Chapter 2

Contents of the Project

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2-1 Objectives of the Project

In the FSM, an island country with a large number of islands scattered in a vast sea area, the sea transportation sector plays an indispensable role for personal exchanges; transportation of living commodities and construction equipment to provide for better social infrastructure; domestic physical distribution of copra, fishery products, etc., and export of those products to international markets. Additional important tasks are to develop and promote the rural fishing villages, and to dissolve the economic disparity between the city areas and other areas.

The FSM government laid down the Five-Year Plan for Rationalization of Sea Transportation to improve its marine transportation policies under the Second National Development Plan (1992 – 1996), and set up the following objectives. In the fisheries sector the government well recognizes the importance of the fisheries in view of country's natural environment, and is proceeding with the preferential items set up in the Second National Development Plan.

[The development plan in the sea transportation sector]

(1) To review and improve programs of seaport operations and maintenance implemented by each state government to ensure more efficient domestic and international sea transportation services;
(2) To reduce subsidization to the field-trip vessel operations to the minimum extent necessary to maintain continued improvement in the quality; and
(3) To prepare and implement for the succeeding five (5) years a program to provide replacement of overage vessels.

[The development plan in the fisheries sector]

(1) To increase the fishing yield and earnings of foreign currency
(2) To consider the protection and rearing of the depleted fish species in the reefs, which are in danger of extinction and have a remarkably decreased fishing yield due to overexploitation
(3) To consider countermeasures for scientific evaluation and conservation of the fishery resources in its own exclusive economic zone bound under ratification of the law of the sea
(4) To promote high-grade vocational training for fishery personnel of succeeding generations who will play core roles in the fishery industry

Under the above item (3) of the sea transportation sector, this Project is to introduce a new vessel replacing the Existing Vessel, an old and much deteriorated landing craft vessel which requires increased costs for docking, operation, and maintenance due to breakdowns, repairs, and decreases operation efficiency. By introducing this vessel, the FSM will improve its sea transportation capabilities, thereby contributing to the development and promotion of the rural fishing villages with respect to the increase of the fishing yield as referred to in the above-mentioned item (1) of the fishery sector. It is also among the objectives to strengthen and streamline the efficiency of the FSM government's public support system for the

transportation services in favor of the rural fishing villages.

2-2 Basic Concept

This is a Project to construct a vessel to replace the existing landing craft inter-islands vessel, the Existing Vessel, for the purposes described in the preceding subsection 2-1. The sizes and main specifications of the requested vessel are listed together with the existing landing craft vessel in Table 2--1.

Table 2-1 Comparison of the main specifications

Items	Requested vessel	Existing vessel
Type of vessel	Landing craft type	Landing craft type
Length (overall)	Approx. 60.0 m	54.58 m
Breadth	Approx. 12.7 m	10.80 m
Designed draft	Approx. 3.75 m	3.75 m (Full load draft)
Deadweight tonnage	Approx. 1,000 tons	845 tons
Gross tonnage	Approx. 1,300 tons	813 tons
Cargo hold (dry)	Approx. 1,800 m^3	1,219 m^3
Cruising speed	Approx. 12.5 knots	Approx. 10.0 knots
Main engine	1,500PS x 2 = 3,000 PS	900 PS x 2 = 1,800 PS
Cargo gear	Deck crane	Derrick boom
Rampway Width	Approx. 2.5 m	Approx. 4.0 m
Length	Approx. 6.0 m	Approx. 7.5 m

Consideration of the Basic Design

(1) Type of Vessel

In consideration of the basic design, the type of Vessel is to be treated first on the basis of the requested type and the actual operation results of the Existing Vessel.

In the case of the FSM and other island countries in tropical and subtropical areas, individual islands are located in atolls or surrounded by base reefs. There are deep channels between island that may provide approaches to specific islands, and islands that are rather densely populated are utilized as good ports equipped with port and loading facilities that enable ordinary-type vessels to come alongside. There are six (6) ports in the FSM; the Pohnpei Harbour (Pohnpei), the ports of Weno and Dublon (Chuuk), and the ports of Colonia (Yap), Lelu and Tafunsak (Okat) Harbors in Kosrae, all of which are located in or in the vicinity of state centers. Large international freighters and container ships can call at those ports and use their loading facilities, and 800-GT-type field-trip vessels operated by each state have their base ports in those ports.

In the rural fishing villages in the outer islands of the FSM, however, there are no well arranged port and loading facilities because they are thinly populated and surrounded by

atolls and base reefs. Thus the ordinary-type field-trip vessels that are operated by the state governments are forced to transship passengers and cargoes to boats offshore for loading/unloading. Those cargoes and passengers may be at the mercy of weather, and sea conditions, and danger, thus precluding the use of such vessels for transportation and/or unloading of heavy cargoes such as construction machinery, equipment and materials, vehicles, generators, etc. A landing craft, that can touch down at simple bank facilities or secure approach to coasts by beaching in the rise and fall to load/unload cargoes through the bow door is very effective for sea transportation to the rural fishing villages in the outer islands. Even if a beaching approach is impossible, a landing craft may come near to an island within the limit of its draft because of the specific form of its bottom and gyration capacity, and thus it is safe and more effective than ordinary-type vessels in transshipping cargoes and passengers to/from boats. Utilizing the characteristic vessel form and functions, the Existing Vessel is an indispensable vehicle operated as an inter-islands vessel to meet various public purposes, including transportation of construction equipment, materials, and machinery.

In addition to the physical linkage in sea transportation services, the Existing Vessel, with its specific hull functions such as direct beaching, and close approaches to islands, is incidentally very effective for enhancing the awareness of the significance of the federalism of the FSM in rural fishing villages under administration by the state government.

Since, the requested type of landing craft is judged necessary and appropriate given the above factors, further consideration will be given to the basic design on the premise of a inter-islands vessel of a landing craft type.

(2) Size of the Project Vessel

It was determined that the Project Vessel should be less than 60 meters long and its draft not more than 3.75 meters deep, i.e., the same as that of the Existing Vessel under full load, because it will run through narrow and complicated channels in atolls and/or reefs. Under those restrictions, a replacement vessel with greater load weight and capacity was requested, but the vessel's size setting will be made in consideration of the following problems and conditions:

1) As the public services, the Project Vessel will be engaged in sea transportation service for the rural fishing villages in the outer islands. A part of the fixed expenditures of the operation cost will be covered by the budget allotment of the FSM government, and the fuel cost for cruising will be borne by the users such as state governments and the communities. Thus, it is important to reduce the financial expenditures of the FSM government and users, and to consider economical efficiency allowing for effective operation of the Project Vessel in view of the possibility that the Compact Grant, an economic aid from the USA will be terminated in 2001.
2) Since the Project Vessel will be required to undertake cruising operations in support of the field-trip vessels operated by the state governments, its deadweight capacity, which will have to be less than those of the field-trip vessels (about 850 tons equal to

the Existing Vessel's), might be a hang-up against the support and replaced operation.

3) As the four (4) existing field-trip vessels are over 18 years old and have deteriorated hulls and equipment, their operation services may be not so safe. It is anticipated that the cargo loading operation of the Project Vessel will have to have dramatically increased efficiency in order to meet the increasing demands for shipping from the state governments. The Project Vessel will be forced to have a combination of plural operation purposes encompassing the support operation mentioned in the above 2) in place of single-purpose operation, and it will be necessary to secure a space to facilitate planning for loading assignment of cargoes and related arrangements.

In view of the problems and conditions, the size of the Project Vessel shall be set to match but not exceed the Existing Vessel in deadweight capacity and volume.

(3) Consideration of the operation costs for the Project Vessel

If this Project is implemented, the Project Vessel will be put in service in 1998 before termination of the Free Association Compact between the United States and the FSM. The chances are minimal that the Compact grant, an economic support, will be continued after 2001.

A common recognition arises that the fuel cost, the largest operational expenditure (including the fuel cost during the vessel cruising and borne by users), should be reduced for the purpose of economical efficiency in operation by some effective measures to be considered by the FSM government counterparts on the basis of such a prospect.

Therefore, both parties agreed that the main engine should be designed to run at a cruising speed of about 10.5 knots, 2 knots lowered than the initially requested speed of 12.5 knots because of economical efficiency in preference to speed.

Besides, the following matters are embodied in the basic design to consider economical efficiency in operation:

1) Increase of propulsion capability through improved hull form and use of a lighter hull material (saving of fuel cost)
2) Reduction of maintenance cost through selection of durable materials and equipment
3) Improvement of cruising efficiency through proper selection of navigation instruments

(4) Safety

Since the Existing Vessel was designed and built as a roll-on/roll-off type vessel for operation in rivers, it is easily subject to rolling at light loading because of its flat bottom, and if easily suffers from wave shocks from the bow because of its large, plate-like bow door. Further, since its bottom shell is not thick or strong enough to ensure beaching touchdown in areas of rock substratum, it may not be an exaggeration to say that the craft has no ample capacity and function for safe loading by beaching in the outer islands. Thus, the structure and functions should be adequate to meet the operation purpose on the basis of the following matters:

1) Greater seaworthiness of the bow form in view of seakeeping and propulsion capacities.
2) Adequate hull strength by thickening the bottom shell and strengthening

the bow door structure.

3) Superstructure made of aluminum alloy to improve the initial recovery (capability to recover from an inclined state).

4) Trolley winch for safe loading and unloading of a work boat.

(5) Consideration of efficiency

1) Alteration of loading equipment

The loading equipment on the Project Vessel should be a derrick boom consisting of one union purchase system (burtoning system with two booms and a winch) installed at the bow side and aft side of the cargo hold, respectively. As opposed to a deck crane, a derrick boom is so simple mechanically, and can be so easily checked and maintained by the FSM crew that its installation may improve the vessel's operation efficiency.

2) Alteration of dimension of bow door and related equipment

The bow ramp way and inner door shall each be approx. 4.0 m larger than the minimum limit requirement in order to facilitate the loading of the heavy machinery (bulldozers in particular), thereby improving the actual loading results exhibited by the Existing Vessel.

(6) The Project Vessel's grade

The design of the Project Vessel is made in conformity with FSM Marine Acts in light of safety in hull structure, operation, passengers' lives at sea, and seaworthiness. In anticipation of the engagement of the Project Vessel in international voyages, the GMDSS (Global Marine Distress and Safety System) will be applied with the intention to apply the SOLAS Convention Rules in advance.

Table 2--2 lists comparisons between the proposed optimum specifications for the requested Project Vessel, prepared through the above alterations and considerations, and specifications for the existing vessel.

Table 2-2 Comparisons of the main specifications

Item	Project Vessel	Existing Vessel
Type of vessel	Landing craft type	Landing craft type
Length overall	Approx. 57.0 m	54.58 m
Breadth	Approx. 11.0 m	10.80 m
Designed draft	Approx. 3.75 m	3.75m (Full load draft)
Deadweight tonnage	Approx. 850 tons	845 tons
Gross tonnage	Approx. 1,220 tons	813 tons
Cargo hold (dry)	Approx. 1,210 m^3	1,219
Cruising speed	Approx. 10.5 knots	Approx. 10.0 knots
Main engine	1,000PS x 2 = 2,000PS	900PS x 2 = 1,800PS
Cargo gear	Derrick boom and Union purchase	Derrick boom
Rampway Width Length	Approx. 4.0 m Approx. 7.5 m	Approx. 4.0 m Approx. 7.5 m
Complement Crew Passengers	23 persons 12 persons	20 persons
Classification	NK or ABS	Not eligible (ABS through March 1996)
Applicable rules	International Rules FSM maritime rules	-

2-3 Basic Design

2-3-1 Design Concept

As a landing craft, the Project Vessel will have the potential capacity to transport large or heavy cargoes to outer islands where there are no shore infrastructures, port or loading facilities. With a shallow draft, bow ramp way, and twin engines/twin propellers equipped, landing craft vessels have excellent gyration capability in narrow channels, and therefore have very suitable functions for cruising in the reef areas. These functions enable vessels of this type to directly beach on simple bank facilities or beach at the bow, load/unload large machinery, equipment or materials (bulldozers, excavators, dump trucks, generators, ballasts, etc.), clear land or gyrate in narrow wharfing areas, and secure easy approaches to beaches even when it is difficult for the vessels to come near to wharfs. For these reasons, landing craft vessels are ideal field-trip vessels in rural fishing villages. Specifically, this type of vessels features a roll-on/roll-off system enabling the direct loading and/or unloading of cargoes and passengers through the ramp way. This is a remarkable advantage over ordinary-type vessels. An additional advantage is that this type of vessel can easily lay down channel marks, buoys, and FADs using a space on the deck and derrick boom. The basic design of this Project, therefore, will be made in light of the concept following those characteristics, namely, the objectives of this Project.

(1) Basic Concept

The following four (4) items are the basic concepts of the planned construction:

1) Safety 2) Operation efficiency 3) Economical efficiency 4) Effectiveness in provision of aid

This means that in order to ensure that the Project Vessel has sufficient capacities to safely transport cargoes and passengers at sea, to carry out loading works safely and efficiently, and to perform efficient sea transportation operation, the size and specifications should enable economical efficiency with appropriate costs for operation, maintenance and administration. Further, this Project may effectively provide aid as a consequence of contribution to the development of social infrastructures, the promotion and development of fishery activities in the outer islands, and extension of planning for rationalization of sea transportation.

1) Basic Concept to Secure Safety

① Concept for natural conditions

Data on weather and sea conditions in the FSM sea area that are necessary for "safety" in the basic design concept of the Project Vessel are collected at the NOAA office, Pohnpei and at the Ship Research Institute in Japan. Results of the data analysis are shown in Table 2-3.

The actual rainstorms, typhoons, and anomalous weathers for the past 10 years in the Pohnpei Island are indicated in Table 2-4. Data on crest values and wave periodicity in the most important cruising area (15°N-0°, 130° - 170°E) for the study of safety of the Project Vessel are indicated in Table 2-5.

Table 2-3 1994 Air speed and direction in Pohnpei (m/sec.)

Month	Jan	Feb	Mar	Apr	May	June
Direction (*)	NW	NW	WNW	WNW	W	W
Air speed (*)	4.3	3.9	3.6	3.6	3.4	2.9
Direction	E	NE	NE	E	E	E
Air speed (**)	17.4	15.7	16.1	13.9	16.1	13.4
Month	July	Aug	Sep	Oct	Nov	Dec
Direction (*)	W	S	SW	SE	WSW	WNW
Air speed (*)	2.6	2.5	2.3	2.9	2.3	3.4
Direction	E	W	SW	W	SE	E
Air speed (**)	14.8	14.8	12.5	20.6	14.3	16.6

* Average

** Maximum

Source: Local Climatological data, NOAA 1990-1994

Table 2-4 Actual rainstorms, typhoons and anomalous weather for the past 10 years at Pohnpei

Rainstorms, Typhoon etc.	Date	Air speed	Air direction
Tropical Storm "Els III E"	Jan. 1985	40 - 50 knots	-
Typhoon "Lola"	May 1986	46 knots	-
High Tide	Oct. - Dec. 1988	-	-
Flooding	Apr., Aug. 1989	-	-
Typhoon "Russ"	Dec. 17, 1990	49 knots	NW
Typhoon "Owen"	Dec. 26, 1990	30 knots	-
Typhoon Yur III"	Nov. 25, 1991	54 - 64 knots	WNW
Tropical Storm "Axel"	Jan. 1992	-	NW

Source: Tropical Storm/Typhoon/Weather Condition, NOAA 1993

Table 2 - 5 Wave periodicity (sec) in horizontal row, crest values (m) in vertical column

	0-5	5-7	7-9	9-11	11-13	13-15	15-	Total
0.0 - 0.9	26.73	1.74	0.69	0.14	0.14	0.05	11.3	40.79
0.9 - 1.8	23.89	16.34	3.07	1.05	0.18	0.05	1.19	45.77
1.8 - 2.7	0.55	2.7	3.16	0.18	0.09		0.41	7.09
2.7 - 3.7	0.05	0.09	0.37	0.32	0.18			1.01
3.7 - 5.8							0.05	0.05
5.8 - 7.8							0.09	0.09
7.8 - 10								
Total	51.22	20.87	7.29	1.69	0.59	0.1	13.04	100.0

Source: Ship Research Institute, Tokyo, Japan March 1980

As clearly indicated in the above tables on sea conditions in the proposed cruising area for the Project Vessel, crest values not more than 1.8 meters account for more than 86% annually, and crest values between 1.8 and 2.7 meters appear at a frequency of about 7%. Thus, conditions are almost always calm except during storms and typhoons.

By estimation on the basis of the crest value and wave periodicity, a wavelength of 50 to 60 meters, a length equal to the overall length of the Project Vessel, may occur frequently.

If, as expected, the Vessel may often meet with such waves, it will affect the vertical strength of the hull due to hogging and sagging (vertical flection in the hull by waves) and impacting to the bow and bow door during pitching. Careful and full consideration should be given to the vertical strength of the hull and partial strength at the bow, as well as strength at pitching.

② Height of cargo hold floor and bow ramp way

The cargo hold floor at the crest of the double bottom (the bottom tank) in the Existing Vessel is located below the load draft of 3.75 meters, and may always sink under the sea surface the draft under 2 meters deep. If troubles arise at the bow ramp way and inner door, the cargo hold may spring leaks, resulting in flooding of cargoes and, even the possible danger of sinking. After an actual sinking accident occurred, the International Classification Society (IACS) made an amendment in its clause on the "Bow door (bow ramp way) and inner door" which is applicable to all vessels requesting classification (NK) registry on and from July 1, 1996.

This amended clause stipulates that the bow door (bow ramp way) shall be installed over the freeboard.

The Project Vessel shall be designed with a double structure so that the weather-tight bow ramp way is equipped further with a water-tight door inside, and, if possible, the cargo hold floor for more than one half of the vessel's length will be located over the load draft to escape operational dangers. Design work will be proceeded by regarding the cargo hold floor, as it were, as a freeboard in spite of the laying of the upper deck as the freeboard deck. These steps are expected to give the vessel added safety. Further, in consideration of the utmost reduction of the draft, design specifications will call for the placement of the crest of the double bottom over the draft as much as possible. The height of the floor, thus, should be decided carefully through consideration of the size of the vessel, seakeeping, and propulsion capacity at the bow.

③ Superstructure made of aluminum alloy

The initial recovery of the Project Vessel will be improved by making the superstructure of aluminum alloy. For the safety of the vessel the initial recovery, namely, the cross metacentric height (GM: distance from the base point of rolling to center of gravity in hull) should ideally be about 0.80 m. If a steel superstructure is adopted according to the summarized hull plan and rough calculation of weight, the center of gravity and trim will give a cross metacentric height (GM) of about 0.70 m, which throws some doubt on the safety of the vessel.

If about 0.80 m of GM is secured increasing the breadth of the vessel without

changing the gross tonnage, the usability and working traffic line will be worse, and the propulsion will weaken so drastically that the proposed main engine power of 2,000 PS may not ensure the speed of 10.5 knots. Less weight and a lower center of gravity attained by employing a superstructure of aluminum alloy will ensure a GM of about 0.75 m, a value which will pose no problems in the safety in the Project Vessel, but a GM of 0.80 m may be hard to obtain. Thus, our planning will go with the superstructure of aluminum alloy.

④ Radio and nautical instruments

The radio and nautical instruments of the Existing Vessel consist of an out-of-date shading radar and a wireless telephone on SSB/VHF insufficient to cover A_2 area. As the Project Vessel will be engaged in international voyage and rescue activities in the FSM, radio and nautical instruments should cover A_3 area, and MF/HF radio equipment meeting international standards should be installed together with a GMDSS (Global Marine Distress and Safety System) and related equipment. Further, a daylight-type radar accompanied by ARPA (Automatic Radar Plotting Aids), and a GPS plotter to accurately locate the vessel's own position should be installed in order to secure safety in voyage.

2) Basic concept to improve efficiency

① Gyration capacity and system of the twin engines, the twin-line-shafting, the twin rudders

As already described, access passages to the outer islands pass along narrow channels, and at places, vessels are required to have the capability to circle at a right angle, i.e., to "rotate on the spot".

In a simulation voyage during the last field survey, the Existing Vessel, equipped with twin engines and twin-line-shafting, circled in a narrow channel using one propeller for go-ahead and one for sternway. The Existing Vessel makes the best use of this gyration capacity on the basis of the system with the twin engines and twin-line-shafting.

Generally, a vessel with a one-propeller and one-axis system has reduced maintenance costs and improved fuel efficiency through improved propulsion efficiency. Such a vessel may have same degree of propulsion capacity through the use of a special steering system, but the FSM crew are getting used to the steering process of the existing twin-propellers and twin-line-shafting system. If trouble occurs at one side, the vessel may run by itself with only one propeller at the other side. Also the vessel can be designed with a shallow draft because the twin engines and twin-line-shafting system have smaller-diameter propellers. The Project Vessel, therefore, will be designed with a system of twin engines, twin-line-shafting, and twin rudders.

② Selection of the loading equipment and other equipment installed

The loading equipment shall be the union purchase system (burtoning system), consisting of a derrick boom and winch according to alteration of the requested system.

Generally, a deck crane can be expected to reduce the amount of deck work, simplify the equipment layout on deck, and reduce troubles due to breakdown. However, inspection may not be sufficient in the FSM at present to ensure operation of a deck crane, if adopted. The country has few technical experts able to work with the power and weak current handling of the crane itself or the electromagnetic clutches as the starter. Further, the FSM government counterparts requested a mechanical boom winch. In view of the present conditions of repair and inspection for deck cranes which use much electrical equipment in the FSM, mechanical equipment may be more efficient.

In view of the cargo vessels currently operating in the FSM, an out-of-date loading equipment and an out-of-date system to start the hydraulic equipment will be installed on the Project Vessel. Because of the present conditions of the FSM and crew's familiarity with the existing devices, thus, equipment, though out-of-date to some degree, may be appropriate.

③ Onboard work boat and trolley winch

In order to load at sites where roll-on/roll-off system is impossible, the Project Vessel will have an onboard work boat of the same type used in the existing vessel. The work boat may be loaded and/or unloaded to/from the Project Vessel with the sick, aged, and children aboard. Since such works may be dangerous in the sites in troubled waters, the Project Vessel will be equipped with a trolley winch as a safeguard to secure the efficiency and safety of loading works.

3) Basic Concept for better economical efficiency

① Limited overall length, draft, size, and loading tonnage/capacity

Transportation to outer islands may be made by the vessel running through passages along narrow and complicated channels which are subject to rise and fall tides. As the FSM government counterparts requested that the overall length of the Project Vessel not exceed that of the Existing Vessel, the overall length has been set at less than 60 meters and the draft has been set at 3.75 meters deep i.e., the same as that of the Existing Vessel. The design, therefore, will be made with those limitations. A further request was made to ensure a maximum loading capacity within those limitations, but economical efficiency in operation and maintenance costs should be considered.

The actual operation results of cargoes transported by the Existing Vessel are considerably diversified, as indicated in Table 1-1. In the FSM, the Existing Vessel is the sole vessel which can transport an abundance of sand and ballast for construction, and there is a great demand for transportation by vessels which can carry out roll-on/roll-off loading of construction machinery. The Existing Vessel runs at an almost full load of 500 to 530 deadweight tons and sometimes runs double two-way transportation to meet the large demand.

Construction machinery weighs less than sand and ballast, but takes up a larger volume in the cargo hold, as shown in the case of backhoes (excavators) and bulldozers.

If such plural large machinery is carried, limited space remains in the cargo hold for general cargoes loaded together. Such machinery is almost always transported back to the departure port after the work is over.

In the case of copra transportation, the vessel is used for collection and outbound delivery, and sometimes export transportation to Japan or Korea. In such cruises, the vessel invariably runs with its hold filled to the maximum capacity, about 500 deadweight tons.

In anticipation of these cargo conditions and increases in construction machinery, equipment, and materials for development plans, as well as continuance of copra transportation to cradle the outer islands' industries and support their economies, the FSM government counterparts hope to have a replacement vessel capable of ensuring maximum possible deadweight tonnage and capacity within the limitations of 60 meters of overall length and 3.75 meters of draft. From review of the financial expenditures, a larger deadweight tonnage and capacity in a replacement vessel may not lead directly to cost saving and reduction of operation cost by means of mass transportation. It may be appropriate to set the deadweight tonnage and capacity to the same levels as those for the Existing Vessel.

② Cruising speed, main engine, and lightweight hull

In discussion with the FSM government counterparts, the cruising speed at full load was set to about 10.5 knots at the continuous service output (C.S.O) by 15% sea margin. The original speed requested was 12.5 knots, but, as already mentioned, economical efficiency should be given priority over cost reduction.

The deadweight tonnage of the Project Vessel, if amplified to the same level as that of the Existing Vessel (about 850 tons), would make the hull a bit larger under the Classification Rules.

For safety in the hull, the bottom shell of the Project Vessel will be 15 – 18 mm thick – an improvement from the 11 mm of the Existing Vessel, which is too thin as a landing craft – and the reinforced thickness may make the vessel more heavy. The super-structure of aluminum alloy made to obtain a lighter weight of hull will contribute to reduction of the draft.

It was agreed that a four-cycle medium-speed engine will be selected as the main engine for the Project Vessel in consideration of a range of alternatives, including procurement from a third country, since such an engine is more economical in fuel and maintenance costs than a high-speed engine, and no two-cycle or high-speed engines will be adopted for the Vessel.

③ Minimum indispensable equipment and endurance

The Project Vessel will have to endure, like the Existing Vessel, for more than 20 years. A minimum amount of indispensable and very endurable equipment should be selected for installation. Equipment layouts in the engine room and on deck should provide as much elbowroom around each piece of equipment as possible, leaving maintenance space for simple machine tool installation. However, such propositions must not result in any surplus size of the vessel, so

detailed design will come through careful consideration.

④ Convertibility and procurement of machinery and equipment parts

The FSM is also unexceptional among the aided countries receiving Grant Aid in terms of the difficulties in procuring machinery and equipment parts. The procurement of maintenance parts, therefore, will be as easy as possible and allowable as spare parts procurement within the scope of Grant Aid. Convertibility and simplification of parts will be ensured, for example, by selecting a main and auxiliary engines from a single manufacturer. This also will apply to pumps, motors for engine-related equipment, and radio and nautical instruments. Procurement from third countries is included as an alternative in our planning, but as already mentioned, the FSM government counterparts hope Japanese parts are selected in view of the regular inspection, repair docking, and actual operation results of the Existing Vessel.

4) Concept to make the provision of aid more effective

① Improvement of public services and development of the rural fishing villages in the outer islands

As described in the section on the appropriateness and effectiveness of this Project, the Project Vessel is expected not only to play a role for cargo transportation as an inter-islands vessel, but also for repletion of public services in transportation operation, promotion and development of the rural fishing villages, and further contributions in enhancing the awareness of the inhabitants in the outer islands of the significance of maintaining a federated country.

For these purposes, the Project Vessel is planned as an inter-islands vessel offering functions and capacities that afford transportation of more equipment and construction machinery necessary for development and promotion to the outer islands where ordinary-type vessels cannot operate similar services.

② Management capability of the implementing agency and the FSM crew's technical level

FSM management staff and crew will operate this Project Vessel.

The Project Vessel shall have functions, capacities, and equipment that are suitable to the technical level of FSM personnel and can be easily manipulated by them. Selection of the functions and capacities will raise the effectiveness in providing aid, and all-around judgement will be made in the detailed design.

5) Other matters to be considered

① Cruising days

when the Project Vessel runs in FSM waters, its range will be 319 miles between Pohnpei and Kosrae, 1,210 miles between Pohnpei and Yap, and 1,512 miles (3,058 miles two-way), the longest distance, between Kosrae and Yap.

The cruising ranges to the main ports the Existing Vessel has actually called for

copra exports, regular docking, and repairs are shown as follows.
The same voyage may be also expected in the Project Vessel:

Cruising ranges

Destination Pohnpei~	Major City	One-way (miles)	Two-ways (miles)	Major City	One-way (miles)	Two-ways (miles)
Japan	Kobe	2,135	4,270	Yokohama	2,008	4,016
Korea	Pusan	2,419	4,838			
USA	Honolulu	2,685	5,370	Guam	907	1,814
Australia	Brisbane	2,108	4,216	Sydney	2,514	5,028
Marshall	Majuro	779	1,558			

The FSM government counterparts hope to give the Project Vessel the capacity for a two-way voyage to Japan, and thus, the vessel's maximum cruising range is planned at 4,500 miles, i.e., long enough for a round trip to Kobe.

② Number of crew

When the Project Vessel is put in service, the Existing Vessel will be disposed of as mentioned later. The crew of the Project Vessel will be moved from the Existing Vessel, and from 20 to 23 additional persons will be added. The FSM government counterparts explain that their Seamen's Act stipulates three shift watches for 24 hours at sea for a vessel, though the Existing Vessel is forced to operate with only 20 persons because of its limited complement.

Crew assignment and watch order are shown in Table 2-6.

Table 2-6

	Watch A 08h-12h, 20h-24h	Watch B 04h-08h, 16h-20h	Watch C 00h-04h, 12h-16h	Total
Deck	C.O. + 2 Deck.	2nd O. + 2 Deck.	3rd O. + 2 Deck.	9
Engine room	1st E. + E.	2nd E. + 2 Oil.	3rd E. + 2 Oil.	8
Bosun	One, 08:00 - 12:00 13:00 - 17:00			1
Galley	3 persons 06:00-08:30, 10:00-13:00, 16:00-18:30			3
			Subtotal	21
	Captain and Chief Engineer		Total	23

Notes: C.O. : Chief Officer
E. : Engineer

As there are no stevedores in the outer islands, all of the crew will be engaged in loading work there. The above watch assignment seems to be much more than those in Japan or in general cargo vessels of neighboring countries, but it is probably not excessive in view of the present state of loading work by crew in the outer islands.

③ Grade and qualification of the Project Vessel

The Project Vessel will operate copra exports to overseas, voyages for regular docking and repair, and rescue activities in sea distresses. In addition, the Project Vessel will be required to insure itself. These facts may require the FSM to take the necessary steps to make the Project Vessel a national vessel. Thus, it is planned that the Vessel will be subject to relevant FSM laws and regulations, and will have a classification certificate from NK (Nippon Kaiji Kyokai) or ABS (American Bureaux of shipping). In planning, all equipment and installations of the vessel will exceed classification requirements and fully comply with JIS (Japan Industrial standard) or regulations equivalent to JIS.

2-3-2 Basic Design

According to the results of the field survey conducted to answer the request of the FSM, this draft design is made through analysis and studies performed in Japan.

In the general basic design of a vessel, it is said that design works begin at a general plan and end at the general plan. Initial layouts and main dimensions are decided as follows; after the applicable rules and standards are set for the sizes and outlines of main specifications mentioned above, necessary capacities of holds, chambers, spaces, displacement and trim (the vertical inclination of vessel), gross tonnage, propulsion capability of the main engine, and recovery (the capability for a vessel to return to its ordinary standing from inclination) are calculated for respective requirements and fed back to the layout plan for the draft general design. On the basis of this draft design, careful checks and detailed designs will be made upon each section (hull, engine, electricity, and special equipment) and its equipment. Through these processes, the basic design, including the layouts, will come to finalization. The basic concepts in the basic design for this project are as follows:

(1) Applicable Rules and Standards

As the FSM has no shipyard or repair facilities in its own territory, FSM vessels are accepted into insurance coverage with inspection carried out overseas by the International Association of Classification Societies (IACS) (mainly by the American Bureau of Shipping (ABS)) In view of navigational safety, seaworthiness, and safety of passengers' lives at sea, the following rules are applied to design of the Project Vessel since it also is to be put into international voyage service:

Classification:
The Project Vessel will acquire NS*, MNS* or AI*, and AMS* (a mark affixed to the certificate verifying that the hull structure, including steel materials and engines, passes the inspection) for registration of classification after undergoing overseas inspections during its construction by Nippon Kaiji Kyokai (NK) or the ABS.

Rules applicable:
International Convention for the Safety of Life at sea, 1974, with the Protocol of 1978, and Amendments 1981, 1983, 1988 and 1992

International Load Line Convention, 1966

International Telecommunication and Radio Regulations, 1982

International Convention on Tonnage Measurement of Ships, 1969

International Convention for the Prevention of Pollution from Ships, 1973, with the Protocol of 1978

International Regulation for Preventing Collision at Sea, 1972

FSM maritime regulations

USCG Rules and Regulations for Foreign Vessels operating in the Navigable Waters of the United States

Standards:
In addition, ships' metal parts which are not stipulated in the above rules are subject to JIS requirements and Nippon Senyohin Kentei Kyokai (HK) standards.

(2) Hull Plan

1) Plan for main dimensions and gross tonnage

In the plan for the main dimensions of the hull, including both its the form and size, of the Project Vessel as a cargo vessel, the cargo hold will occupy a good deal of space under the upper deck, engine room, and the steering engine room. Fuel and fresh water tanks (under the cargo hold) will fill the same section. Accommodation space will be laid out on the upper deck as a superstructure space.

Accordingly, in a vessel such as a small-sized vessel, which has an accommodation space under the upper deck, the main dimensions of the hull may vary with the maximum holding complement of persons (including crew) aboard the vessel. In the Project Vessel, however, the maximum complement of persons aboard may not affect the main dimensions of the hull even though it may affect the gross tonnage.

In a trial calculation on the presumption that the overall length is less than 60 meters, the draft is less than 3.75 meters, the deadweight tonnage is approx. 850 tons, the deadweight capacity is 1,200 m^3, the cargo loading capacity is set at the same level as that in the existing vessel, and the height of the cargo hold floor (depth of the double bottom) is set over the load draft as described later (though this presumption may be ideal in safety of vessel), then the volume of the under-deck may be fairly large.

Now another presumption is made: a virtual freeboard deck is prepared, the lowest edge of the inner door (watertight) is placed at approx. 300 mm over the load draft, and the deck in front of the inner door is kept exposed. Presuming that the cargo hold floor is sunk as low as possible to ensure enough buoyancy even at leak, this presumed design may be considered as long as it requires to obtain the approval by the Classification Society.

Thus, it is planned that the cargo hold floor height will be set partially below the draft to the extent that roll-on/roll-off operation will not be interrupted.

On the presumption that the overall length shall be less than 60 meters and the breadth shall be approx. 11 meters in view of propulsion efficiency, the outline of the layout plan under the deck may be as follows:

Length of steering engine room (at the bow side of A.P.)	approx. 3.5 m (approx. 5.5 m overall)
Length of engine room (part of the bow side to be a chilled cargo hold)	approx. 14.5 m
Length of cargo hold	approx. 27.5 m
Chain locker and entrance of roll-on/roll-off	approx. 7.5 m
	Total 53.0 m

In the trial calculation, the length between perpendiculars will be 53 meters, and the overall length will be 57 to 58 meters in light of a cruiser type stern and a bow stem. Thus, the planning will be based on a length b.p. of 53 meters.
Comparisons of elements between the Project Vessel and the existing vessel are listed in Table 2-7. Table 2-8 immediately following shows the abridged signs used in this subsection.

Table 2-7 Comparisons of elements

	Lpp x B x D (m)	Dead Weight(ton)	Capacity (m^3)	Lpp/B	B/D	d(m)
Project vessel	Approx. 52.0 x 11.0 x 7.00	Approx. 850	1,200	4.73	1.57	3.75
Caroline Islands	49.29x 10.8 x 4.50	845	1,218.6 (43,034ft^3)	4.58	2.40	3.75

Table 2-8 Abridged signs used in this subsection

Lpp	: Length between perpendiculars of vessel
B	: Breadth molded
D	: Depth molded
C_B	: Block coefficient of vessel (showing vessel's fatness) $C_B = V / (Lpp \times B \times D)$ V : Displacement capacity (m^3) d : Planned full load draft (m)
CM	: Cross metacentric height (distance from base point of rolling to center of gravity in hull) (m)
CoM	: Cross metacentric height at free water (m)

Though there is no remarkable difference in elements between the two vessels, the depth of vessel (d) itself is different even if the cargo hold floor height of the Project Vessel is adjusted by presuming the virtual freeboard deck. As mentioned before, this difference is caused by the amendment of the uniform Rules (UR) of the International Association of Classification Societies (IACS) relating to the "bow door and inner doors", i.e., the stipulation that all bow doors must be fixed over a freeboard deck. Since the

Project Vessel therefore cannot fit out any bow door, ramp, or inner door below the load draft in the same manner as it is done in the existing vessel, it will be impossible to have the layout for the height of the cargo hold floor similar to that of the existing vessel. Although peculiar layout to be used for the Project Vessel will be discussed on the basis of the actual detailed plan with the Classification Society to obtain its approval, in view of the actual safety of voyages and seakeeping at the bow of the hull, layout instructed by the society for height of the hold floor, the bow door, and inner door may ensure the best safety. By this measure, the surface of the hold floor can be even and flat, facilitating the smooth handling of roll-on/roll-off cargoes in the replacement vessel.

On the other hand, as a consequence of this measure, the vessel expands in size, hull weight, and draft, and the location where the doors are installed is raised. It is anticipated that the increases in these various factors, together with tidal variations in the site, will increase the angle between the door and the floor when the door is opened and closed, making it difficult to ensure smooth operation of loading and/or unloading.

Further consideration will be given to the design planning in view of the aforementioned matters, the bow form, and propulsion capability.

(3) Consideration of freeboard and recovery

The minimum height of the freeboard of the Project Vessel is, of course, the lowest at a full load. Calculated displacement tonnage at that time will be summarized as follows:

Displacement tonnage at light load	approx. 765 tons	approx. 770 tons
Crew, passengers, their personal effects, and foods	approx. 5 tons	
Fuel oil (170 kl), lubricating oil, engine-room oil	approx. 150 tons	approx. 850 tons Cargo weight
Fresh water (150 kl)	approx. 150	
Dry cargoes	approx. 530	
Refrigerated and frozen cargoes	approx. 10	
Others	approx. 10	
At departure at full load	approx. 1,620 tons	

By the deadweight draft restriction to not more than 3.75 meters, the block coefficient (CB) is required to be between 0.72 ~ 0.73 =1,620/(53x11.0x3.75x1.025). The CB is planned at 0.73, and the freeboard and the original recovery are affirmed.

As mentioned before in the subsection of main specifications, the virtual freeboard deck, the assumed freeboard deck, is set up with the low edge of the inner door set at 300 mm over the load draft (3.75 m), and 4.05 m over the hull base line (the upper face of keel).

With the following conditions below;

Lf (hull length for calculation of freeboard) 53.09 m (0.96 L WL)

Df (depth for calculation of freeboard) 4.05 m

(depth to the virtual freeboard deck)

the height of freeboard (f), under requirements of Classification (NK), will be f_0 = 478 mm according to the table of schedule freeboard of the Classification Rules, and the amended freeboard by CB (f1) will be 496 mm. If f2 (amendment by the forecastle), f3 (amendment by depth and length), and f4 (amendment by the sheer) are calculated for trial purposes, the freeboard height (f) is equal to f1 − f2 + f3 + f4 (<0 showing a minus figure). Thus, the Project Vessel will have a minimum freeboard height of 50 mm, and it may be acceptable to plan the low edge of the inner door at 50 mm over the load draft. This is a position 3.80 m over the baseline. In this Project Vessel, the low edge of the inner door, even at a full load, will be 250 mm higher than this position, and 4.05 m over the baseline. Those calculations will be acceptable to NK requirements.

In order to confirm the initial recovery, the summarized hull plan and the rough calculation of weight, center of gravity, and trim will give a cross metacentric height (GM) of approx. 0.75. (For your reference, the GM is approx. 1.15 at the displacement tonnage at light load.)

Ideally speaking, it is preferable that the breadth of vessel is more than 11.5 m and the GM more than 0.80, but since such figures would increase the size of the Project Vessel and a GM of 0.75 may be a sufficient, though perhaps not optimal, figure, the breadth is planned at 11.0 meters.

There are no NK Rules or figure requirements on the ship recovery applicable to vessels less than 60 meters long or roll-on/roll-off cargo ships such as the Project Vessel. Thus, since no factors cause any apparent problems on the basis of the above figures, the above planning will be made.

(4) Affirmation of gross tonnage

There are no factors restricting the gross tonnage of the Project Vessel under FSM laws or rules, or in view of its operation. When cruising, however, the Project Vessel will be required to indicate the international gross tonnage, and it will thus be necessary to confirm the summarized figure:

The layout plan is on the following basis;

- Fuel tanks, lubricating oil, fresh water, and general service water are equipped on the double bottom.
- The cargo hold, engine room, and steering engine room are equipped under the upper deck.
- An accommodation area with space for 23 crew members, 9 rooms, 4 passengers' rooms (12 persons), a galley, 2 dining rooms, toilets, a dispensary, an air-conditioning machine room, an emergency generator room, a CO_2 room, and an engine casing is equipped in the superstructure on the upper deck.
- The wheel house is equipped on top of the superstructure.

To secure 2,000 mm for the ceiling height of the accommodation space, the average height between decks is planned at 2,300 mm. On the basis of the heights, the volumes of the various enclosed chambers are calculated as follows: the volume under the upper deck is approx. 3,570 m^3, the hatch is approx. 150 m^3, and the superstructure and others are 755 m^3. The gross volume covered by gross tonnage will amount to approx. 4,475 m^3.

Accordingly, the international gross tonnage (G/T) is approx. 1,221 tons (4,475 x (0.2 x 0.02 $\log_{10}$4,475). The Project Vessel, calculated on 1,200 G/T or more, will be planned with a gross tonnage between 1,200 and 1,250 G/T, but the difference of the cargo hold height from the existing vessel will result in an increase of the gross tonnage.

(5) Cargo hold and deadweight

It goes without saying that economical efficiency as a cargo vessel is rated by the rise and fall of transportation costs. The annual transportation volume including the deadweight and capacity, the annual operation cost, and current expenditures of a vessel account for a greater portion of the efficiency. The Project Vessel will have a deadweight of approx. 850 tons and a cargo hold capacity of approx. 1,200 m^3, i.e., approx. as much as the Existing Vessel, it will be replacing.
In the existing vessel, the cargo hold (dry excluding the salient of the hatch), is 783 m^3, but calculated from 29.0 (L) x 10.8 (B) x 2.5 (H) meters, and the height of the cargo hold hatch is approx. 1.25 m at the mid part, giving approx. 3.75 meters of height, allowing a hold volume of 1,219 m^3, including the hatch volume.

The opening clearance of the project Vessel is 4.0 meters high, and it will be necessary to ensure transportation of 4-meter-high construction machinery. The height between the decks in the hold will be planned at approx. 4.2 meters.

By these measures, the Project Vessel will have a cargo hold of approx. 1,270 m^3, calculated from 27.5 (L) x 11.0 (B) x 4.2 (H) meters, i.e., a bit more than the existing vessel. With this length (27.5 m), the increases in the size of the vessel, main engine power, and fuel costs which would appear if an ideal length of 29.0 m was adopted will be prevented. For that decision, consideration is given, in vain, also to the fact that the inclination of the cargo hold floor is much larger as a consequence of amendment of the Classification Standard concerned, which requires the setting position of the bow door ramp to be higher in order to ensure more improved working effectiveness with the length of 29.5 meters.

Equipment in the hold is not so special, but a 4-meter-wide wooden dunnage board will be placed on the center line of hull to protect the double-bottom surface against construction machinery with caterpillar wheels, and a demountable side sparring (2.4 m high) and fittings to clamp containers will be installed in order to deal with bulk loads of copra, sand, and ballast.

(6) Capacity of tanks

1) Fuel oil tank

The maximum number of cruising days for the Project Vessel voyage is based on a voyage between the FSM and Japan (Kobe, 2,135 miles). The cruising speed of 10.5 knots given, the fuel oil tank will allow 13.5 days of cruising (8.5 days of one-way cruising and 5 days for loading and unloading of cargoes, and waiting in Japan):

For one-way cruising for 8.5 days

Main engine 1,000PS x 2 x 85% x 145kg/PS·hr x 24hrs ÷ 0.85 x 8.5 d = 59.16kl

Aux. engine 210PS x 1 x 80% x 170kg/PS·hr x 24hrs ÷0.85 x 8.5 d = 6.85kl

At wharf (only auxiliary engine in use 1.5(cargo handling) + 3.5(waiting) days=5 days)

Loading/unloading 210PS x 2 x 85% x 170kg/PS·hr x 24hrs ÷0.85 x 1.5 d = 2.57kl

Waiting 210PS x 1 x 75% x 170kg/PS·hr x 24hrs ÷0.85 x 3.5 d = 2.47kl

Total 71.05kl

In anticipation of 95% of stowing and 10% of residues, the necessary fuel oil will be approx. 83kl, and a tank of that capacity may suffice for the vessel. However, the FSM government counterparts hope for a capacity of 170kl, twice that of the necessary quantity, because ① fuel oil (light oil) is more cheaply supplied in Japan than in the FSM, and preferably it can be supplied for return in Japan whenever the vessel visits Japan; ② in the outer islands fuel has been frequently supplied to fishing vessels by the existing vessel; and ③ in rescue operations in disasters the vessel will not always be able to call ports where fuel supply is possible.

If the Project Vessel has a 170kl fuel oil tank below the cargo hold, or double bottom, no alteration of layouts will be required. Thus, the fuel tank will have a capacity of 170kl, as requested by the FSM government counterparts.

2) Fresh water tank

According to Japanese standard, fresh water requirements are 20 ℓ for drinking and 20 ℓ for utility use per man-day, totalling 40 ℓ or more. On the presumption of the maximum cruising days of 13.5 days between the FSM and Japan, likewise in the case of fuel oil;

use of fresh water per voyage 40l/day x 23 persons x 13.5 days = 12.42 kl

That is to say, the necessary fresh water in one voyage is 16kl including residue in the tank, and the fresh water tank will have a capacity to hold that quantity.

For reasons of supply of fresh water to outer islands and transportation of fresh water to disaster areas, (i.e., the Vessel's operation services,) FSM government counterparts request a fresh water tank capacity of 150kl. If the fresh water tank is equipped at the double bottom, a capacity of this level can be attained without any change of the vessel's size.

(7) Main specifications of the hull

The main specifications of the hull are listed in Table 2–9.

Table 2-9 Main specifications of the Project Vessel

1. Nationality:	Federated States of Micronesia (FSM)	
2. Type and Objectives:	Roll-on/roll-off cargo vessel capable of beaching (a landing craft cargo vessel)	
3. Material of hull:	Steel (aluminum alloy for the superstructure)	
4. Classification:	NK or ABS	
5. Applicable rules:	International rules and FSM maritime rules	
6. Cruising area:	International voyage	
7. Main dimensions:		
1) Length (overall):	approx. 57.0 m	
2) Length between perpendiculars:	approx. 53.0 m	
3) Width molded:	approx. 11.0 m	
4) Depth molded:	approx. 7.0 m	
5) Planned draft:	Not more than 3.75 m	
8. Tonnage:		
Deadweight:	approx. 850 tons	
Gross tonnage (International):	approx. 1,220 tons	
9. Cruising speed	approx. 10.5 kt (C.S.O. 15% sea margin)	
10. Cruising range:	approx. 4,500 miles (at speed of 10.5 kt)	
11. Complement (maximum number of persons aboard):	35	
Crew	23	
Passengers	12	
12. Capacity:		
1) Deadweight capacity:	(approx. 1,230 m^3)	
a Hold for dry cargo (bale):	approx. 1,210 m^3	
b hold for refrigerated and frozen cargoes (bale) :	approx. 20 m^3	
2) Tank capacity:		
a Fuel oil:	approx. 170 kl	
b Fresh water:	approx. 150 kl	

(8) Hull outfit plan

1) Deck equipment

① Roll-on/roll-off device

As already mentioned, the Project Vessel will be equipped to deal with transportation means to ensure transport of large, heavy cargoes to the outer islands where there are no well arranged port facilities, and the vessel will have the capability to beach and the function of roll-on/roll-off with the bow door and bow rampway equipped.

In the Existing Vessel, a roll-on/roll-off type vessel, a device with the following functional features;

Bow rampway 5.73 m (B) x 7.45 m (L)

Inner door (clearance) 4.89 m (B) x 3.94 m (L)

is working by means of mechanical and manual opening/locking methods which are

disputable in terms of water-tightness due to deterioration by successive use; and, as one of the defects, an external impact by waves of approx. 6 meters or less in width in rough sea conditions upon the bow rampway produces a wave resistance strong enough to decelerate the vessel's cruising pace.

Although it is desirable to avoid this defect as much as possible in the Project Vessel by reducing width of the door and clearance, in light of the past results with transportation of construction machinery and equipment, and the prospective transportation planning, the FSM government counterparts hope to have a width of 4 meters and height of 3.9 meters, at minimum; or, if possible, to have these dimensions approach the existing vessel's measurement. The existing vessel, however, was not constructed for international voyages, and does not have sufficient cruising capability in high sea. In view of seakeeping, course keeping, propulsion, and strength of the bow rampway, the clearance will be set at 4.0 m (B) and 4.0 m (H), at the most, with the doors having corresponding dimensions and functions.

In order to improve safekeeing and course keeping, prevent direct wave impact upon the bow rampway and inner door, and improve the water-tightness of the inner door, the Project Vessel will be designed with a bow door (wave breasting at the bow) having a form similar to that used for ordinary-type vessels. The planned roll-on/roll-off device for the Project Vessel is summarized as follows:

– Bow door	Double door (biparting and not watertight)	
	Aperture dimension	4.5 m (B) x 4.0 m (H)
	Driving method	Hydraulic cylinder (with a control stand) for opening and clamping
– Bow rampway	Steel single-panel type (wind- and raindrop-proof)	
	Ramp dimension	Approx. 7.5 m (L) including flap x 4.0 m (effective breadth)
	Aperture dimension	4.0 m (B) x 4.0 m (H)
	Driving method	Opening: Hydraulic-driven winch 1 Clamping: Hydraulic cylinder with the control stand used together with the bow door)
– Inner door	Steel single-panel type (watertight)	
	Aperture dimension	4.0 m (B) x 4.0 m (H)
	Driving method	Opening: Hydraulic-driven winch 1 Clamping: Hydraulic cylinder with the control stand used together with the bow door, and a sub stand in the cargo hold)

② Cargo gear

As already mentioned, a union purchase system (burtoning system) using a derrick boom will be adopted through discussion with the FSM government counterparts. To enable double loading operation, derrick posts will be installed over the center part of the cargo hold on the upper deck between hatches at the bow and stern. The winches for the derrick will have a capacity of 5 tons x 30 m/min., respectively, for a

combination of cargo and topping. One winch will be installed on each of the booms, for a total of 4 winches.

③ Mooring equipment

The winch for anchoring, unanchoring and mooring will, of course, be in conformity with the Classification Society's Rules, and a stern anchoring device specifically designed for a landing craft will be further installed to prevent rolling at the stern when the vessel touches down by beaching, and to support the vessel's refloatation by anchoring astern.

Outlines of planned specifications of the mooring equipment are as follows:

- Windlass and mooring winch (5/3 ton x 9/15m/min) 2 sets
  one on each broadside
- Stern anchoring and mooring winch 1 set
  anchoring (10 ton x 15m/min wire drum 1)
  mooring (3 ton x 15m/min rope drum 2)

④ Work boat and davit

The Project Vessel will have an FRP work boat for special purposes such as unloading living commodities and small parcels to the outer islands where the Project Vessel cannot reach by beaching, and for picking up the sick, the aged and children. Since will be fairly dangerous to load and/or unload the boat with the derrick boom under rough sea conditions, an exclusive davit will be installed. This small boat will carry cargoes weighing 300 to 500 kgs stored in with the electric trolley. The davit will be capable of loading the boat onto the vessel in rough sea conditions by using the trolley. The boat, therefore, will be installed with 4 lifting eyes and 4 sets of spring wire. Specifications for the boat are as follows:

approx. 8.0 m (L_{OA}) x 1.8 m (B) x 0.75 m (D) FRP with floor
Equipped with 1 outboard engine (40 PS), 4 lifting eyes, and 1 set of spring wire

2) Accommodation equipment

① Compartment

Through discussion with the FSM government counterparts it was agreed that the Project Vessel will be installed with compartments which meet the FSM requirements for social conditions, as indicated in the following table. FSM Seamen's welfare rules of the Maritime Act require that vessels of 800 to 3,000 tons be provided with not less than 2.35 m^2(25 ft^2) of crew compartment floor per person. Although there are some clauses to be overlooked due space constraints, planning will for the most part be in conformity with those conditions. Beds in the compartments will be 1,950 mm in length and 950 mm in width, dimensions large enough to accommodate amply proportioned crew members.

	Type of room	No. room	Total persons	Room used for	Position of room
Crew (23)	State room	3	3	Senior officer	Subjacent to bridge
	2-bed room	2	4	Junior officer	Above same section, and boat deck
	4-bed room	4	16	Ratings	Boat deck
Passengers	4-bed room	3	12	Passengers	Upper deck
Dispensary	-	1	-	Sick, injured	Upper deck

② Dining room and cooking equipment

In compliance with the FSM requirements for FSM social conditions, two dining rooms will be installed in the Project Vessel; one for officers and special passengers as a salon at the right broadside of the upper deck accommodation section, and the other for ratings as a mess room at the stern side of the upper deck, adjacent to the galley.

Two small refrigerators (200 ℓ each) will be placed in each dining rooms for crew serving on night watch.

In the galley, the kitchen ranges will be powered by electric ignitors (not by gas) for greater safety, and a cooking table, cupboard, etc., will be installed.

Subsistence storage, in the following specifications, will afford holding provisions for 14 days of cruising with a complement of 35 persons, and will be located adjacent to the refrigerated and frozen cargo hold for joint use of the cooling unit. However, since the storage is below the deck and easy daily access is limited with this layout, a separate refrigerator (600 ℓ) will be placed in the galley for storage of provisions for the day.

Type	Capacity	Kept at
Freezer	approx. 5.0 m^3	- 18℃
Storage for dry goods, vegetables	approx. 10.0 m^3	+ 4℃

Air conditioning (only for cooling) will be provided to the accommodation section by the central cooling device. The galley will be ventilated by an electric-driven ventilator and natural draught, and it will make use also of the central cooling device for spot refrigeration in the engine monitoring chamber. The air conditioning chamber will be located as practicably as possible at the bridge boat deck to prevent waste heat exhaust and/or air intake from salt pollution.

③ Toilets and showers

The toilets and showers will be installed, together in combination-type western-style rooms for toilet bowls and showers. In compliance with the FSM requirements for FSM social conditions, separate chambers for combination toilets and showers will be installed for officers, ratings, passengers, and getting-on-the-bandwagon passengers of the type usually transported in inter-islands voyages.

As stipulated under the FSM Environment Control Act, to conserve the environment in port, toilet drainage will be kept in holding tanks which prevent outflow while the Project Vessel is in port. Necessary capacity of the holding tank will cover a maximum

complement of 35 persons for 3 days, that is, approx. 5.0 m^3 (15 gallons per man-day), and the tank will be installed in the engine room for maintenance purposes.
As the Project Vessel will sometimes call at Guam and Honolulu, one of the rooms will be equipped with a circulating water toilet (24 ℓ type) under US Coast Guard Regulations.

3) Radio and nautical instruments
Planned radio and nautical instruments are listed in the table described later. In particular, radar, GPS and MF/HF radio wil be planned as follows:

① Radar
The current SOLAS Convention stipulates that all passenger vessels engaged in international voyages and all cargo vessels not less than 300 gross tons must be equipped with radar and, on and from February 1, 1999, one of the equipped radars, at the least, will be required to operate in the frequency band of 9 GHz. By the current rule only one radar set for operation in the 9 GHz band (X band) is acceptable, but the Project Vessel will be installed with 2 sets. In the FSM waters, which are full of squalls of the type so often encountered in the southern pacific, an X-band radar can often lose sufficient resolution in fierce squall conditions, and eyeshot is often too limited at such (approx. 20 meters).
Thus, the vessel will be installed with a 3 GHz band radar (S band) which keeps high resolution in fierce squalls to maintain safe cruising.

② GPS
One plotter and a GPS will be installed. The current rule has no stipulation regarding actual requirements to equip specific instruments for the transitive period between 1997, when LORAN C and NNSS discontinue their operations, and February 1999. However, since US Coast Guard regulations require vessels to equip themselves with GPS, the Project Vessel will fully conform with the equipment standard going into effect from 1999, and voyage safety and reduced fuel costs will secured by improving the interactive functional effectiveness of those navigation instruments by means of a gyrocompass (autopilot) with a plotter and connection of signals with radar for assured interface between those instruments for an accurate grasp of the vessel's own position, course, and trajectory. That installation will meet the equipment standard to go into effect from 1999.

③ Communication equipment (radio equipment)
As communication equipment (radio instrument), a radio instrument for GMDSS which acceptable under the SOLAS Convention will be installed, as mentioned before in the section on the basic design concept. Additionally, installation of an MF/HF radio together with INMARSAT C will clear the requirement for double installation of radio equipment stipulated by the SOLAS Convention for maintenance purposes.

4) List of main equipment on the hull section.
Through analysis of the results of discussion with the FSM government counterparts and the aforementioned checks, the main equipment on the hull section will be selected on

the following conditions:

① Equipment in full conformity with all international rules, Classification Rules, FSM maritime regulations, USCG Rules and Regulations for Foreign vessels operating in the Navigable waters of the US, and SOLAS Rules which will be completely in force on and from February 1999, applicable to the Project Vessel (*)

② Equipment that is not stipulated in the current equipment rules, but that should be installed with an ordinary cargo vessel to run and steer the vessel

③ Equipment necessary for the cruising of the Project Vessel, which will act as an inter-islands cargo vessel in FSM waters

The main equipment summarized in the following list is sorted by item and use:

A. Hull section

Equipment	Item no.	Standard · specification	Used for	Quantity
[1] Equipment on Deck				
1) Steering Gear	①	Electro-hydraulic 2.2KW 2.4t/m	Steering	1 set
2) Windlass/Mooring Winch	①	5/3t x 9/15mm/min. Hydraulic-driven open type		1 unit
3) Stern Mooring Winch	①	3t x 15mm/min. Hydraulic-driven open type	Entry/departure, mooring, berth	1 unit
4) Derrick Post	②③	Gantry type	Loading/unloading	1 set
5) Derrick Boom	②③	S.W.L. 5t	Loading/unloading	4 units
6) Hoist/Topping Winch	②③	5t x 30m/min.	Loading/unloading	4 units
7) Electric Trolley	②③	1.9t x 1 unit	Loading/unloading for small parcels Loading of Work boat	1 unit
8) Bow Door	③	4.5m(W) x 4.0m(H) at opening	Improving seakeeping and propulsion	1 unit
9) Bow Rampway	③	7.5m(L) x 4.0m(W) 4.0m(W) x 4.0m(H) at opening	Loading of large heavy cargoes, construction machinery · equipment	1 unit
10) Bow Watertight Inner Door	②③	4.5m(W) x 4.0m(H) at opening	- do -	1 unit
[2] Anchoring/Mooring Equipment				
1) Bower Anchor	①	Stockless type 1,440kg AC-14	Entry/departure, mooring, berth	2 units
2) Anchor Chain	①	34mm dia. (Grade2) 412.5m		1 set
3) Mooring Rope	①	35mm dia. x 140m		4 sets
4) Tow Line Rope	①	Steel wire 25mm dia. x 180m		1 set
5) Stern Anchor	③	1,250Kg		1 set
6) Stern Anchor Rope	③	Steel wire 30mm dia. x 100m		1 set
[3] Lifesaving Equipment				
1) Lifesaving/Rescue Boat	①	FRP, with Engine 25PS	Maritime disaster escape, and Rescue	2 units
2) Boat Davit	①	Electric-driven	Maritime disaster escape, and Rescue	2 units
3) Life Raft	①	Case 1, with Auto-release, stand	Maritime disaster escape, and Rescue	6 sets
4) Life Jacket	①	With flashlight and whistle	Maritime disaster escape, and Rescue	150
5) Life Buoy	①	With rope	Maritime disaster escape, and Rescue	8 sets
[4] Galley Equipment				
1) Marine Electric Range	②	16KW x 1	For Galley	1 unit
2) Electric Soup Kettle	②	3.5KW x 25ℓ x 1	For Galley	1 pc.
3) Water Heater	②	1KW x 10ℓ x 1	For Galley	1 unit
4) Calorifier	②	15KW x 400ℓ x 1 Freshwater Shower	For Galley	1 unit
5) Refrigerator	②	600ℓ x1, 300ℓ x2, 60ℓ x3	For Galley	1 set
6) Sterilizer	②	1 for drink water	For Galley	1 set
7) Water Cooler	②	2 small type	For Galley	2 units
8) Electronic Range	②	2 units in galleys	For Galley	2 units
[5] Firefighting Equipment				
1) CO_2 Fire Extinguisher	①	for both cargo hold and engine room	Compulsory firefighting equipment	1 set
2) Fire Hydrant	①	15 units in accommodation section	Compulsory firefighting equipment	1 set
3) Emergency Fire Pump	①	Electric-driven 15m³/h x 45m	Compulsory firefighting equipment	1 set
4) Fire Alarm	①	Main indicator: 10 windows x 1 plane (with sensor)	Compulsory firefighting equipment	1 set

[6] Nautical Instruments				
1) Gyrocompass	①②③	AC110V & DC24V, Repeater 2 sets	True direction finding	1 set
2) Autopilot	②③	Built in the gyrocompass	Auto steering	1 set
3) Magnet Compass	①		Direction finding	1 unit
4) Radar	① →	16" X-band with ARPA 1 set	Identifying position	1 set
	②③ →	16" S-band 1 set	and anticollision	1 set
5) Direction Finder	①④	200KHz-4.9Mhz 12 CH with memory	Direction finding	1 set
6) GPS, Plotter	①②③	GPS x 1, Color Plotter	Identifying position	1 set
7) Speed log	①②③		Measuring speed	1 set
8) Meteorological Facsimile	②③	Sheet width 14 inch and more	Meteorological conditions affirmed	1 unit
9) Anemometer	②③	Vane type, max. 90m/sec.	Meteorological observation	1 unit
10) Barometer	①			2 units
11) Echo Sounder	①	Matched up to IMO rules, Paper recording	Measuring water depth	1 set
12) Seawater Thermometer	①	Recording type	Measuring temperature	1 set
13) Atmosphere Thermometer	②			1 set
14) Clear View Screen	②③	300mm dia.	Visual forward check in rough sea	3 sets
15) Control Board for Navigation Lights	①	AC110V & DC24V, Wall-mounted	Safe cruising	1 set
[7] Communication Equipment Matched up to GMDSS				
1) MF/HF Radio Equipment	①	Synthesizer type 250W	Near and long-distance communication	1 set
MF/HF Transmitter/ Receive				
DSC Unit (Digital Selective Calling		Printer for DSC/NBDP (Telex)	Selecting circuit and automatic connection	
DSC Receiver		2182KHz transmitter/receiver built in	SOS transmitter/ receiver	1 set
NBDP (for Narrow-band Direct Printing)			Telegraph transmission by international telex	1 set
2) International VHF Radio Telephone	①	With DSC function F3E, F2B, 25/1W	Communication in port and for near distance	2 sets
VHF Transmitter/ Receiver		One of installed with a VHF printer	One under double equipment requirement	
DSC Unit				
DSC Receiver				
3) INMARSAT C	① *	EGC Receiver function built in	Communication by telex via satellite (Double equipment in place of MF/HF)	1 set
4) NAVTEX Receiver	① *	518KHz, with printer	Safe cruising	1 set
5) Satellite EPIRB	① *	Float type, full-automatic	SOS transmitter	1 set
		(Radio beacon indication distress position)		

6) Radar Transponder	① *	Portable type, X-band	Responding to search and rescue	2 sets
7) Two-way Radio Telephone	① *	150 MHz, portable type	Communication in distress	3 sets
Other Equipment				
8) Transceiver	②③	400MHz, portable with charger	Communication to the working boat	3 sets
9) Inboard Command Apparatus	①	100W, AM Radio, cassette type	Inboard practice, work management	1 set
10) Inboard Telephone	①	10 C.B. stations, C.B. type 1:3	- do -	1 set
[8] Other Equipment				
1) Air Conditioning System	②③	Outside air temperature 35℃ inside air temperature 30℃ (Rule required times of ventilation)	Maintenance of living environment	1 set
2) Sewage Disposal System Toilet	①	Circulating water washing and Sewage tank	Environmental protection, anti-pollution	1 set
3) Work Boat	③	FRP, with 40PS outboard engine About 7.8m(L)x1.8m(B)x0.8m(D)	Loading of small parcels, carrying sick, aged, children	1 unit

(9) Engine and electric plan

1) Main engine

The main engine will be a medium-speed four (4)-cycle diesel engine on twin-engines and twin-line-shafting, as mentioned in section on the design concept.

The cooling system will rely on water cooling, which is excellent in keeping engines high endurance, and silencers will be installed to reduce the exhaust sound from the main engine. In light of the simplified engine room layout and improved capability of the twin- engines and twin-line-shafting system, no power will be taken out through the main engine front-drive device.

① Main engine horsepower

Through discussion it was agreed that the cruising speed will be 10.5 knots under C.S.O. (continuous service output) by a 15% margin, and the main engine will have a sufficient output to cope with that speed with two sets of 1,000PS each. The necessary output of the main engine for the vessel to cruise at approx. 10.5 knots at full load is calculated here.

Accounting for hull resistance, propeller efficiency, and transmission efficiency of power together with data on similar vessels and actual results, an estimated curve of BHP (brake horsepower) at a 15% margin (increase of hull resistance by fouling on hull or sea conditions) is drawn. Figure 2−1 illustrates the curve.

The condition of the vessel at departure is as follows:

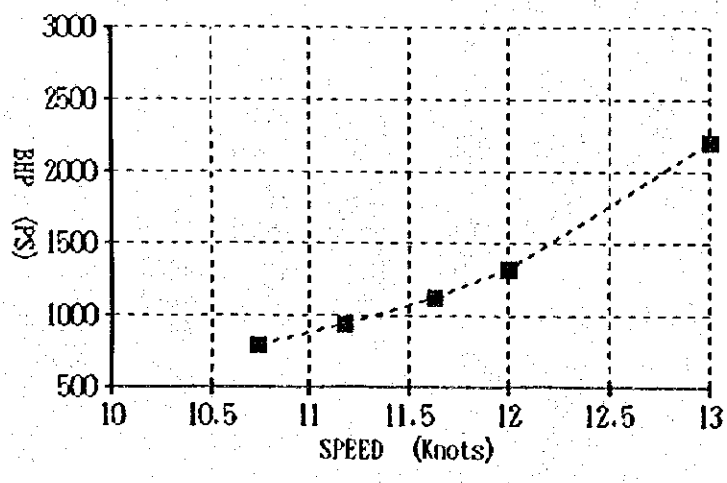
Lpp x B x D

53.00 m x 11.00 m x 7.00 m ····· @

Full load

△	(Displacement)	≒ 1,620 tons
d	(Full load draft)	≒ 3.75 m
C_B	(Block coefficient)	≒ 0.73 (Displacement/@)
S_W	(Area of wetted surface)	≒ 910 m^2

Fig 2-1 Estimated Curve of Brake Horsepower



From the curve, BHPs of 2 main engine units show approx. 1,910 PS and 2,230 PS at 11.0 knots, respectively. The speed of 12 knots initially requested by the FSM government counterparts may require 3,000 PS or so, and those supposed figures will be on a part of the fairly rising curve, indicating that a plan for a cruising speed of 10.5 knots may be an appropriate proposition from the viewpoint of economical efficiency.

Accordingly, each of the main engines on the twin-engine and twin-line-shafting system has an output of 955 PS (1,910/2), and the planning, therefore, is for the vessel to have 2 engines of 1,000 PS each, for a total of 2,000 PS or less.

② Propellers and stern device

As the Project Vessel is planned to be on a twin-engine and twin-line-shafting system due to the special conditions of inter-islands voyages, it will be equipped with two propellers, one on each side. Unlike ordinary type vessels, it has been decided in view of the propulsion resistance from the hull form in front of the propeller that the shaft bracket method or hull skeg method is appropriate to support the propellers and the twin propeller shafts bearings. At the present stage of planning, the skeg method will be adopted in view of the risks to the bottom of the vessel from contact with the seabed by beaching.

2) Generator and diesel engine generator

The inboard power supply of the Project Vessel will be mainly from a 440 V, 60 Hz, 3-phase alternating current and a 110 V single-phase current, and partially from a 220 V current for small-size devices and a 24 V direct current for emergency.

From calculation of the approximate inboard power consumption, the maximum requirement of power will be 220 KW and over. This covers the maximum power required when 2 hydraulic pump units using maximum electric load are run at night to afford double loading works, and the necessary power in cruising will be calculated at approx. 100 KW.

Therefore, the vessel should have 2 generators with 140 KW outputs, driven by diesel engines, under a load factor of 80% at the largest electric load, that may run parallel to meet the largest power need.

Thus, the vessel will be equipped with 2 diesel engines of 210 PS, 4 cycle, 1200 rpm or 1800 rpm, calculated on the power factor of 0.8, for necessary axial input horsepower to those generators.

3) Hydraulic-driven devices

The hydraulic system will be selected in consideration of the operating efficiency of each individual device, as well as the effective reduction of the vibrations and noises of each device, primarily because each device has its own specific objective, capacity and usage. The time zone of the operation of these devices will be roughly divided into three phases; the vessel's cruising time, the vessel's departure from and return to port, including berth in port, and its loading work time, and there are few times when the devices will be used concurrently. The hydraulic system will have 2 sets of 55KW electrical motors driving hydraulic pump units in order, first of all, to deal with the

largest power need, that is, the aforementioned double loading work at night, and second of all, to comprise one line, as a system, with a pressure of 150 to 160 Kg/cm^2 (a maximum of 210 Kg/cm^2) as the pressure for daily use.

cargo gears

Hoisting winch with topping drum	4 sets	By 2 electrically driven
Cylinder unit for hatch cover	2 sets	hydraulic pumps (parallel running)

Mooring equipment

Windlass and mooring winch	1 set on each broadside	
Stern anchoring and mooring winch	1 set	
	By one of the above 2 units	

Roll-on/roll-off equipment

Cylinder unit for bow door	1 set
Winch and cylinder unit for bow rampway (weathertight)	1 set each
Winch and cylinder unit for inner door (watertight)	1 set each
By one of the above 2 units	

A trolley (1.9 tons) will also be installed for loading small parcels and refrigerated and frozen foods. This trolley will also be electrically driven in view of its small capacity and effectiveness in loading works.

4) List of main equipment on the engine and electric section.

Through analysis of the results of discussion with the FSM government counterparts and the aforementioned checks, the main equipment on the deck section will be selected on the following conditions:

① Equipment in full conformity with all international rules, Classification Rules, FSM Maritime Rules, and SOLAS Rules which will be completely in force on and from February 1999, applicable to the Project Vessel (*)

② Equipment that is not stipulated in the current equipment rules, but that should be installed with an ordinary cargo vessel to run and steer the vessel

③ Equipment necessary for the cruising of the Project Vessel, which will act as an inter-islands cargo vessel in FSM waters

(10) Legal accessories and fittings

As there are no detailed rules in the FSM concerning the legal accessories on the Project Vessel, Japanese rules applicable to Japanese cargo vessels engaged in international voyages and equivalent to 1,200 G/T shall be applied to the vessel within the applicable scope.

For nonlegal fittings, a basic concept is to select fittings necessary for the following purposes; fittings necessary for the Project Vessel to cruise back to the FSM after completion of a voyage, fittings necessary for maintenance and/or minor repair of the vessel at sea, and fittings difficult to procure for running repairs in the FSM. Fittings of

these types are summarized below. These items represent contents similar to those contained in lists of legal accessories and fittings usually used by shipbuilders in contracts for the construction of vessels with international classification.

A. Accessories and fittings on the deck section	
[1] Legal fittings	1 setout
[2] Fittings on hull	1 setout
[3] Fittings in bosun's store	1 setout
[4] Cloth fittings	1 setout
[5] Fittings for cooking	1 setout
B. Accessories and fittings on the engine section	1 setout
C. Accessories and fittings on the electric section	1 setout

The main equipment summarized in the following list is sorted by item and use:

B. Engine section

Equipment	Item no.	Standard • specification	Used for	Quantity
[1] Propulsion Equipment				
1) Main Engine and Reduction Gear	①	Diesel 4-cycle medium-speed Engine Output MCO:1000PS x 800-1000 rpm CSO:850PS x 758-947 rpm	Propulsion machinery running	2 sets
2)Propeller	①	Fixed-pitch propeller	Main propulsion	2 sets
3)Line Shafting device for the above	①	Stern tube, seawater-lubricated	- do -	2 sets
[2] Electric and Electronic Equipment				
1) Engine to drive Main Generator	①	Diesel 4-cycle, output approx. 210PS	Main generator driving	2 units
2) Main Generator	①	175KVA(140KW), AC450V, 3P, 60Hz	Electricity generation(active)	2 units
3) Engine to drive Emergency Generator	①	Diesel 4-cycle, output approx. 60PS		1 unit
4) Emergency Generator	①	50KVA(40KW), AC450V, 3P, 60Hz	Electricity generation(emergency)	1 unit
5) Transformer	①		Power supply system to various equipment	1 unit
6) Main Switchboard	①	Dead-front, NF		1 set
7) Emergency Switchboard	①	Dead-front, NF, shore power termina		1 set
8) Battery Switchboard	①	Dead-front, NF		1 set
9) Group Starter Panel	①	Dead-front		1 set
				1 set
10) Light Distribution Panel	①	Drip-proof, wall-mounted		1 set
11) Bridge Distribution Feeder Panel	①	Control of navigation light and instrument		4 groups
12) Battery	①			
[3] Automatic Control				
1) Various Control Boards	①		Control of equipment	1 set
2) Various Monitor Boards	①		Equipment monitor	1 set
3) Various Indicating Panels	①		- do -	1 set
4) Various thermometers	①		- do -	1 set
[4] Other Engine Equipment				
1) Main Air Compressor	①	2-Stage compressor, 35m³/hFA x 30Kg/cm³	Starter of main/ auxiliary engines	2 sets
2) Auxiliary Air Compressor	①	Manual	- do -	1 set
3) Air Reservoir	①	Main x 2, Aux. x 1	- do -	1 set
4) Freezing Compressor	① →	R22, automatic start/stop	For subsistence	1 set
	③ →	Used jointly with the above	For refrigerated hold	1 set
5) Various Heat Exchangers	①			
6) Hydraulic Pumps/Motors	②③	With 55KW motor, high-pressure hydraulic pump	For hydraulic machinery	1 set
7) Various Control Valves	①		- do -	1 set
8) Various Pumps	①		Fresh/seawater etc.	1 set
9) Flow Meter	②③		Fuel supply measuring	1 set

10) Oily Bilge Separator	①	0.5 m³/h, 15rpm, with alarm	Environmental conservation	1 set
11) Incinerator	①	Approx. 200KW	Drain oil disposal and environmental conserv.	1 set
12) Oil Purifier	②③	for both F.O. and L.O. 700ℓ/h		1 set
13) Marine-Growth-Prevention System	③	120 m³/h x 2	Seawater piping protection	1 set
14) Machine Tools in engine room	②③	all-purpose lathe, grinder, gas welding, cutter, vice, 1 each	Maintenance and repair at sea	1 set

2-3-3 Drawings of the Basic Design

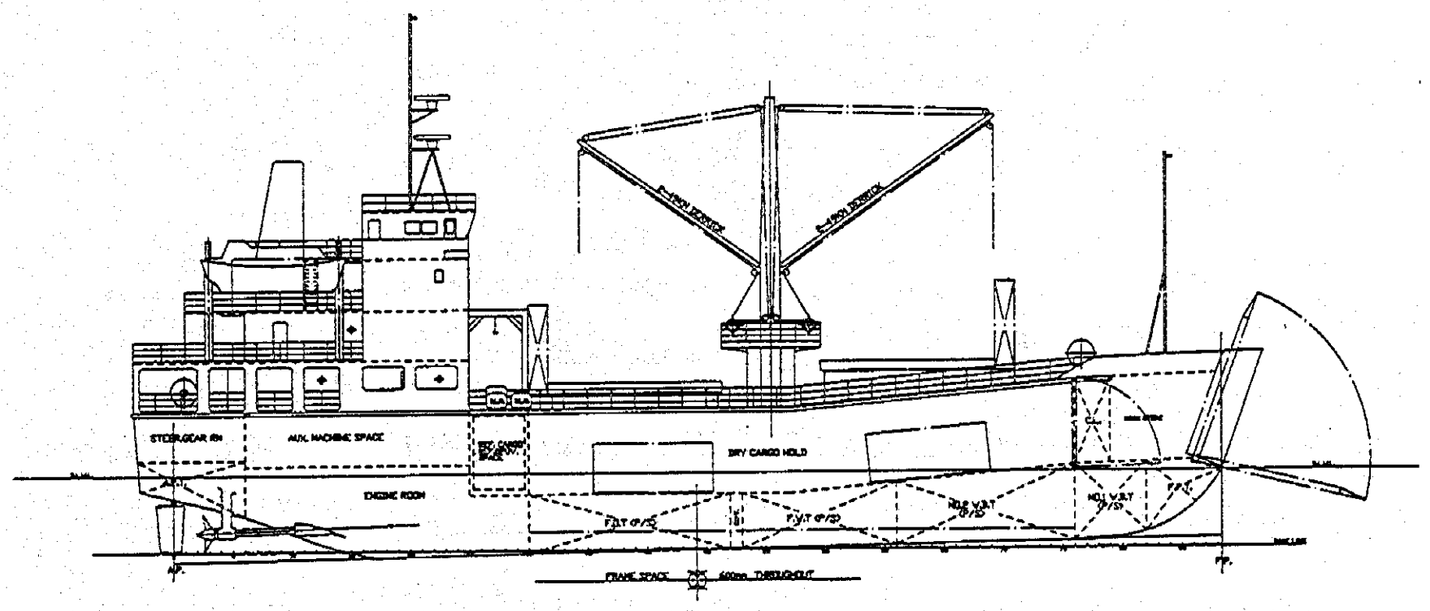
The drawings of the basic design of the Project Vessel are shown on the succeeding pages in the following order:

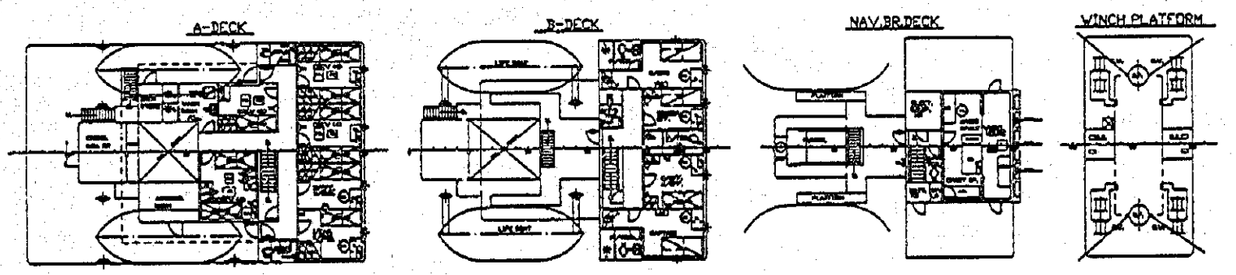
(1) General Arrangement
(2) Roll-on/Roll-off System (Bow door)
    Roll-on/Roll-off System (Rampway)
    Roll-on/Roll-off System (Inner door)
(3) Machinery Arrangement of Engine Room
    Lower Floor
    2nd Deck
    Elevation
    Engine Casing

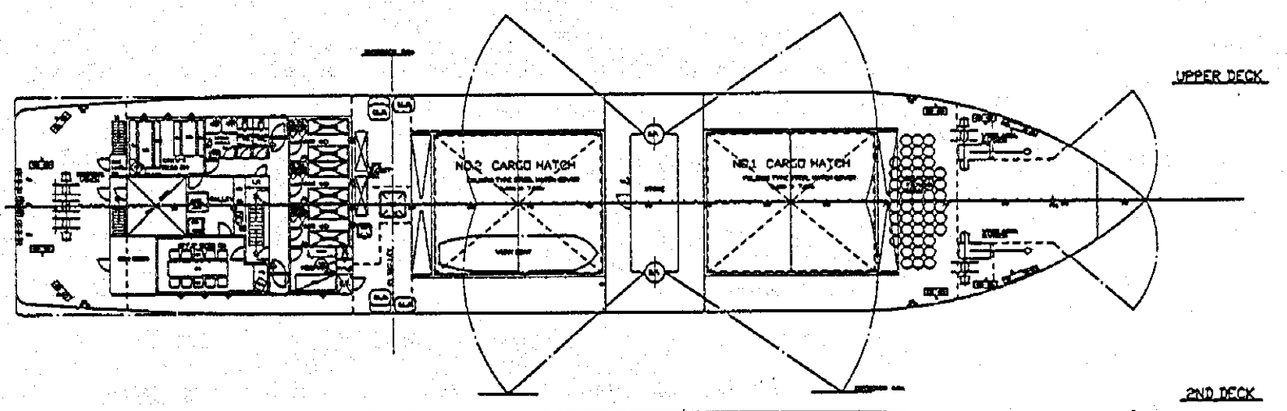
INTER-ISLANDS VESSEL
FOR FISHING VILLAGES

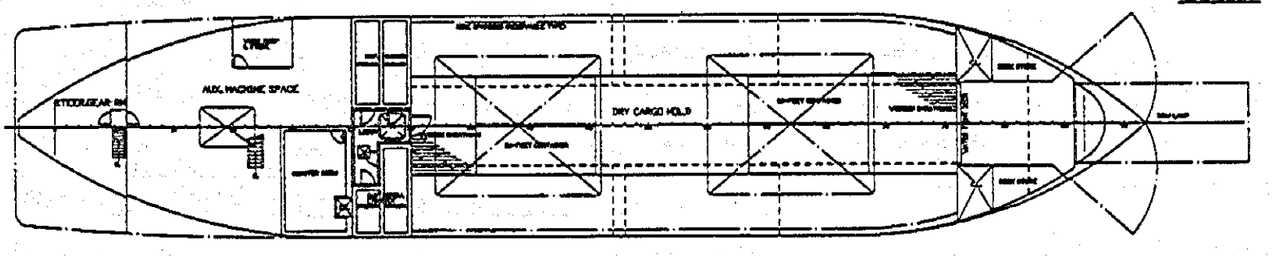
PRINCIPAL PARTICULARS		
LENGTH	(OVER ALL)	APPROX.57.m00
LENGTH	(P.P.)	APPROX.53.m00
BREADTH	(MLD.)	APPROX.11.m00
DEPTH	(MLD.)	APPROX. 7.m00
DRAFT	(DESIGNED)	APPROX. 3.m75
GROSS TONNAGE		APPROX. 1,200
MAIN ENGINE		APPROX.1,000ps×2
SERVICE SPEED		APPROX. 10.5 KT
COMPLEMENT		35 P.

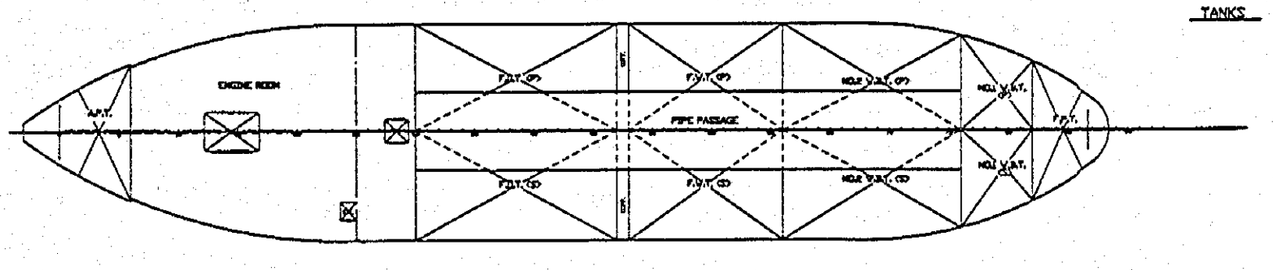
GENERAL ARRANGEMENT (SCALE:1/300)



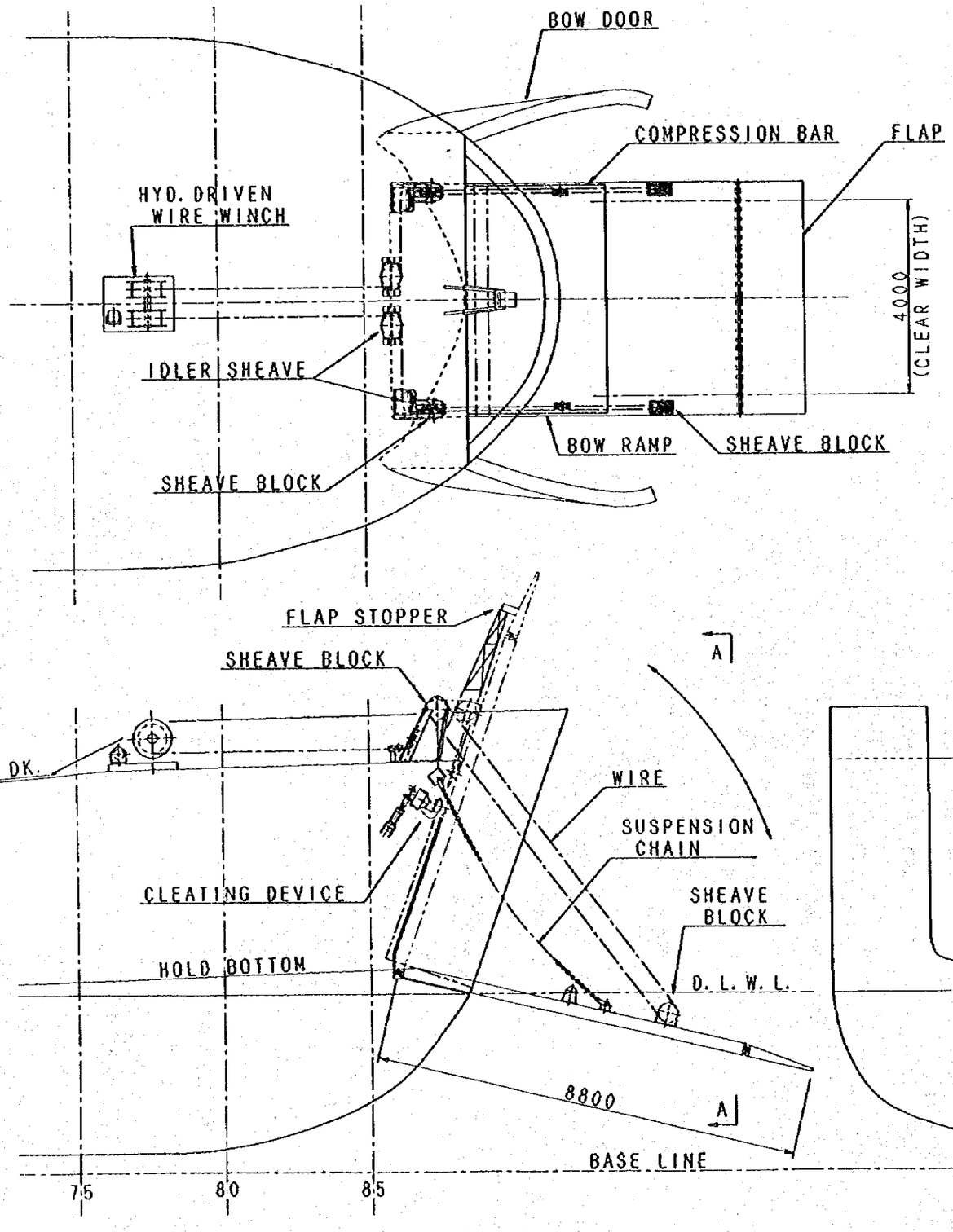


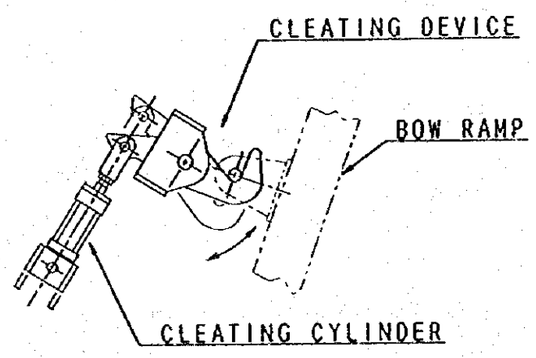




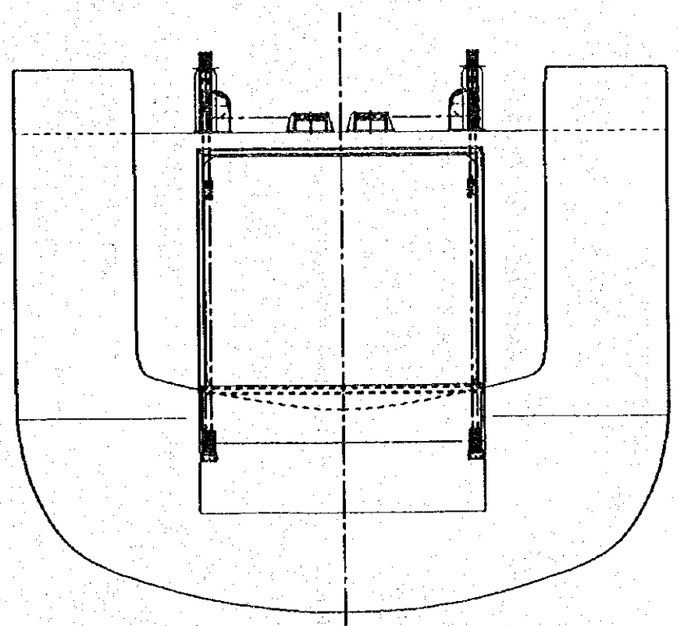


ROLL - ON / ROLL - OFF SYSTEM (BOW DOOR)





DETAIL OF CLEATING DEVICE

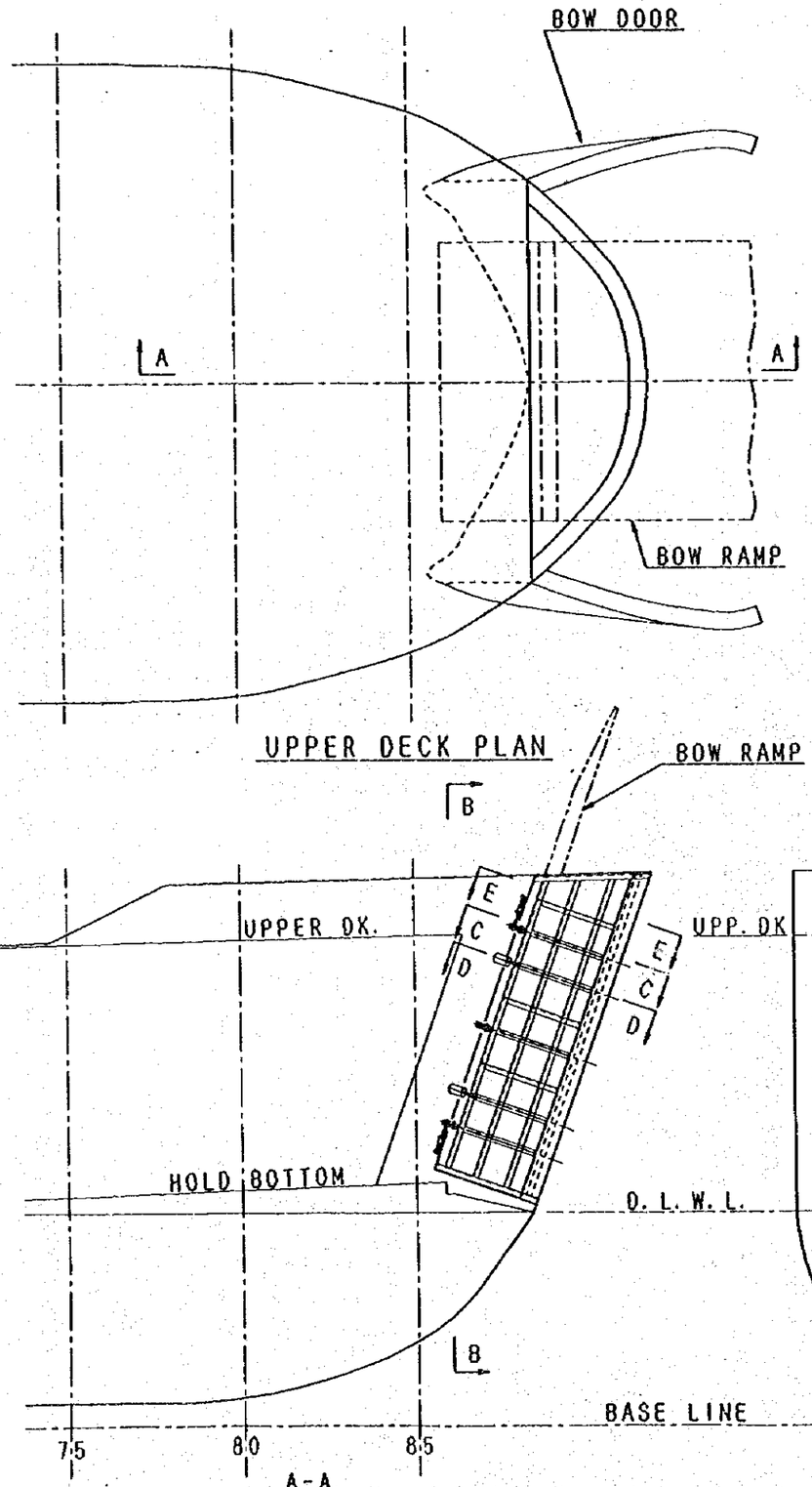


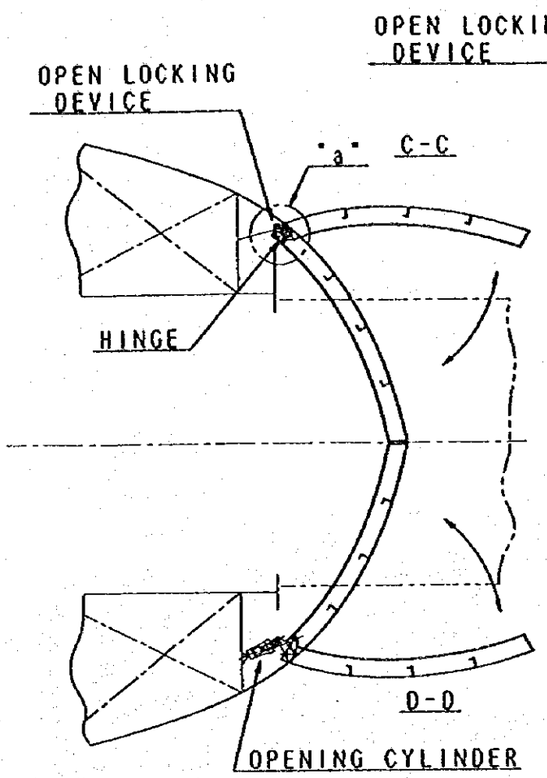
A-A

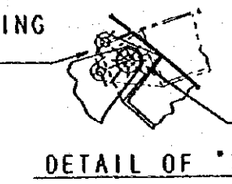
SCALE : 1/100

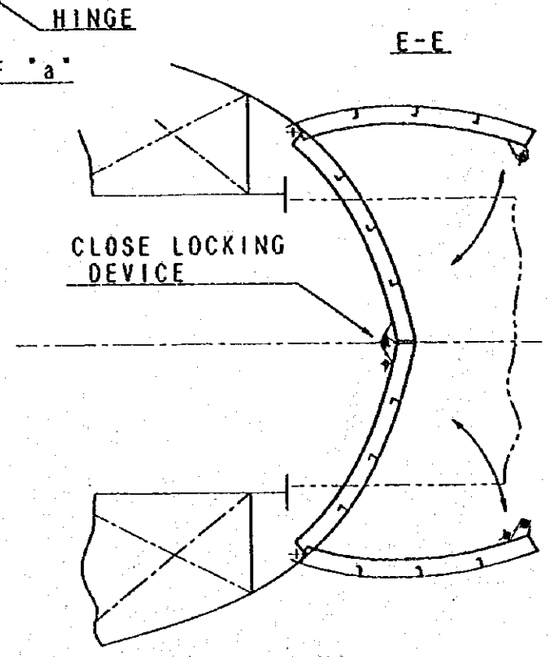
ROLL - ON / ROLL - OFF SYSTEM

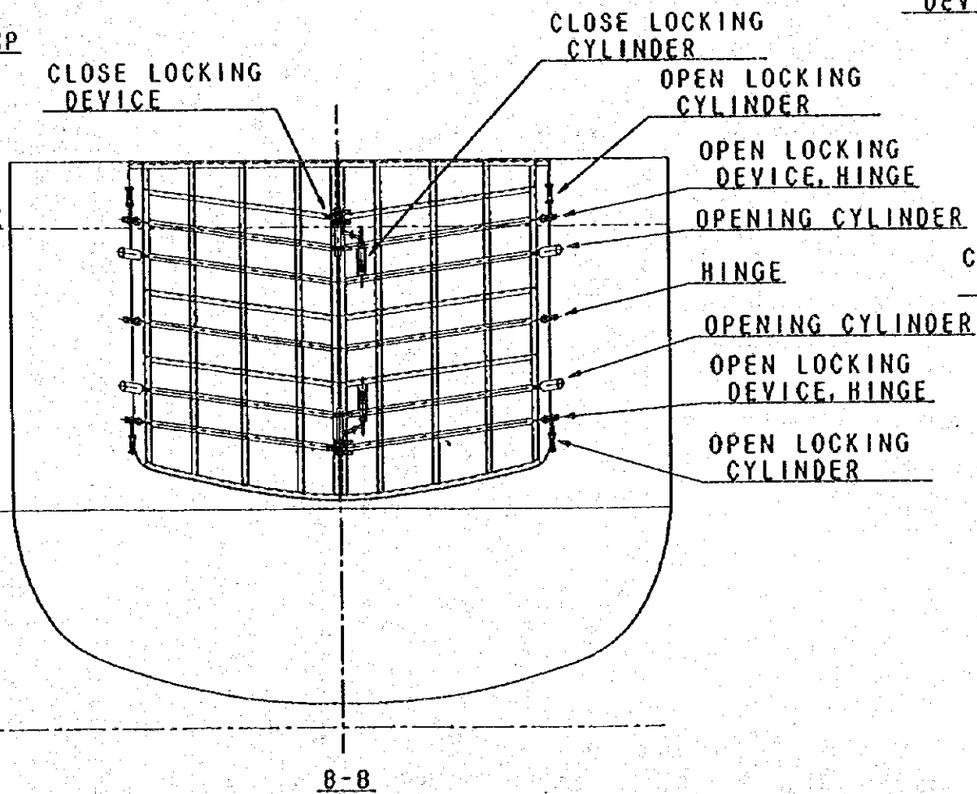
(RAMPWAY)





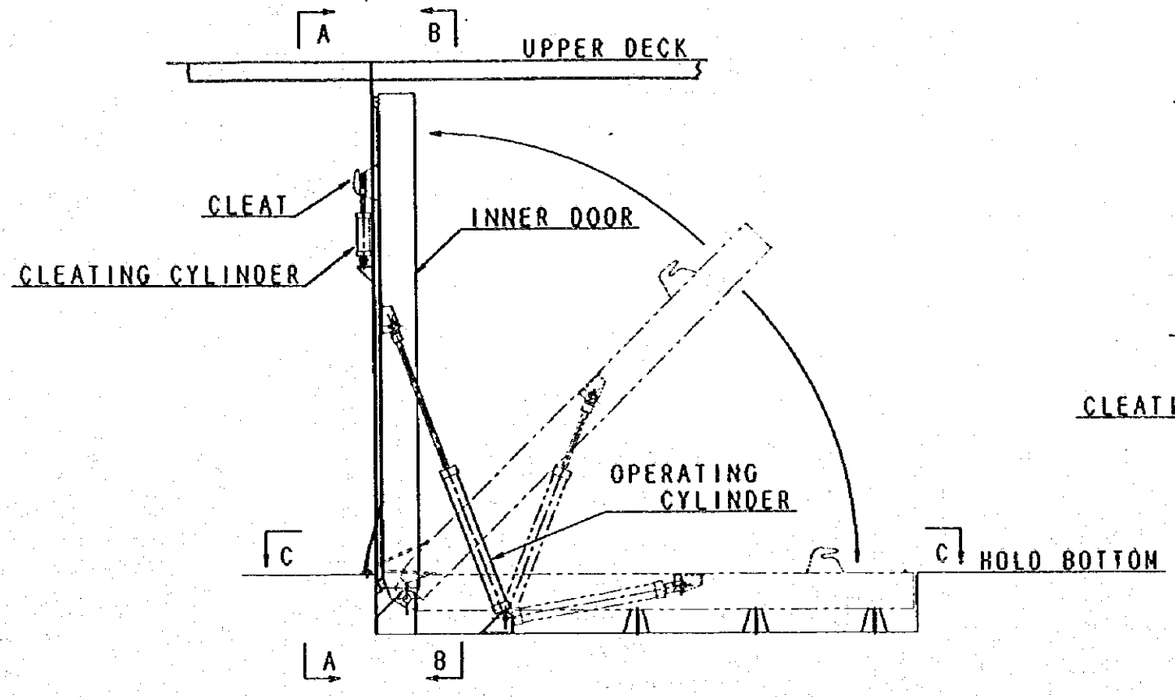


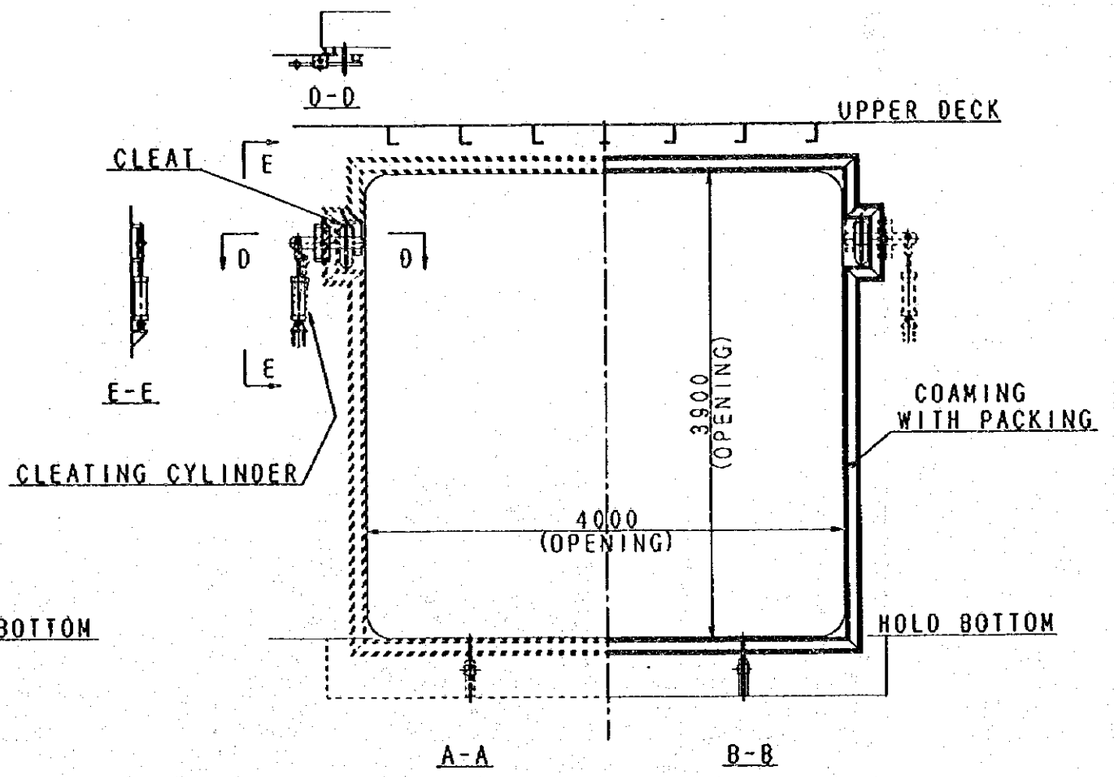


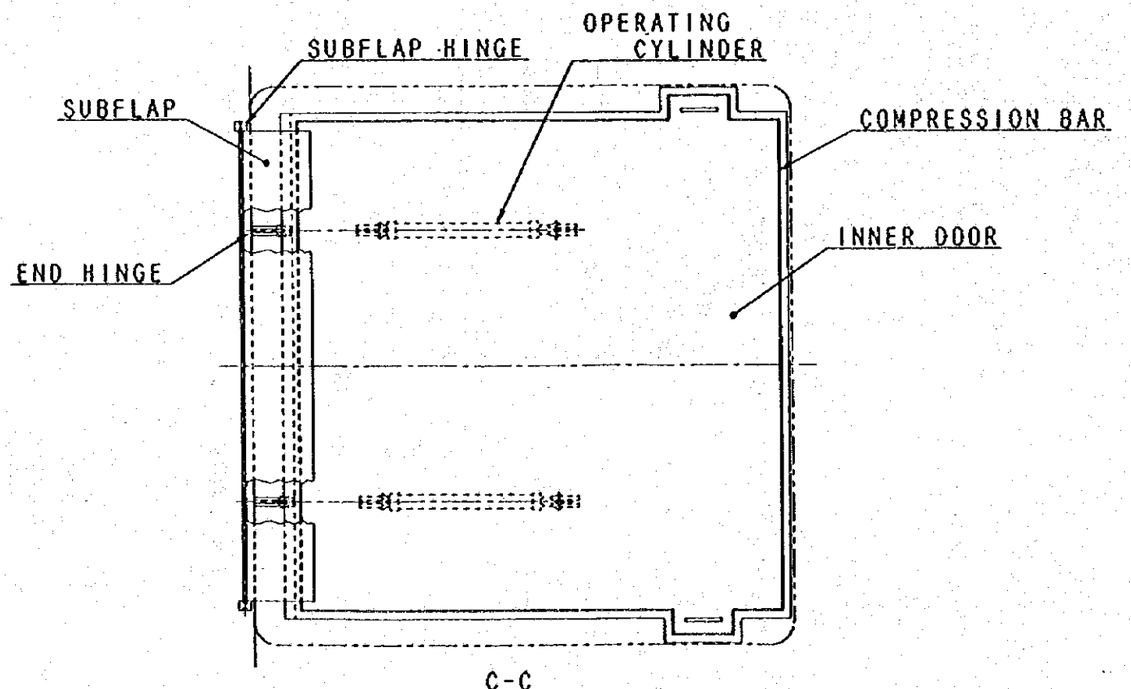


SCALE : 1/100

ROLL - ON / ROLL - OFF SYSTEM (INNER DOOR)



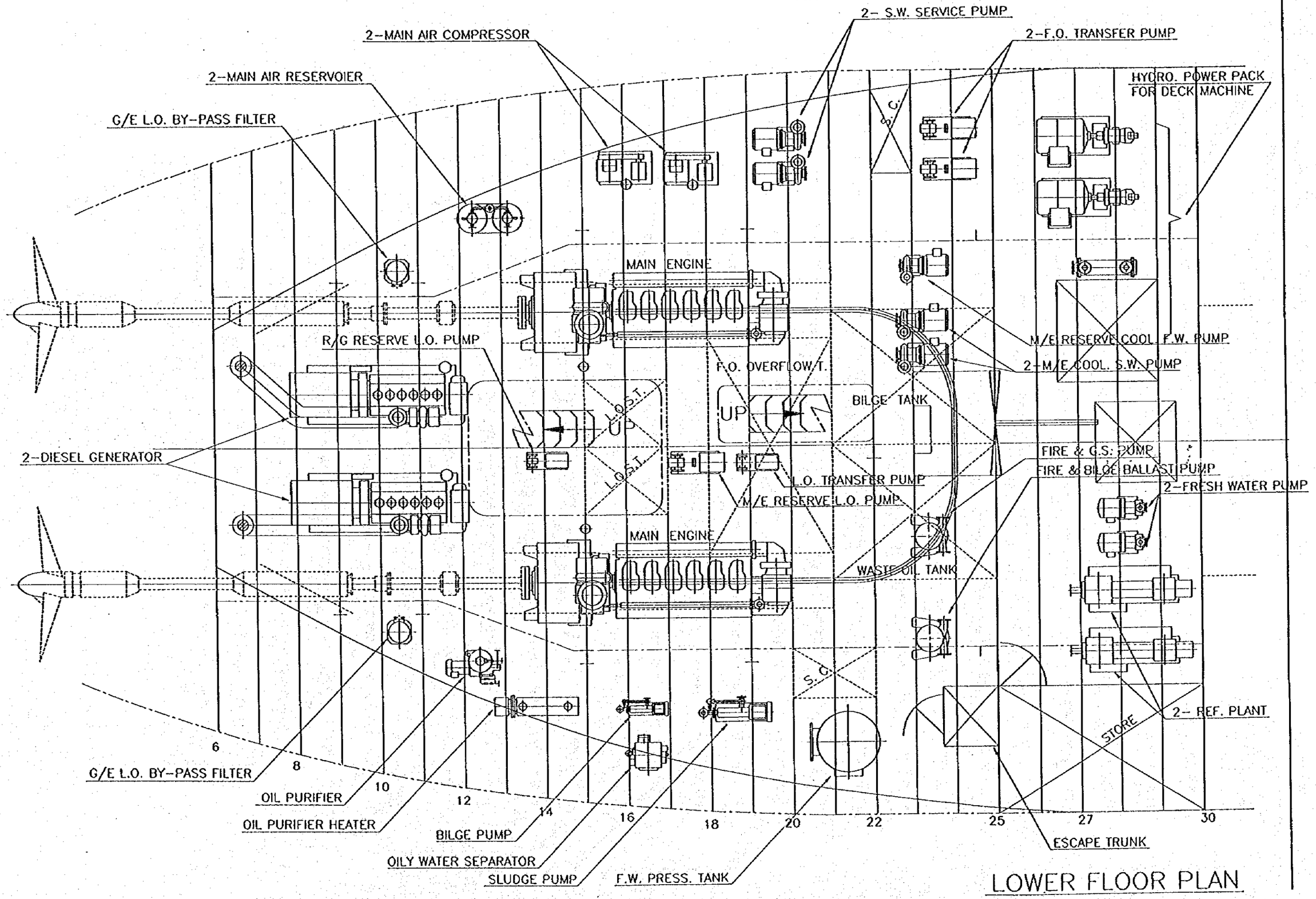




C-C

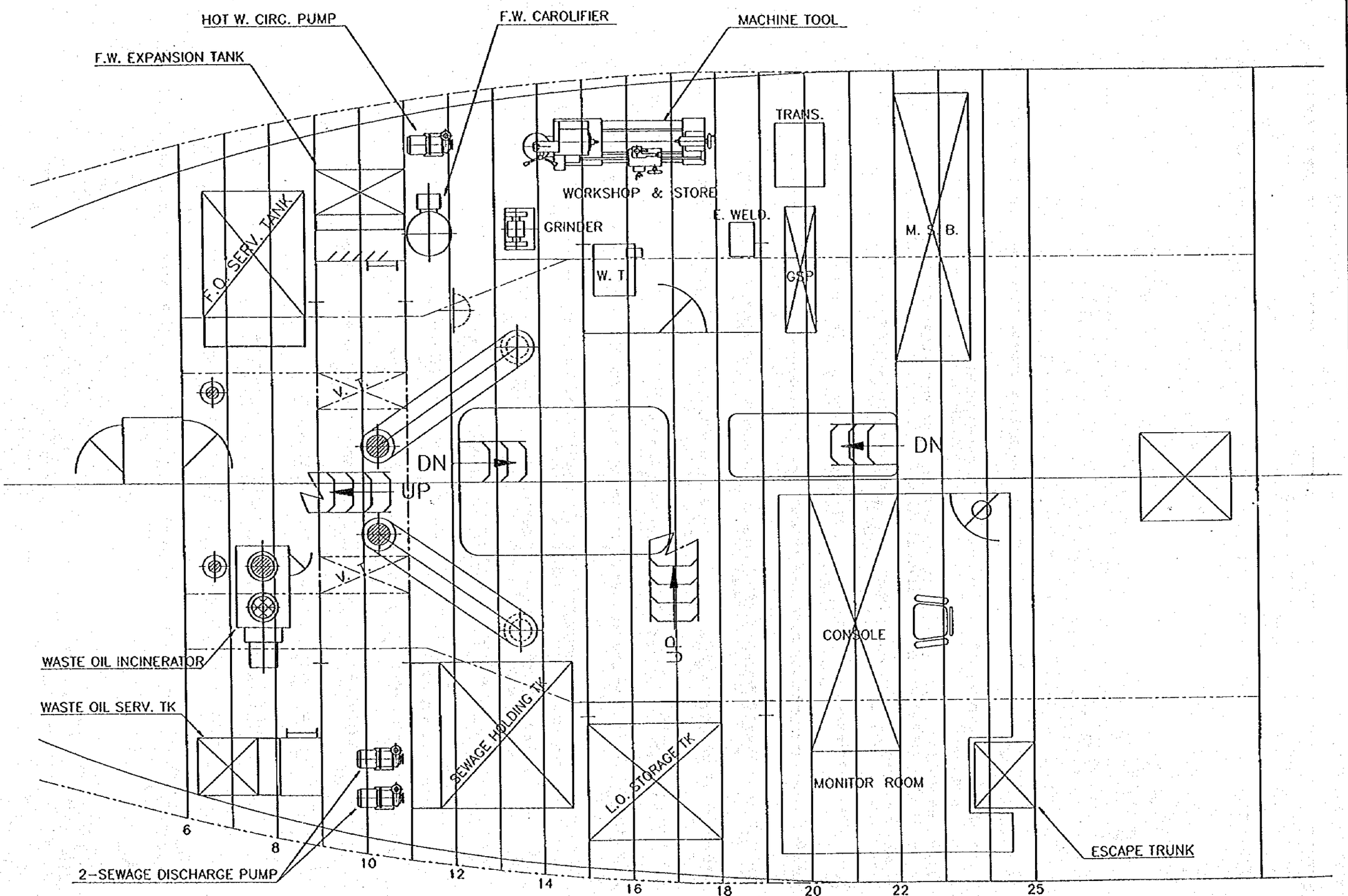
SCALE : 1/50

MAIN ENGINE ROOM (LOWER FLOOR) (SCALE:1/50)



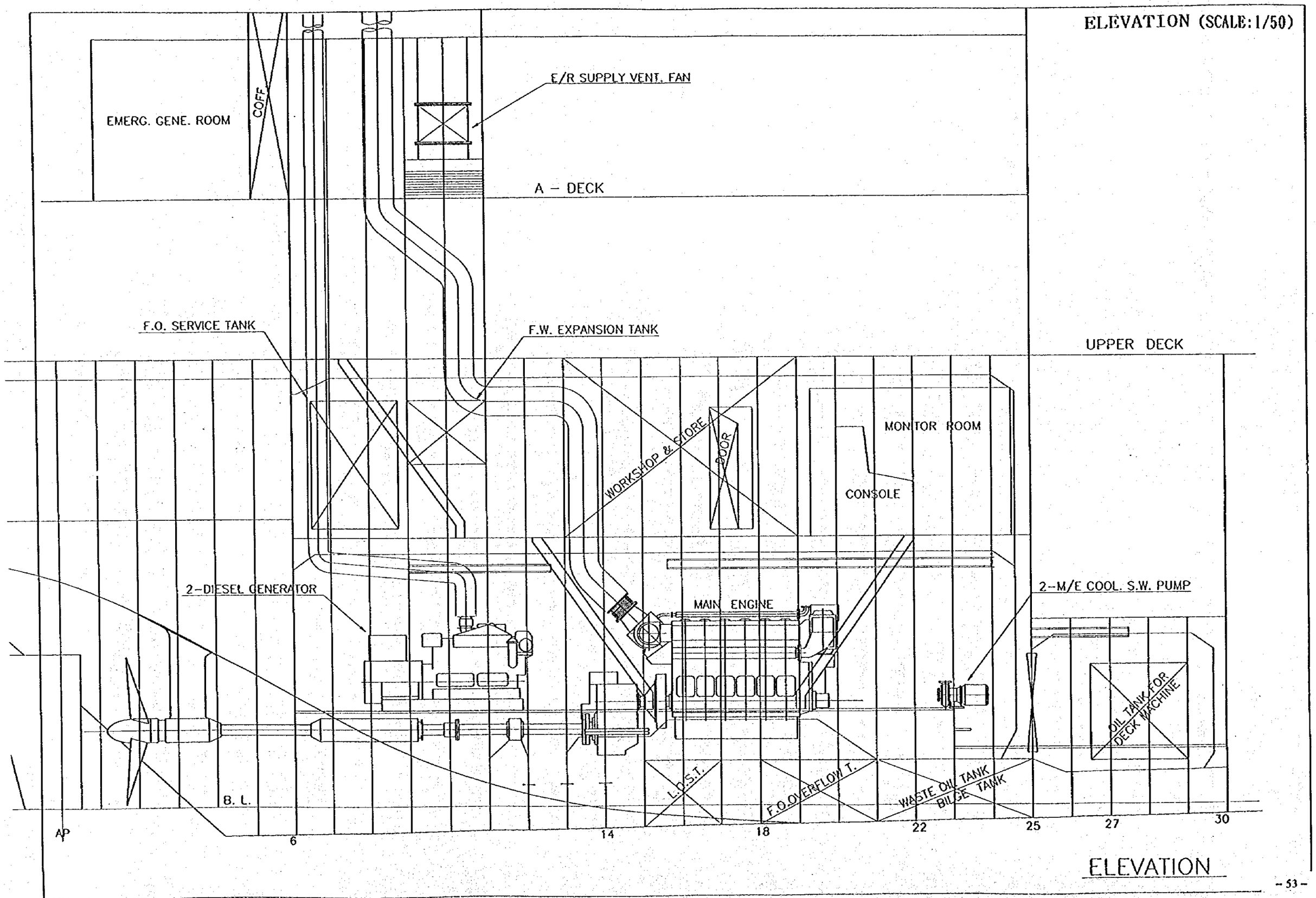
LOWER FLOOR PLAN

MAIN ENGINE ROOM (2ND DECK) (SCALE:1/50)



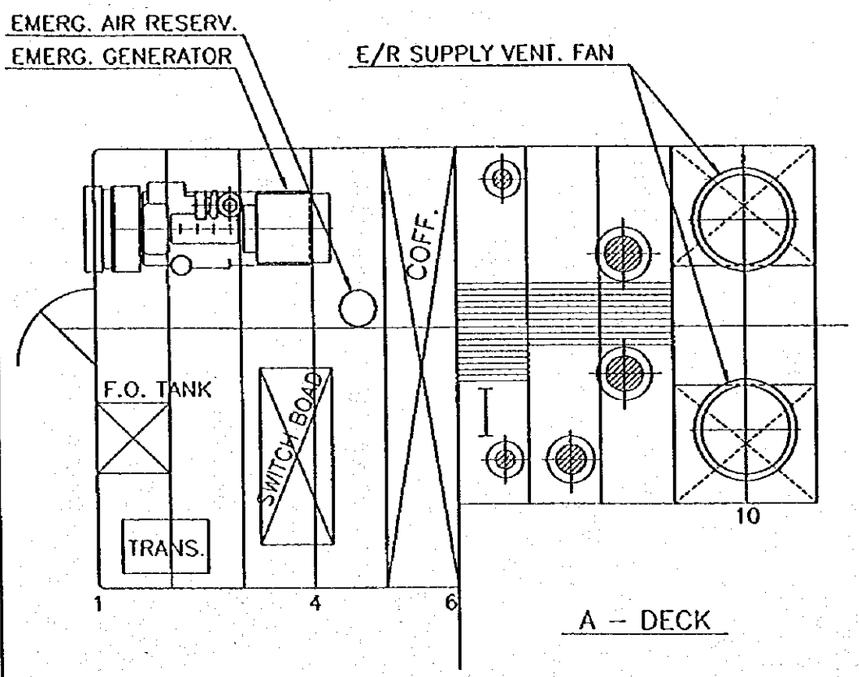
2ND DECK PLAN

ELEVATION (SCALE:1/50)

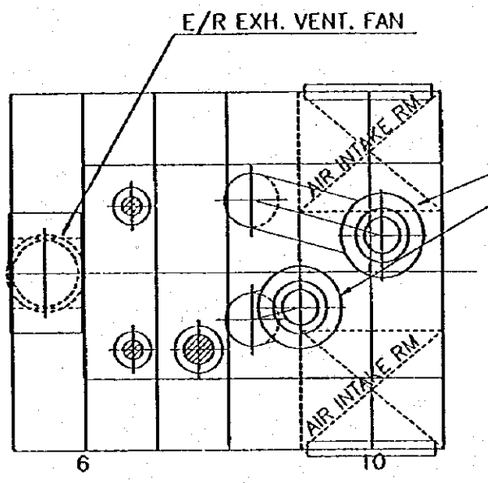


ELEVATION

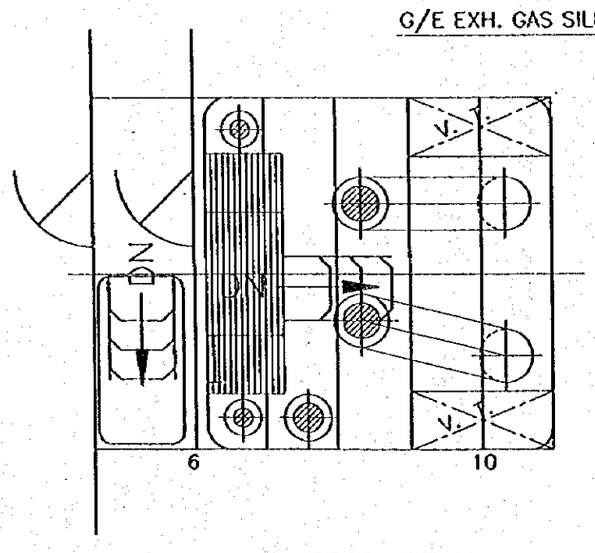
ENGINE CASING (SCALE:1/50)



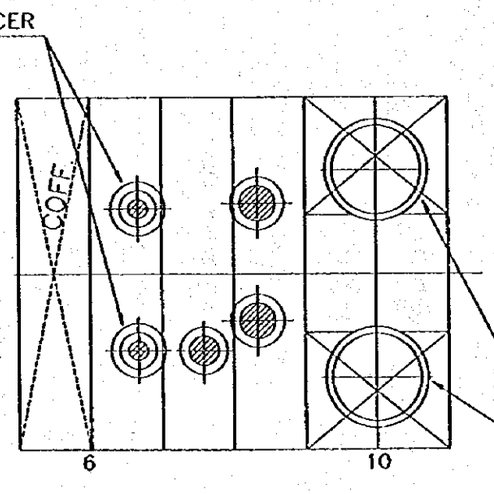
A – DECK



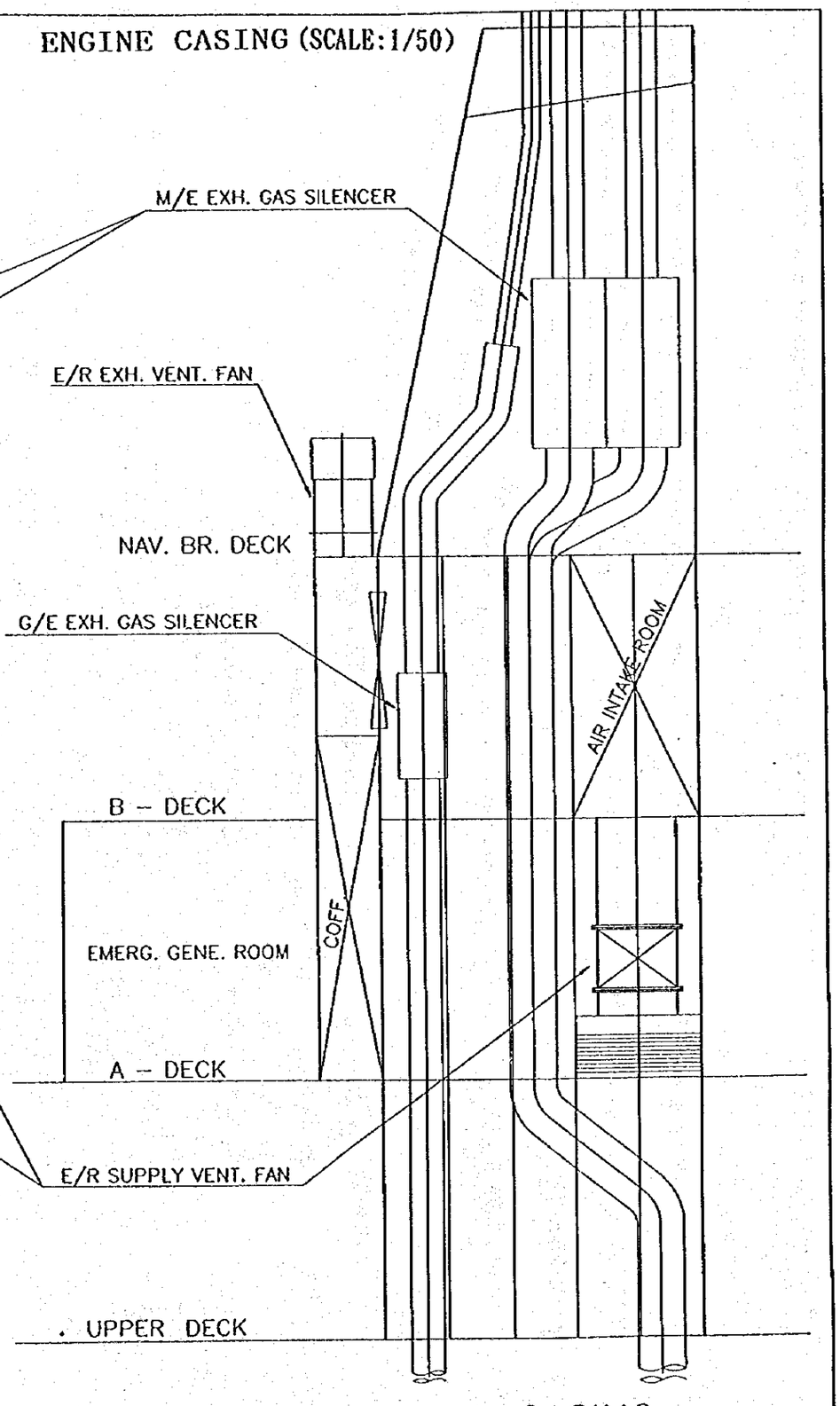
NAV. BR. DECK



UPPER DECK



B – DECK



CASING