within its Council, a “Japanese Grant Aid Eligible Countries Committee” (tentative name), composed of Cambodia, Indonesia, Myanmar, the Philippines, and Vietnam. This Committee will then, in consultation with the Government of Japan, draft a mid-term training and research plan for the Plan Vessel.

An “Operation Committee” (tentative name), established within the SEAFDEC Training Department, will prepare annual operating plans for the Plan Vessel. Since the plan to set up a “Committee of Grant-aid Eligible Countries” (tentative name) has already been approved at a special meeting of the SEAFDEC Council, as soon as a decision is made to implement the subject Plan, SEAFDEC will be required to activate the said “Japanese Grant Aid Eligible Countries Committee” (tentative name), which will, in consultation with the Government of Japan, promptly draft a mid-term training and research plan for the Plan Vessel.

2-5-2 Confirmation of Duty/Tax Exemptions and Customs Procedures

While the subject Plan is based on cooperative grant-aid funding for SEAFDEC, a regional international organ, as in the case of Japan’s cooperative grant-aid funding for developing countries, exemptions must be provided from custom duties and other charges on vessels and equipment imported in connection with project implementation into Thailand, where the SEAFDEC Training Department is based.

The Note from the Ministry of Foreign Affairs, Government of Thailand, addressed to Acting Secretary-General, Southeast Asian Fisheries Development Center, dated August 3, 1970, No. 0502/26034 said that “The Center shall, in appropriate cases, be allowed to import free of duty into Thailand vessels, equipment and materials including motor vehicles for use directly by the Center for purposes of study and research in fisheries in pursuance of its normal functions.”

However, with regard to the VAT (value-added tax), as no law or statute existed at the time stipulating the procedures for tax-free clearance of SEAFDEC equipment, no system for handling such exemptions has yet been determined by the Thai government. Accordingly, as soon as a decision is made to implement the subject Plan, SEAFDEC will be expected to confirm the VAT exemption procedures with the Thai government so as to avoid any delays in the importation of the Plan Vessel and equipment.