Development of the Port of Nuku'alofa into an international fishery terminal;
Improvement of the wharves of Pangai, Hu'afeva and Nomuka
(Possible source of funds: Australian Government);
Restoration work of the Port of Nufanua;
Installation of a derrick in Niuas;

3) Program-3
Feasibility study of building a slipway with a capacity for vessels of 2,000 tons
Feasibility study of constructing Yacht marina

4) Program-4
Establishment of the Port Authority
Revision, improvement and supplement of regulations related to shipping and port regulations;
The Harbours Act, Wharves Act and Dock Regulations Act,
Marine pollution prevention legislation,
Maritime legislations, Seamen's employment regulations.
Training:
To promote the present Tonga Maritime Polytechnic Institute to a comprehensive science and technology college by increasing the number of courses.
Development of human resources at all levels is considered as a priority given technical changes in the shipping and port industry.

2.6.2 Current Situation and Improvement Plan of the Port of Nuku'alofa

(1) Current situation
The trading ports in the Kingdom of Tonga are the following two: Nuku'alofa on Tongatapu Island, its main island, and Neiafu on Vava'u Island. At the port of Neiafu, however, vessels coming alongside berths are restricted in size up to approximately 115 m length owing to the limited width of the entrance to the port, the length of the wharf and the water depth. For this reason, approximately 80 to 85% of foreign-going vessels visiting the Kingdom of Tonga use the Queen Salote Wharf in the Port of Nuku'alofa.

The Port of Nuku'alofa has two berths for foreign-going vessels, Nos.1 and 2. The number of vessels which used this wharf is as follows according to a record of the Ports Administration Department.

Table 2-6-3 Vessels berthed at Queen Salote Wharf

Year	1989	1990	1991
No. of ships in port	166	176	190
Ships at berth No.1/2	127	148	162

Source: Tonga Ports Administration Dept.

On the other hand, when turning attention to the development of the number of containers handled at the port, it is increasing as indicated below:

1989 - 4679 units, 1990 - 6882 units, 1991 - 9090 units showing accelerated containerization of cargo.

The port of Nuku'alofa features as follows:

It handles almost all foreign trade of the Kingdom of Tonga;

Foreign-going vessels except tankers, gas carriers, and exceptionally large-sized passenger ships use Nos.1 and 2 berths, Queen Salote wharf.

Approximately 85 to 90% of foreign-going vessels are freighters, with large-sized container ships on the increase.

(2) Development plan

(a) The repair work of Nos.1 and 2 berths of the Queen Salote wharf was completed at the end of 1985 under the assistance of Australia. Although No.1 berth is 93 m in length and No.2 110 m, No.1 berth is more suitable for the use of large-sized vessels owing to the arrangement of the wharf. By using the wharf and mooring buoys effectively, vessels of 150 to 250 m in length can be accommodated.

As the number of containerized cargo is growing in volume, there is a plan in which No.1 berth is elongated to 130 m to accommodate large-sized container ships and to make it an exclusive berth for container ships.

(b) The Vuna Wharf and the Yellow Pier lie 1 km east of the Queen Salote Wharf. Their seaward edges remain destructed as a result of attacks by a cyclone and an earthquake, and are used only for mooring small fishing boats. This wharf is planned to be improved in the 1990 to 1995 development plan.

2.6.3 Relation of the Project

The Port of Nuku'alofa is practically on only port for foreign trading in Tonga, which goods and materials necessary for the life of the people are fed from, and the most important port to the country.

For this reason, about 70% of total budget of the marine sector in the 6th Development Plan is planned for provision of facility in the Port of Nuku'alofa and construction of ship repairing facilities.

The acquisition of the tug boat is ranked in the first place and an issue of the greatest importance and priority for the marine sector of the development plan.

2.7 PROCESS AND CONTENTS OF THE REQUEST

2.7.1 Process of the Request

The Kingdom of Tonga is located almost in the middle of the South Pacific Ocean (15°-00 to 23°-30' S, 175°-00 to 177°-00' W) close to the Date Line, 700 km southeast of Fiji and 800 km south of Western Samoa. It is an archipelagic country consisting of approximately 170 coral atolls (middle and southern parts) and volcanic islands with a population of about 96,000.

For the nation, the shipping industry makes up an important sector owing to its geographic factors of being isolated from trading partners and an archipelagic country, depending on the marine transportation for most of its food stuffs and materials necessary for the manufacturing and construction industries.

In addition, tax revenues from the import tax on the foreign trade, port service charges, wharfages, etc. account for a large portion of the government revenues, making the shipping transportation an important sector for the government treasury and economy.

For this reason, the construction and maintenance of port service facilities to secure the safety and efficient operation of vessel traffic in international trading ports is one of the issues which must be urgently tackled by the Government of Tonga. At present, almost all vessels engaged in international trade with Tonga call the port in the City of Nuku'alofa, its capital, and the number of such vessels reaches 190 a year. The Port of Nuku'alofa has two berths for foreign-going vessels, accommodating vessels alongside of 250 m and 150 m in length respectively.

Generally, vessels of 2,000 gross tons or more are berthed or unberthed under the assistance of tug boats in Japan, in addition in South Pacific countries, vessels of 1,000 gross tons or more are charged for assistance of tug boat. It is usually the case that international trading ports which receive large-sized freighters are equipped with tug boats as one of port service facilities. However, the Kingdom of Tonga owns no tug boat now. Partly thanks to the favorable sea condition with moderate sea waves, as it is

surrounded by coral reefs, vessels have been berthed without any tug boat assistance at the Port of Nuku'alofa.

In order to respond to the increase in the number and size of foreign-going vessels, berthing under vessel's own power without any tug boat assistance poses problems in terms of safety in the port and the efficiency of berthing operations. The port is deficient of facilities to cope with fires in the port, marine pollution and other marine accidents, and should the port fall in an inoperative condition because of such disasters or accidents, its impact on the people's life and economy in Tonga will be extremely serious.

Against such background, the Government of Tonga made a request for the provision, in the form of Grant Aid, of a tug boat so equipped as to assist in securing the safety of vessel traffic and berthing in ports, and also to cope with marine disasters.

2.7.2 Contents of the Request

The outline of the contents of the requested tug boat is as follows:

(1) Number of tug boat: 1

(2) Principal particulars

Gross tonnage: approximately 175 tons

Major dimensions

Length: approximately 26 m
Width : " 7.7 m
Depth : " 3.2 m
Draft : " 2.4 m
Speed (on sea trial): approximately 12.5 knots (Max.)
Cruising distance : approximately 1,500 miles
Bollard pull : approximately 25 tons
Main engine horse power: 1,000 HP x 2 units
Crew members : 8 persons
Propellers : 2 units
Deck machinery : 1 set
Main generator set : 2 sets
Nautical and communication equipment: 1 set

(3) Facilities for marine safety:

Fire pump for fighting fire on board of other vessels;

Oil booms, and other equipment and materials for recovering split oil; and Rescue boat.

CHAPTER 3

CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3.1 PURPOSE

At the Port of Nuku'alofa, the capital of Tonga, foreign-going vessels for international trade is increasing in number and size year after year. To make up for this, this project is designed to construct a tug boat assisting these vessels in operating safely in the port and capable of responding to accidents occurring in the port.

3.2 STUDY OF THE CONTENTS OF THE REQUEST

3.2.1 Reasonableness and Necessity of the Project

(1) Status of the Port of Nuku'alofa in Tonga

Tonga depends on imports by marine transport for all commodities except for a portion of food stuffs and the amount of imports reach as much as 5 to 6 times that of exports. Of imports, food stuffs, drinks and other commodities for daily life account for 36%. The ratio of the tax income from foreign trade in the government revenues is high, making the marine industry one of the most important sectors from the viewpoints of the life of the people, and the government treasury and economy.

Most of the foreign trade is carried out through the Queen Salote Wharf in the Port of Nuku'alofa in the capital city, with approximately 190 vessels calling the port a year. The Queen Salote Wharf has two berths, namely Nos.1 and 2. However, owing to its configuration, when a large-sized foreign-going vessel is moored to No.1 berth, No.2 berth can accommodate a small-sized vessel only. It can be said that the port is virtually accepting large-sized foreign-going vessels only by one berth.

(2) Problems in the present situation

The fairway in the port is restricted owing to the presence of reefs about 850 m northwest of the wharf as indicated in Fig. 3-2-1.

Vessels entering or leaving the port must reduce speed down to 4 to 5 knots, extremely deteriorating the ship's maneuverability.

When attention is turned to the historical movement of vessel arrivals and departures, the ratio of container ships is increasing. Container ships, with a high lateral wind pressure, depending on the ship's loading condition, require more precautions in berthing operations when the wind is strong owing to the prevailing wind direction at the Queen Salote Wharf.

Under such circumstances, presently vessels berth to and unberth from the Queen Salote Wharf without the assistance of tug boat. The study team surveyed potential problems in terms of safety in such a case.

As is illustrated in "Figs. 2-3-6 and 2-3-7 of Chapter 2.3 Outline of port and wharf, a vessel entering the port drops her anchor and comes alongside the wharf, properly using the engines and rudder by putting the hull ahead or astern.

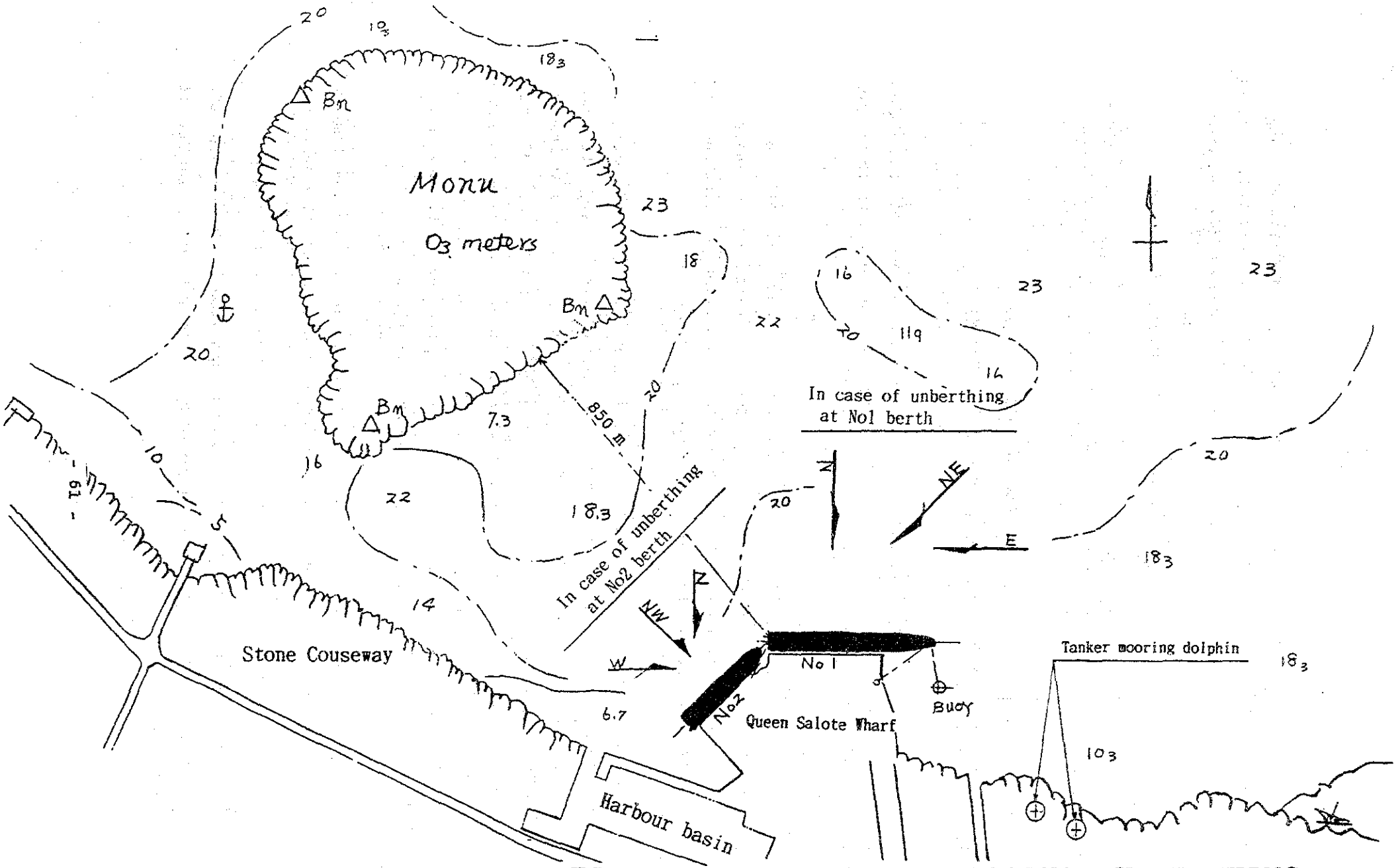


FIG 3-2-1 WIND/SWELL AGAINST UNBERTHING

(Winds in opposit direction is against berthing)

The frequencies of constantly blowing trade winds which affect berthing and unberthing operations are as shown in Table 3-2-2 when the arrangement of Nos.1 and 2 berths of the Queen Salote Wharf is taken into consideration.

Table 3-2-2 Winds at the Port of Nuku'alofa

Period	Wind direction	Frequency (%)
Jan. to Mar.	East or SE winds of 10 m/sec or more	52
Apr. to June	Ditto	46
Jul. to Sept.	North or NE winds of 10 m/sec or more	23
Apr. to Sept.	North or NW winds of 10 m/sec or more	10

When a vessel maneuvers by herself without the assistance of tug boats under the wind condition as shown in Table 3-2-2, the following items can be expected as problems on safety.

1) When berthing to No.1 berth, should winds blow out of south or southeast, the vessel take a sheer, making it difficult to fasten a buoy rope to the mooring buoy, resulting in more time for berthing and resultant danger of the hull drifting toward the west.

2) When unberthing from No.1 berth, should winds blow out of north or northeast, the unberthing operation becomes difficult owing to wind pressures and swells from seaward. For this reason, the vessel has to wait until the wind calms down. Even by an effective use of main engines and rudder, the vessel may fall in a danger of being sheered while scraping the wharf by the hull as it is difficult to put the vessel head windward toward the fairway because of wind pressures. This may result in damage to both the hull and the wharf.

Presently, delays in berthing owing to winds occur two or three times a month, and delays in unberthing by 8 hours or more about once every two months.

Such a delay incurs losses to shipowners, and also gives rise to the necessity of changing the schedule in operation and administration of the wharf.

3) When berthing to No.2 berth, should winds blow out of the southeast or the south, there is a possibility of the vessel being sheered toward the southwest. And when unberthing, should winds blow out of northwest or west, vessels may not leave the wharf and take a sheer toward the land.

As mentioned above, problems associated with maneuvering upon berthing and unberthing are expected with their resultant accidents and damage to vessels and the wharf.

The following are problems in connection with the maneuvers of a vessel without tug boat assistance from the aspects of port control on the side of Tonga and ship allocation plans on the owner's side:

1) There is a high possibility of a vessel giving a great impact to the wharf resulting in the broken wharf as it is difficult to control the inertial motion of the vessel and to change her heading in a controlled manner. It may also bring about damage to the vessel herself, damaging propellers and rudders in unberthing operations.

   For this reason, shipowners may tend to dislike vessel allocation to ports which tug boats are not provided.

2) Should an emergency situation occur because of squally winds during cargo handling operations while in berth, no action can be taken to respond to such a situation.

3) The Port of Nuku'alofa, as is surrounded by reefs, has no marginal space in the east and west directions. Owing to the presence of a large reef on the west side, in particular, there is a risk of a vessel going aground.

(3) Marine accidents

A survey was made into marine accidents in the past 5 years. Two vessels which grounded and sank owing to accidents are still seen in the port.

Fire:	July 1988	Ekiaki	Engine room fire
	February 1989	Hina Malia	Foundering owing to hold explosion (2 deaths)
Collision:	1988	Urte	Collision with No. 1 berth
	February 1988	Sea Princess	Starboard side collided with berth
	June 1990	Pacific Island	Collision with No. 1 berth

Main engine failure: 2 cases
Grounding and foundering of yachts: 3 cases

Situation of search and rescue operations at high seas in the vicinity of Nuku'alofa in the past 5 years. (Data of the Ministry of Marine)

1987 : 10 cases including search and rescue operations of missing fishing boats, search for yachts, etc. (cost: T$17,000)
1988 : Assistance of the Olovaha on fire and 9 other cases (cost: T$16,000)
1989 : 2 cases including search for yachts (cost: T$4,000)
1990 : 9 cases including search and rescue operations of fishing boat Hakautapu (cost: T$8,200)
1991 : 9 cases including search operations of fishing boats and domestic trade vessels (cost: T$10,500)
1992 : 8 cases including search operations for the Takuo (cost: T$162,000)

(4) Study of the reasonableness and necessity

While there are problems of safety, as described in (1) and (2) above, when vessels berth or unberth in the Port of Nuku'alofa without tug boat assistance, such operations have been carried out without serious accidents up until now thanks to the skill of experienced pilots.

Should the function of the port be damaged owing to vessel collision, damage to the wharf, fire in the port or marine pollution, it may give a tremendous impact on the life of the people and economy of the nation.

The reason that the government of Tonga, which has controlled vessel entry

and departure without tug boat assistance, made a request for the donation of a tug boat, is the change in the situation of the Port of Nuku'alofa and that of vessels calling the port.

The improvement of facilities necessary to secure safety of vessel traffic in the port by coping with the increase in the size and number of vessels owing to the expansion in trade volume, is an issue of the greatest importance and priority for the government.

In the Sixth Development Plan of the nation (1991 to 1995), providing a tug boat ranks first in the marine sector.

The above circumstances would naturally suggest necessity for a tug boat in the Tonga at present and the reasonableness of implementing this project in the form of Grant Aid cooperation.

3.2.2 Study of Specifications of Tug Boat

(1) Study of vessels to be assisted by the tug boat

Table 3-2-3 shows the actual record of calls by foreign-going vessels from 1989 to 1992.

No.2 berth mainly accommodates vessels less than 9,000 gross tons and vessels larger than those are berthed at No.1. Therefore, the power required of the tug boat is discussed on the basis of No.1 berth.

Among foreign-going vessels which called at the port, those of 15,000 gross tons or more are almost all passenger ships cruising the South Pacific Ocean and calling at the port on a temporary basis, and calls by freighters are also on tramper business.

The largest foreign-going vessel which calls at the port on a regular basis is 13,000 gross tons as Table 3-2-3 shows, and even when the increase in vessel size in the future is taken into consideration, it is appropriate to judge that the vessel size the tug boat in question is to assist normally is 15,000 gross tons or less.

(2) Calculation of bollard pull

The study team has discussed the bollard pull necessary for berthing under the conditions as described below. The discussion was carried out in accordance with the 'The Guide Line of Tug Boat Basic Design' by the Japan Workvessel Association.

Table 3-2-3 Vessels calling at Nuku'alofa (1989 to 1992)

Gross tonnage (tons)	Type of ship				Berth name			Total
	Passenger	Freighter	Tanker	Others	No.1	No.2	Others	
0 - 499	0	56	14	26	42	37	17	96
500 - 599	0	0	75	6	4	13	64	81
1,000 - 1,999	0	25	30	5	14	17	29	60
2,000 - 2,999	1	49	6	4	13	40	7	60
3,000 - 3,999	1	113	1	3	13	105	0	118
4,000 - 4,999	0	15	0	1	11	5	0	16
5,000 - 5,999	1	10	0	0	7	3	1	11
6,000 - 6,999	0	37	0	1	18	20	0	38
7,000 - 7,999	0	17	0	1	11	7	0	18
8,000 - 8,999	0	59	6	3	56	10	2	68
9,000 - 9,999	1	8	0	0	8	1	0	9
10,000 -10,999	0	1	0	0	1	0	0	1
11,000 -11,999	0	7	0	0	7	0	0	7
12,000 -12,999	0	13	0	0	8	1	4	13
13,000 -13,999	0	2	0	0	2	0	0	2
14,000 -14,999	0	0	0	0	0	0	0	0
15,000 -15,999	4	0	0	0	4	0	0	4
16,000 -16,999	5	0	0	0	5	0	0	5
17,000 -17,999	0	4	0	0	4	0	0	4
18,000 -18,999	0	0	0	0	0	0	0	0
19,000 -19,999	0	0	0	0	0	0	0	0
20,000 -29,999	9	0	0	0	9	0	0	0
30,000 -	5	0	0	0	4	0	1	5
Unknown	2	15	0	13	17	12	1	30
Total	29	431	132	63	258	271	126	655

Note: 1. Among the types of ship, 'freighter' includes general cargo ships and container ships; 'oil tanker' includes oil tankers and gas carriers; and others include survey ships, naval ships, fishing boats, etc.

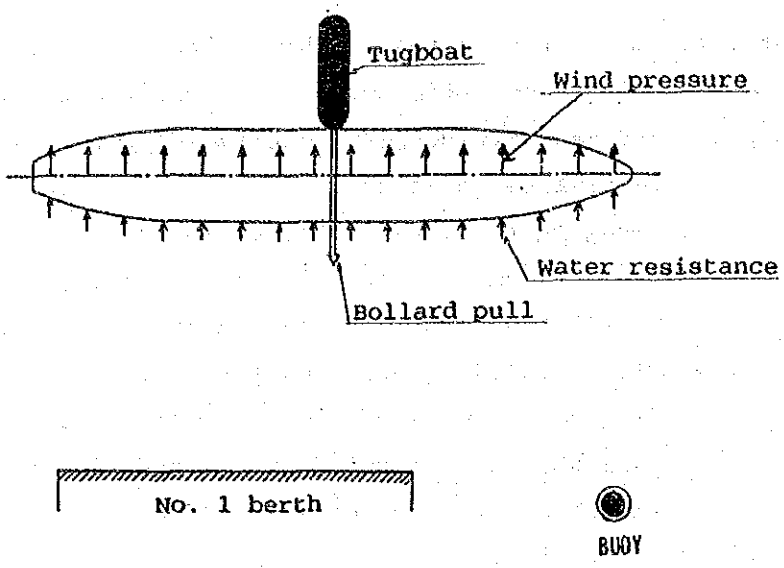
2. Among berth names, 'others' include No.3 berth, No.4 berth (for domestic ships), dolphin for tankers and anchorage off port.

3. While the largest vessel which visited the port is the Queen Elizabeth II (gross tonnage: 69,052 tons; passenger ship), she did not come alongside the wharf but stayed off port. The largest vessel which came alongside the wharf is the Royal Viking Sun (gross tonnage: 37,845 tons; passenger ship).

Calculation conditions:

(a) Subject vessel

Gross tons	: approximately 15,000 gross tons
Length overall	: 160.00 m
Length between perpendiculars	: 150 m
Breadth	: 25.00 m
Depth	: 14.0 m
Draft (load)	: 8.50 m
Broadside windage area	: approximately 1,800 m^2
Underwater side area	: approximately 1,275 m^2
Draft (lightweight)	: 3.5 m
Broadside windage area	: approximately 2,600 m^2
Underwater side area	: approximately 525 m^2



Bollard pull > Wind pressure + Water resistance

Fig. 3-2-2 Calculation conditions

(b) Condition of the vessel to be assisted

A vessel of the above particulars is brought in parallel at a proper distance off the wharf and pushed by a tug boat at a right angle toward the wharf. The speed of the lateral motion of the vessel is set at 0.15 m/sec (approximately 0.3 knots) and the alongside depth at 12.5 m.

(c) Wind

Winds normally blow at a right angle to the subject vessel at a speed of 4 to 10 m/sec, i.e., the bollard pull required to cope with south winds of 4 to 10 m/sec is obtained. (Refer: 4.2.1 (1) Winds)

(d) Calculation method

The wind pressure applied on the subject vessel and water resistance accompanied by the movement of the vessel (including shallow water effects) are calculated on the basis of the above conditions; the required bollard pull of the tug boat is computed by considering a necessary margin in addition to the above values.

(e) Calculation result

The calculation results of the bollard pull required of the tug boat to

cope with each wind velocity are shown in Table 3-2-4.

Table 3-2-4 Required Bollard pull for each wind velocity

Wind velocity (m/sec)	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Full load condition (t)	12.2	14.1	16.3	18.9	22.0	25.4	29.3
Lightweight condition (t)	5.4	8.1	11.3	15.1	19.5	24.5	30.0

(3) Study of specifications of the tug boat

The tug boat is required to be capable of assisting vessels in berthing and unberthing safely under south winds of 10 m/sec as described in 3.2.2 (1) and (2). Therefore, from the above calculation results, the required bollard pull is approximately 30.0 tons greater than 25.0 tons as requested.

As a consequence of this alteration, it became evident that the horse power of the main engines must be increased from originally requested 1,000 PS x 2 to 1,200 PS x 2. The increase in the horse power of the main engine in turn requires slight alternations in a space of engine room and main dimensions of the tug boat (length, width, depth, etc.).

3.2.3 Execution and Management Plans

(1) Operational plan

(a) Legislation to use tug boat

When the project is put into practice, the tug boat will be operated by the Ports Administration Department as described in "2.3.3 Managing organization".

At present it is strongly recommended by the Ports Administration Department for vessel of 1,000 gross tons or more to take a pilot as payments of fee are compulsively under the Harbours Act. According to the Ports Administration Department, it is planned that the Harbour Act is to be amended to require vessels of 1,000 gross tons to hire a tug boat once a tug boat is provided at the port.

By this requirement, the needs of operation of the tug boat is guaranteed.

(b) Crew members to operate the tug boat

The operation of tug boat is mainly by a master and the maneuverability of tug boat depends entirely upon his skill of operation. The Ports Administration Department has assigned two pilots to give shiphandling instructions for entering and leaving vessels.

Once the tug boat is provided in the port, the Ports Administration Department has a plan to increase more one pilot and manage harbour service duties by three pilots each serving both as pilot and master of the tug boat.

According to the field survey, as is described in "2.4.1 Technical level of seafarers", the capability and career of each present pilot proves their worthiness as the masters of the tug boat and they only need, it can be judged, to familiarize themselves with its maneuvers.

By having the pilot function as the master of the tug boat, as is planned by the Ports Administration Department, the coordination between an entering or leaving vessel and the tug boat is enhanced, without forcing unreasonable and difficult maneuvers each other, which is desirable from the viewpoint of safety. Making them perform two functions is also cost efficient.

As the berths for foreign-going vessels prohibit simultaneous berthing and/or unberthing owing to their positional arrangement, three persons as pilots and tug boat masters will allow easy management in terms of time, enabling them to provide other crew members of the tug boat with training and instructions.

The additional pilot will be recruited by advertisement. The recruiting of a master seems to be possible because of that there is a sufficient time allowance more than one year to recruit till the tug boat is provided. Should be pilot's position not be filled by such time, the present two pilots may satisfy the least requirement for operation of the tug boat.

As for the chief engineer, there is no specific plan drawn up yet. It is

under discussion to recruit a Tongan seafarer from the Shipping Corporation of Polynesia (SCP, shipping company whose share is 60% held by the Government of Tonga) or advertising.

Five Tongans Work for SCP as chief engineer or engineers on board for the purpose of training and cultivation. In connection with the chief engineer, as he is not as important as the master, the experience as engineer on board vessels owned by SCP will be sufficient.

Crews assisting the master and chief engineer respectively, and deck ratings will be recruited in an ordinary manner and advertising.

As to the operating staff of the tug boat, as mentioned here, it can be judged that the present technical level of Tongan seafarers and the recruitment plan by the authority in charge have no problems for a smooth operation of the tug boat.

(2) Maintenance and administration

When the project is implemented, it is required to properly maintain the tug boat, which is stationed in the Port of Nuku'alofa, in order to operate it effectively.

Main items concerning maintenance and administration are to be discussed.

(a) Standard of maintenance

The tug boat is to be constructed as a coasting service vessel classed with Nippon Kaiji Kyokai (NK). Thus, the maintenance standard required for the operation of this class of vessel should be applied.

The class surveys designated by the Classification Society are intermediate and periodical surveys made every 24 months after construction and the vessel is to undergo designated inspections in the drydock or on the slipway.

The vessel is to be drydocked for the purpose of maintenance once every year, when the bottom is to be cleaned, zinc anodes renewed, sea valves inspected and maintained, the hull beneath the waterline painted, the

propellers inspected and the main engines maintained.

(b) Drydocking and repairs

Tonga has no facility to drydock the tug boat, and slipways in neighboring countries are to be used. Such neighboring countries which own slipways are, as described in "2.5.1 Repair facilities", Fiji, New Zealand and American Samoa.

Although the facility in American Samoa is near in distance, it seems to have problems in terms of schedule control and the Ports Administration Department is not considering it as a place for drydocking the tug boat.

Fiji has large facilities and is nearby and is considered as a place for drydocking.

New Zealand is farther in cruising distance as compared with Fiji, but is more attractive than Fiji in easier availability of parts necessary for repairs.

Either Fiji or New Zealand will be selected for the availability of a relevant drydock and the contents of work planned to be done.

The reservation of a drydock for regular inspections in Fiji or New Zealand may be required 10 to 12 months in advance. Even if a slipway is reserved, the schedule is subject to change owing to the convenience of the dockyard owing the slipway. Good administrative activities concerning maintenance and repairs must be conducted by monthly confirmation of the reservation with the pertinent dockyard after having made reservations.

In this manner, inspections and repairs by drydocking are made on a slipway by dispatching the tug boat to a neighboring country.

Routine maintenance and minor repairs are planned to be made by its crew members or by using facilities in the city of Nuku'alofa.

(c) Repairs of machinery

The Shipping Corporation of Polynesia operates a general cargo ship of 3,800 gross tons, a ferry boat of 700 gross tons with a capacity of 350 passengers and other ships and their vessels are manned with Tongan crews.

When their experience on board such vessels is taken into consideration, routine maintenance of the tug boat by crew members, excluding overhauls and reassemblings of engines and auxiliaries, seems to be possible.

In connection with maintenance and repairs of motors, pumps, air compressors and heat exchangers, etc. as are described in "2.5.1. Repair facilities", repair facilities and skills of workshops, public or private, in the city of Nuku'alofa are applicable.

The study as mentioned above leads to the conclusion that there is no problem regarding the maintenance and repairs of the tug boat when the project is implemented.

(3) Budget of Administration of the Project

The Ports Administration Department will be in charge of management and operate the tug boat on its responsibility and budget.

The fiscal year of the government of Tonga is from July 1st to June 30th in next year. The Ports Administration Department has the plan to request the budget necessary for the operation and maintenance of the tug boat when this project is put into effect.

The revenues and expenditures of the Ports Administration Department are as shown in the Table 3-2-5.

Table 3-2-5 Budget of Ports Administration Dept. (Unit: T$)

Year / Budget	Revenue	Expenditure
1987/88	1,044,325	620,674
1988/89	1,229,946	665,000
1989/90	887,937	704,000
1990/91	1,532,598	786,563

Major items of revenues are harbour service dues, pilotage dues, fresh water supply and slipway fee.

(4) Cost of operation and maintenance

When vessels get the assistance of the tug boat, ship owners are to pay its service charges. The Ports Administration Department is planning to set up a towage tariff rate in the Port of Nuku'alofa when the Harbours Act is revised. The Tongan government policy is now the service charge of the tug boat to be revised every 2 year.

They are discussing, as a standard to set up a tariff rate, a method in which 'the service charge is specified by the gross tonnage by using the amount, as a basic charge, derived by dividing the estimated cost (budget) for a fiscal year by the total number of calls by foreign-going vessels in the previous year'.

The annual maintenance cost of the tug boat changes depending on the presence of major repairs in drydock and the estimated costs after the tug boat is put in service will be as shown in Table 3-2-6.

For this estimation, the following conditions were employed.

1) The tug boat is drydocked once a year and the following jobs are carried out: bottom cleaning, renewal of zinc anodes for the bottom, overhauls and inspections of sea valves, cleaning and painting of hull below the waterline, adjustment of machineries and pipings in engine room and other minor repairs.

Table 3-2-6 Estimate of Tug Boat Operational Cost (Unit: T$)

Item	Base of estimation	1st year	2nd year	3rd year	4th year
Specified items by rule	NK rule (coasting area service ship)	-	Inter-mediate survey	-	Periodical special survey
1) Fixed cost Depreciation expenses Municipal property tax Hull insurance premium Interest	Not included because of grant aid	-	-	-	-
2) Disbursement Crew expenses	5 crew members Estimated increasing of an annual rate of 2%	24,650	25,150	25,650	26,150
Repair charges	Drydocking once every year including fuel for cruising to Fiji for drydocking	12,000	22,500	15,100	41,500
Ship's stores	Mainly towing hawsers and wire ropes	2,000	9,100	10,500	12,000
Lubricating oil charges	(HP x 0.16 x 800 hr x 6.5%)	5,500	5,500	5,620	5,620
Miscellaneous charges	Approx. 1% of the ship's value as a standard	4,000	4,000	4,080	4,080
Sub total		48,150	66,250	60,950	89,360
3) Operation charges Fuel oil charges	Marine diesel oil, annual operating hours: 800 hr, unit price 90/m³	200kl 18,000	210kl 18,900	230kl 20,700	245kl 22,050
Others	Repair of transceivers, Water supply, etc.	150	200	220	250
Sub total		18,150	19,100	20,920	22,300
4) Grand total		66,300	85,350	81,870	111,660

2) Drydocking for classification surveys is to be for intermediate and special inspections at intervals of 24 months.

3) Docking repairs are to be made on a slipway in Fiji.
The fuel cost for cruising to drydock is included.
The fuel price is in accordance with data offered by Tonga.

4) Yearly operating hours of the tug boat
190 vessels x 2 hours x 2 times (entry and departure) x 1.1 (10% margin) = 830 hours

The calculation is made on the basis of 800 hours. The number of vessels is estimated on the basis of actual records of vessel arrivals and departures at the Port of Nuku'alofa.

5) Depreciation expenses, taxes, and insurance premiums are not included (by the intention of the Ports Administration Department).

6) The crew charges are for labor charges of 5 crew members including a Tongan master (captain), and were obtained from Tonga's data on labor charges. The increase in labor charges was estimated at an annual rate of 2.0%.

7) Among the ship's stores, tow lines, wire ropes, parts for the machineries and packings, etc. are to be procured directly from Japan.

A tariff rate schedule as trial calculation carried by the study team is shown in Table 3-2-7.

Table 3-2-7 Trial calculation of towage tariff rates for the Port of Nuku'alofa

Gross tonnage	Tariff Rate (Unit: T$)
Under 1,000	168
1,001 - 2,000	200
2,001 - 4,000	250
4,001 - 6,000	300
6,001 - 8,000	350
8,001 -10,000	400
10,001 -15,000	450
15,001 -20,000	500
Above 20,001	550

Notes: The tug service fee is charged separately for arriving and leaving of vessel.

According to the actual record of vessels which entered the Port of Nuku'alofa, those up to 10,000 gross tons account for more than 90% and the group for tariff rates for vessels of 10,000 gross tons or more are divided at greater intervals.

When the tariff rate schedule was examined by applying the actual record of vessel arrivals in 1991, it proved to substantiate the estimate of the operational cost for the initial year as shown in Table 3-2-6. This fact supports the reasonableness to adopt the tariff rates in Table 3-2-7 as a basis in order to compensate for the operational cost of the tug boat.

The operation and maintenance costs a year are equivalent to the total income for pilotage (T$ 70,757 in 1990) in the port of Nuku'alofa.
As compared with the tariff rate of Table 3-2-1, tug boat service charges in the port of Suva in Fiji, which is an important trading partner and an adjacent country to Tonga, are as follows;

Table 3-2-8 Comparison of tariff rate of tug boat (T$)

Gross ton	Nuku'alofa	Suva	Nuku'alofa/Suva
3,000	250	296	85 %
6,000	300	592	49 %
10,000	400	592	66 %
15,000	500	941	52 %

1 Fiji $ = 0.97 Tonga $

As a reference, this tariff rate schedule corresponds to about 1/3 to 1/4 of that for the port of Tokyo and various ports in the Seto Island Sea in Japan.

When tug service charge in Tonga is scheduled on the base of the estimation of Table 3-2-7, it will be relatively cheaper rate. Due to provision of tug boat in the Port of Nuku'alofa, defrayment by the owners of vessels berthing in the port are to be increased. However, there is much merit in the securing safety of vessel traffic in port.

3.2.4 Necessity for Technological Cooperation

As for the routine maintenance and inspections of the tug boat in question, engineers employed on board put in service in Tonga are considered to be capable of handling on their own technical level. However, when the more efficient operation of the tug boat is considered, it is desirable to repair failures of and overhaul the main engines in Tonga.

At present, the diesel engines of large capacity which are run in Tonga are used for a power plant in the Tongatapu Island of 6 cylinders, 1,700 HP and of 5 cylinders, 2,400 HP and engineers are invited from Australia for their regular overhauling inspections by paying expensive charges.

If education, as part of technical assistance, for the maintenance of the main engines of the tug boat is provided, it may enable Tongan technicians to acquire skills to inspect and maintain the power plant on the basis of that know-how,which means that the technical education not only affects the tug boat but also raises the technical level for care and maintenance of equipment of Tonga as a whole.

The study team interviewed with the chief engineer and the super-intendent of mechanics in the Ministry of Works, which is in charge of overall repairs and other matters of mostly vehicle engines owned by Tongan Govrenment. They said that it might be possible that Tongan mechanics on high technical level were able to be educated to acquire skills to care and maintain the main engines of the tug boat by the training for about 6 months in Japan.

3.2.5 Basic Policy to Execute Cooperation

The study made so far clarified that the donation of a tug boat to the Port of Nuku'alofa might contribute to the stable supply of daily commodities for the people of Tonga, an archipelagic country, supporting in its turn the maintenance of the national treasury and the development of its economy. It has also proved that the nation has a basis necessary to operate and maintain the tug boat.

The construction and donation of a tug boat to the Government of Tonga serves the purpose of Japan's cooperation in the form of Grant Aid and it is reasonably justified to implement the project. Therefore, the study team has decided to study the outline of the project and develop the basic design on condition that it is awarded as one of Japan's Grant Aid Programs.

Incidentally, this cooperation would satisfy the need of Tonga as it is listed as one of the items to be tackled with top priority in the marine sector of the Sixth Five-year Development Plan of the Kingdom of Tonga.

3.3 Project Description

3.3.1 Execution Agency and Operational Structures

The Ministry of Marine and the Ports Administration Department have jurisdictions over the shipping transportation and port/harbour administration in Tonga. The Ports Administration Department administers functions concerning ship operation in port and shipping service at wharf.

When this project is put into effect, the tug boat is placed under the jurisdiction of the Ports Administration Department. The tug boat service section (provisional name) will be established under the Harbour service section of Ports Administration Department and operate it. While the department owns a pilot boat and the service section of the pilot boat is carrying out its operation and management, detailed operational procedures will be decided later including coordination between this section and new section in charge of the tug boat.

3.3.2 Operating Plan

The tug boat is mainly used for assistance to berthing and unberthing operation of foreign-going ships in the harbour of Nuku'alofa. It does not serve in the international ocean outside Nuku'alofa, except for safety at sea such as prevention, fire-fighting at sea and rescue, and for escort of a large passenger ship when she calls Tonga.

Tonga has not any tug boat now and will be requested to employ crew members for tug boat when it is provided.

Required staff members are as follows:

Master (Captain)	1 person
Chief engineer	1
Officer	1
General purpose staff	2 (Mechanic and Deck mate)

5 persons in total will engage the operation of tug boat.

A master who is the most important member for maneuvering of tug boat is

planned to be served concurrently with pilot and more one pilot will be employed in addition to existing two pilots. As for a chief engineer and other staff are planned to be recruited Tongan seafares from Shipping Corporation Polynesia shared by the Tonga government and in an ordinary recruiting manner.

It is judged there is no major problem for recruiting staff necessary to operate the tug boat.

3.3.3 Maintenance and Management

The Ports Administration Department has to give full considerations to the maintenance and administration of the tug boat in order to operate it effectively. The tug boat will be placed at the pier near the entrance to the department office which a pilot boat is moored. It seems to be suitable place for mooring tug boat because a work shop for repair is located.

The machinery service works of the Ministry of Works and other public and private work shops have sufficient capability to repair in case of minor. In case of major repair and drydocking, the capability of slipways in Fiji and New Zealand are available. Concerning routine maintenance, crew members on board are capable of such operations painting of shell plate, supplying consumable stores, replacing packings and repairing of pipings, etc.

Therefore, no problem is seen with regard to maintenance and management of tug boat.

The government authorities concerned should bear the following points in mind for effective operation of the tug boat.

1) To ensure the compliance with regular inspections in accordance with rules of the Classification Society
2) It should have avoid a situation in which the tug boat is put out of service because of a shortage of spare parts by properly securing, supplying, and maintaining them.
   The section concerned has to ascertain the required period to obtain each part which is not prepared in Tonga, and establish the quantity to keep on hand and the method, including the channel to obtain them.

3) The oil boom and other equipments for safety at sea which are stored on land should be kept carefully for the purpose to use them at the sea as required in emergency.
Periodical drills for deployment of oil booms should be executed.

4) It should secure a fund to cover the estimated annual cost of operation, maintenance and administration.

3.3.4 Expense for Operation and Maintenance

Expenses for operation and maintenance of the tug boat, such as crew cost, fuel cost, running cost and repair cost, etc. are covered by the budget of the Port Administration Department. The Ports Administration Department is planned that the Harbours Act is amended to require vessels of 1,000 GRT or more to be assisted by a tug boat in the operation of their berthing and unberthing at Queen Salote Wharf, and to allocate the costs for these operation and maintenance to ship owners as service charge of tug boat.

3.3.5 Necessity for Technical Cooperation

Regarding technical cooperation for operation and maintenance under this project, study team's judgement is such that the executing organization can fully cope with this matter, but it will nonetheless be desirable to provide training in Japan over short periods of time to acquaint personnel with the main engine, shafting and nautical instruments, etc.

CHAPTER 4
BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4.1 BASIC DESIGN POLICY

The study team made it a policy to design a tug boat by paying due respect to the contents of the request and by considering the working environment, surveyed on site, of the tug boat including the actual situation of vessels' calls at Nuku'alofa, weather and sea conditions, and port configuration and facilities.

In addition, the study team paid special attention to the following points, considering the characteristics of the Kingdom of Tonga.

1) The function of the tug boat in question is to assist vessels calling at the port in berthing and unberthing in a safe manner.

   Such functions will be added as to enable the tug boat to be dispatched by the request of respective authorities in charge upon the occurrence of disasters including fire, oil spills and ships in distress in the port and adjacent water areas and to be employed in firefighting, removal of marine pollution, search and rescue operations of ships in distress. These auxiliary functions, however, are to be given to the extent that such functions may not interfere with its original function as a tug boat.

2) Durable and trouble-free equipment and instruments are to be adopted to ensure that the tug boat may not become inoperative owing to failures or a shortage of necessary parts. It is intended to eliminate, as far as practicable, the so-called high-technology equipment and instruments considered difficult to repair or to obtain parts for.

   Specific consideration is not given to saving of labor for operation or decreasing of crew members.

   Spare parts and tools are to be supplied by giving sufficient allowance in accordance with the shipyard's standard.

3) Equipment and instruments easy to operate are to be provided by considering the level of crew members.

4) Propulsion system of the tug boat is Kort Nozzle rudder and fixed pitch propeller system which is of simple construciton. A 360° steerable propeller system or controllable pitch propeller sytem has not been applied for their complicated construction under considerations for abilities of maintenance and repair in Tonga and adjacent countries.

5) Consideration is to be given to safety.
That is to say that a complete set of nautical instruments necessary for safe navigation including sounding equipment, by giving consideration to the geographic conditions, and weather and sea conditions peculiar to the port, and channel depths to the place where the tug boat is constantly moored.

6) Necessary nautical instruments and communication equipment are to be completely provided so that the tug boat may fully function in activities for firefighting, removal of marine pollution sources and search and rescue operations of persons in distress.

7) The fuel oil tanks and fresh water tanks are to have a capacity large enough for intended long-haul cruises to a port with a slipway for dry-docking or from Japan to Tonga for delivery.

8) To prevent corrosion, due consideration is to be given to painting, zinc anodes, selection of materials and the thickness of pipes.

9) Regarding accommodation facilities and space required for maintenance, the physical constitution of Tonga people is to be considered.

4.2 DESIGN CONDITIONS

Concerning the conditions necessary to design the tug boat, a study of the following points are to be made.

4.2.1 Weather and Sea Conditions

(1) Winds

The Port of Nuku'alofa, where the tug boat is to be commissioned, lies in the trade wind zone in the South Hemisphere, where east through south-east winds blow throughout the year.

Table 4-2-1 shows the results of observations made at Fua'amotu Airport in Tongatapu Island from 0100 hours till 2000 hours at one hour's intervals every day from 1980 to 1983 and Fig. 4-2-1 shows a wind rose derived from the data.

While the Fua'amotu Airport is located approximately 10 km southeast of the Port of Nuku'alofa, Tongatapu Island is a flat island without mountains nor constructions which may affect winds, it can be thought that there is no considerable difference between the airport and the Port of Nuku'alofa which may give rise to problems.

From Table 4-2-1, it can be derived that the average wind speed is 10.36 knots (5.33 m/sec) and that the probability of winds exceeding 20 knots (10.29 m/sec) is 3.07%.

With respect to wind direction, winds out of east through south account for the major portion, with east-southeast winds, in particular, being most frequent. South winds, most unfavorable for berthing vessels at No.1 berth, account for approximately 6% of the whole and those exceeding 20 knots are presumed to be encountered 0.07% of the whole, i.e., 0.25 days a year.

The tug boat working in this port, therefore, is required to have capability to offer assistance to vessels in berthing under winds up to 20 knots (approximately 10 m/sec).

(2) Sea waves

There are always sea waves of 0 to 2.5 m and swells of 0 to 2.5 m in outer seas at all times caused by the above mentioned winds. To coral reef lying to the north of the port, works like tetrapods and almost eliminates entry of ocean waves to the port, where the wave height is low and there is no wave which may seriously obstruct vessel's berthing or unberthing even when considerable winds blow.

(3) Visibility

As is described above, the port is constantly blessed with winds and rarely has occasions when there is no wind, eliminating the possibility of the occurrence of fog. The port always enjoys good visibility.

(4) Ocean currents and tidal streams

The outer ocean around the Kingdom of Tonga runs westward at 3/4 to 1.5 knots constantly as it lies in the Equatorial Countercurrent.

Table 4-2-1 Winds at Fua'amotu Airport

Wind direction (°C)
Wind speed (knots)

Wind direction / wind speed	360 ~ 010	020 ~ 030	040 ~ 050	060 ~ 070	080 ~ 090	100 ~ 110	120 ~ 130	140 ~ 150	160 ~ 170	180 ~ 190	200 ~ 210	220 ~ 230	240 ~ 250	260 ~ 270	280 ~ 290	300 ~ 310	320 ~ 330	340 ~ 350	Clam	Total
Clam																			10.41	10.41
1- 5	0.29	0.31	0.54	0.59	1.10	1.03	1.34	1.39	1.21	0.91	0.57	0.37	0.30	0.23	0.09	0.13	0.17	0.16		10.74
6-10	0.61	0.63	0.78	1.55	2.85	2.90	3.88	3.80	2.79	2.01	1.43	0.93	0.66	0.45	0.26	0.20	0.21	0.32		26.24
11-15	0.45	0.62	0.61	1.93	3.17	5.15	6.86	5.63	3.41	2.27	1.44	1.02	0.66	0.47	0.24	0.21	0.14	0.33		34.59
16-20	0.28	0.36	0.24	0.74	0.94	2.88	3.59	2.34	1.52	0.83	0.36	0.21	0.14	0.16	0.10	0.06	0.07	0.10		14.94
21-25	0.06	0.05	0.04	0.08	0.31	0.65	0.58	0.50	0.26	0.07		0.01	0.01	0.03	0.02	0.00	0.01	0.02		2.72
26-30	0.00			0.02	0.07	0.11	0.01	0.03	0.00								0.01	0.00		0.26
31-35	0.00	0.02			0.00	0.01	0.01	0.00												0.05
OVER 35		0.01	0.01			0.00	0.00													0.04
TOTAL	1.69	2.01	2.22	4.92	8.44	12.74	16.28	13.69	9.20	6.07	3.79	2.54	1.78	1.34	0.71	0.60	0.62	0.95	10.41	100

Note: Figures show the frequencies of winds in percentage.

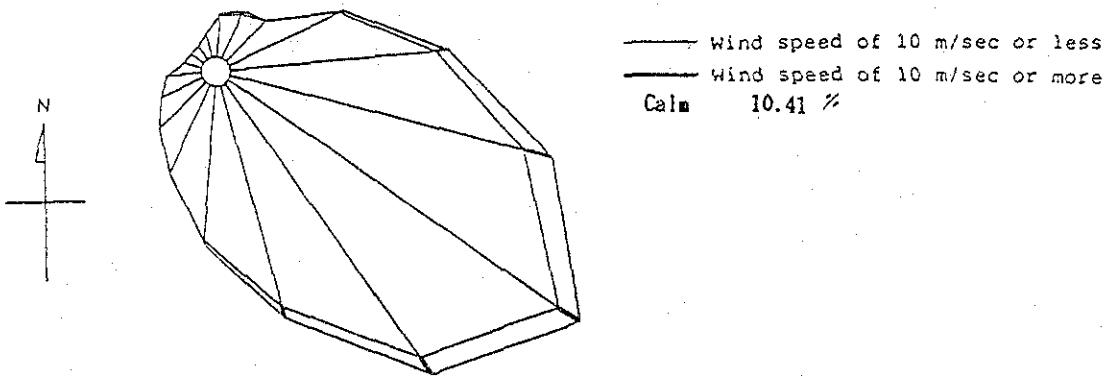


Fig. 4-2-1 Wind rose at Fua'amotu Airport

On the north side of Tongatapu Island, where the Port of Nuku'alofa is located, an anticlockwise eddy current is generated to the depth of approximately 6 m from the surface owing to hydrographic features and coral reefs.

In the vicinity of the wharf, partly owing to the effect of the wharf, currents set in a direction so that the stern of a berthing vessel at No.1 berth is distanced toward offshore. This tidal stream is running constantly at approximately 0.5 knot.

(5) Atmospheric and seawater temperatures

According to the survey carried out, the maximum air temperature was 33 degree C and max. sea water temperature 28 degree C and there is no need to give special consideration to temperature conditions when designing equipment and instruments.

4.2.2 Applicable Regulations

Necessary international regulations are to be applied. There is no special requirements under the regulations of the Kingdom of Tonga which must be taken into consideration for the basic design.

4.2.3 Marine Safety Measures

(1) Firefighting facilities

The tug boat is to be provided with fireman's outfits necessary for fire-fighting operations, in addition to firefighting facilities equivalent to those on board firefighting ships in the Category 1 as specified in the Japan Maritime Safety Agency Notice No.29, on the basis of the types and sizes of vessels which call at the port.

(2) Equipment and materials to cope with oil spills

In order to respond to accidents of oil spills from vessels occurring in the port and adjacent areas, oil booms, oil dispersants, oil absorbents, etc. are to be provided.

As their storage on board the tug boat at all times, with a large stowage

space required, may interfere with its function to assist other vessels, they are to be stored on the shore after arrival at Tonga.

When the necessity to remove spilt oil arises, the tug boat is to load these materials and deliver them to the site to carry out operations.

(3) Search and rescue operations

Communication equipment used to search for persons in distress, is to meet the GMDSS (Global Maritime Distress Safety System) specifications for the purpose of effective search and rescue operations.

The rescue boat is to satisfy the requirements of the SOLAS Convention (International Convention for the Safety of Life At Sea) and is to be provided with a stretcher and other necessary equipment for rescue operations.

4.3 BASIC DESIGN

On the basis of the study of the contents of the request and the design conditions, the basic plan is to be executed out as follows:

4.3.1 Principal Dimensions

In determining the principal dimensions of the tug boat, consideration is to be given to the following points:

1) Main engines necessary to secure the required bollard pull are fitted to secure good propulsive capacity.

2) Maneuverability as well as staunch construction which may ensure safety in all heavy weathers the tug boat may encounter during a cruise from Japan to Tonga upon its completion or from Tonga to possible ports for drydocking.

4.3.2 Design for Hull Part

(1) General arrangement

In order to obtain good visibility from the bridge when maneuvering the vessel, consideration is to be given to such measures as to make the floor of the wheelhouse higher than the bridge deck and to restrict the funnel height as low as practicable.

A store room is arranged behind the engine casing and the storage batteries are to be stuffed in a battery box, which is to be arranged in the aft part of the wheelhouse on the bridge deck.

The space in the aft part of the upper deck is to be made as wide as possible for easy accommodation of oil booms, with a hatch so arranged as to give less obstruction to their stowage.

(2) Fuel oil tank and freshwater tank capacities

The fuel oil tanks and freshwater tanks are to have a capacity sufficient to perform not only a cruise to Fiji for drydocking (approximately 420

miles from Nuku'alofa to Suva) but also a cruise from Japan to Tonga for its delivery.

The route for the delivery cruise is from Japan to Marianas Islands (Guam), Solomon Islands (Honiara) and finally to Tonga with the greatest distance between two bunkering ports being 1,800 miles. For the delivery cruise, fuel oil is to be taken in the reserve fuel oil tank (approximately 10 m^3).

(3) Crane (for hoisting and lowering rescue boat)

The crane boom is to be of a horizontal fixed type, swung by a manual worm gear system. The boat is hoisted and lowered by an electric motor winch.

The height of the crane boom is to be designed to clear the funnel. It is to be manipulated with a portable push-button control.

(4) Hatch and manhole

The dimensions of the small-sized hatch and manhole are to be as large as practicable, considering the physical structure of the Tonga people.

Small hatch	700 mm x 700 mm
Manhole	600 mm x 450 mm

(5) Engine room mechanical ventilation system

The particulars of the mechanical ventilation system of the engine room is to be studied on the following conditions:

To supply air necessary for the consumption of air by two propulsion engines and one generator engine plus air necessary to ventilate the engine room space 30 times an hour.

(6) Life saving equipment

An inflatable liferaft installed on board is to be a product of a maker for which after-sales service is available in Fiji, New Zealand or Australia. In addition, it is to be equipped with a portable fresh water generator.

It is to be provided with a self-activating smoke signal.

(7) Fire fighting arrangement

One fire hydrant is to be installed in the engine room and another on the upper deck. The hydrant in the engine room is to be provided with a combination nozzle for a straight stream and high-velocity fog. Portable fire extinguishers is to be of a dry-powder type.

(8) Coating

The paints are to be oil paints in principle and their colors are to be decided later.

(9) Accommodation facility

The width of the bunk is to be at least 700 mm.

The two stage bunks are to be provided with bed curtains.

One set of mattresses, blankets and sheets are to be provided.

(10) Messroom

A first aid kit container of 500 mm x 300 mm x 500 mm in size (including medicines, necessary for its delivery cruise, to relieve pain excluding narcotics such as morphine and cocaine) is to be provided in the messroom with lock.

(11) Wheelhouse

Necessary electric outlets for various instruments, including a day-light signalling lamp, are to be equipped.

A plastic plate is to be provided on the console stand, indicating the relationships between the rpm of the main engine, horse power and the ship's speed. A ship's clock (quartz) and a heating pot (for making coffee) are to be provided.

(12) Galley

In addition to a refrigerator for home use, such a freezer with a lock device is to be provided as has a capacity for about 6 persons x 6 days in case of a dispatch for rescue operations.

Cooking utensils, including deep pan, frying skillet and kettle, and bowl,

knife, spoon and for, are to be supplied.

A dozen sets of tableware are to be provided.

(13) Spare anchor

A spare anchor is to be provided. It is to be stored on the shore.

(14) Hawsers and ropes

The following ropes are to be provided:

Tow rope:	Nylon 70 mm dia x 80 m	1
Two rope:	Nylon 70 mm dia x 60 m	1
Joining shackle for two rope		1
Hawsers:	Nylon 40 mm dia x 40 m	4
Having lines:	Nylon 10 mm dia x 60 m	2

(15) Flags and pennants

A set of international signal code flags and pennants, 2 house flags and 1 national flag are to be supplied.

4.3.3 Design for Machinery Part

(1) Propulsion unit

The propulsion system is to be of fixed pitch propeller in Kort Nozzle rudder for easy maintenance and repair.

The reduction gear is to be of a co-axial type.

(2) Auxiliary machineries

The main engine cooling sea water pump may be of a direct drive type. The oil/water separator is to meet the requirements of MARPOL (The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 Relating thereto - MARPOL 73/78 and Amendment).

(3) Fittings of pipes

All pipes are to be fitted above the tank top without introducing them in the double bottom for the purpose of easy maintenance.

(4) Insulation material

All insulation materials is to be free of asbestos.

(5) Electric and gas welding machines

The tug boat is to be provided with an electric welding machine (2 hard safety helmets) and a set of gas welding equipment (with 4 oxygen and 2 acetylene cylinders).

(6) Filters

The filters used for fuel oil and lubricating oil systems are to be reusable ones and a spare for each type of filter is to be supplied.

4.3.4 Design for Electric Part

(1) Diesel generator set

Two generator sets are to be installed, one for operation and the other as a reserve. Each generator set is capable of supplying electric requirements when the vessel is at sea, during towing operations, while on stand-by for entering or leaving port, or in port.

The maker of the diesel generator engines is to be the same one as the main engine maker, if possible.

(2) Daylight signal

A daylight signalling lamp (or Aldis lamp) is to be equipped.

(3) VHF radio telephone

The VHF radio telephone is to satisfy the requirements of GMDSS (Global Maritime Distress Safety System) having 80 channels or more. The electric power source is to be D.C. 24 V.

(4) SSB (Single Side Band) radio telephone

The SSB radio telephone is to satisfy the requirements of GMDSS and be capable of dual operation and digital programming. The electric power source is to be D.C. 24 V.

(5) Echo sounding device

The echo sounder with an alarm which is set between depths of 0.5 m and 5.0 m in depth and a digital display is to be provided.

(6) Magnetic compass

The magnetic compass is to be equipped with an internally lighted periscope and connected to an automatic piloting system. Necessary accessories, such as azimuth mirror and shadow pins, are to be supplied.

(7) GPS (Global Positioning System) receiver

The GPS receiver is to have an accuracy of 10 to 50 m.

(8) Citizen band transceiver

Two sets of citizen band transceivers are to be supplied.

4.3.5 Facilities for Marine Safety Measurements

(1) Firefighting facilities

On the basis of the types and sizes of vessels which call at the port, the firefighting equipment installed on board the tug boat is to be equivalent to installations on board firefighting ships in Category 1 as specified in Japan's Maritime Safety Agency Notice No.29, with a pump and a turret nozzle capable of discharging 1,000 liters of water per minute and 45 m distance at 35°. The fire monitor is to be controlled remotelly from wheelhouse by means of electric system.

Further, a set of fireman's outfits a self-contained breathing apparatus is to be provided by giving consideration to life saving operations when on fire.

(2) Equipment and materials to cope with oil spills

While equipment and materials, including oil booms, to cope with oil spills, are to be carried on board the tug boat to the destination, they are all to be stored on the shore, after the arrival of the tug boat, at the expense of the Kingdom of Tonga. Canvas covers are to be supplied by the shipbuilder and wooden gratings are to be prepared by the owner for oil booms stored on land.

It is to be capable of taking action to respond to disasters by loading such equipment and materials only in emergencies. It is also necessary to give advice on the method to store them on the shore so that they can be used effectively in emergencies.

(3) Facilities for search and rescue operations

In addition to providing a rescue boat to rescue persons in distress, communication devices, including a VHF radio telephone which meets the GMDSS specifications, and MF/HF SSB (Single Side Band) radio telephone, a VHF transponder, and 2 sets of citizen band transceiver are to be provided for the purpose of facilitating search and rescue operations.

4.3.6 Spare Parts and Tools

As well as spare parts which are provided in accordance with the requirement by the Classification Society and the maker's standard for each equipment, a 2-year supply of consumable goods which are considered to be difficult to obtain locally are to be supplied in accordance with ship builder's design.

Tools and instruments are to be supplied in accordance with the requirements of the Classification Society and the maker's standard for each equipment as well as items necessary for daily maintenance.

4.3.7 General Arrangement

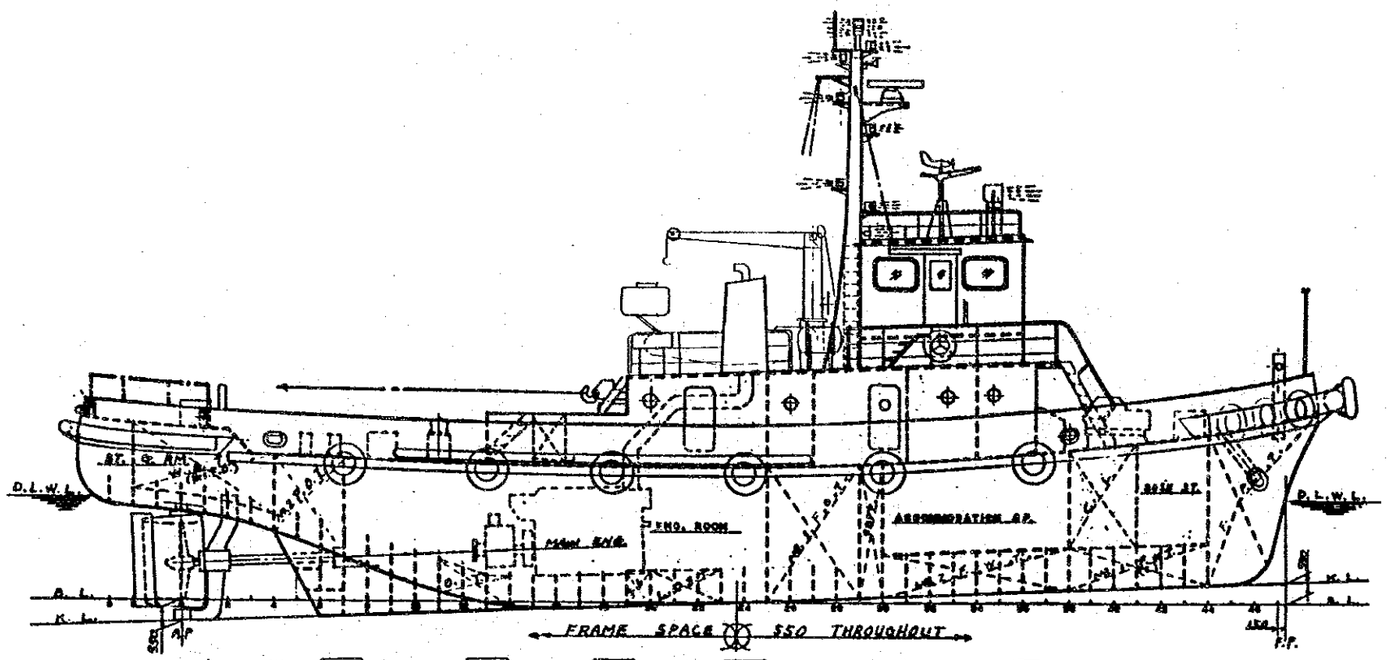
The general arrangement of the tug boat is shown in Figure 4-3-1.

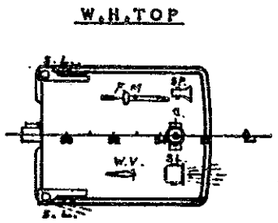
Principal particulars of the tug boat are as follows:

Gross tonnage	177 ton
Length, overall	29.20 m
Length, b.p.	26.00 m
Width, mold	8.00 m
Depth, mold	3.30 m
Draft, mold	2.50 m
Bollard pull	30.0 ton

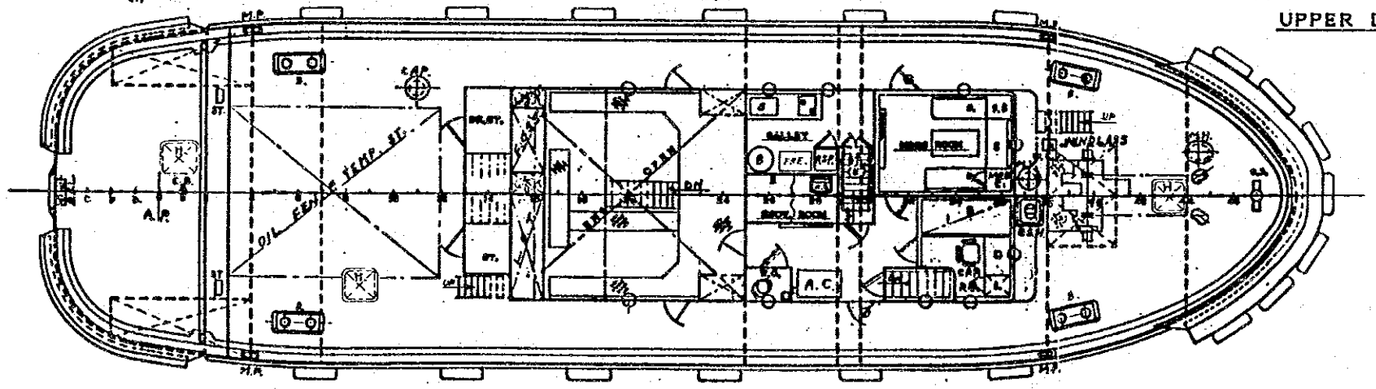
Max. speed	13.0 knot at sea trial
Main engine	1,200 Ps x 2 sets
Complement	6 persons
Classification	Nippon Kaiji Kyokai (NK)

Principal particulars	
Length, overall	29.20 m
Length, b-p	26.00 m
Width, mold	8.00 m
Depth, mold	3.30 m
Draft, mold	2.50 m
Gross tonnage	177 ton
Main engine	1,200 PS x 2
Complenment	6 persons

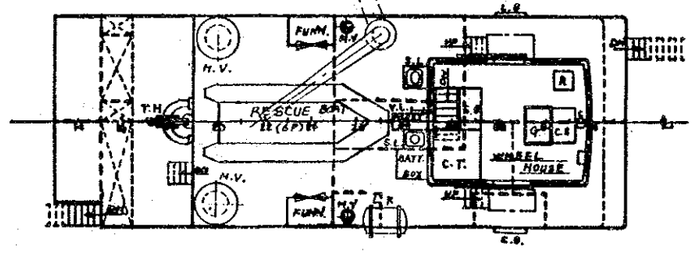




UPPER DECK



TOW.DECK & NAV.BR.DECK



HOLD

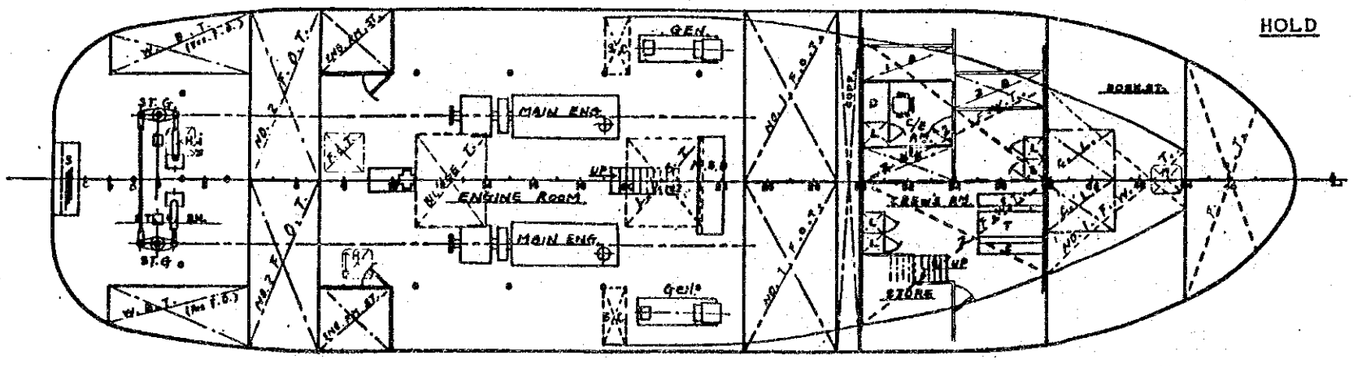


FIG 4-3-1 GENERAL ARRANGEMENT

4.3.8 Outline Specification

(1) General and hull part

(a) General

The tug boat is to be designed and built not only as a tug boat to berthes/unberthes the vessels to/from Queen Salote Wharf in Nuku'alofa in Kingdom of Tonga but also a tug boat which is able to engage in fire fighting, pollution control, search and rescue in the port and adjacent sea areas.

In general, all material, machinery, apparatus and outfittings are to be Japanese make.

(b) General arrangement and propulsion

The tug boat is to be of flush decker with machinery amidships and to have one complete deck and two tiers of deck houses. And the tug boat is to be driven by twin Diesel engines and with two fixed pitch propellers in steerable Kort nozzle.

(c) Classification and rules and regulations

Classification: NIPPON KAIJI KYOKAI (NK)NS* Tug, Coasting service in Tonga, MNS*

Rules and regulations: NK Rules for the Survey and Construction of Steel Ships, Part CS Hull Construction and Equipment of Small Ships

International Convention on Load Lines, 1966

International Convention on Tonnage Measurement of Ships, 1969

International Convention for the Prevention of Pollution from Ships, 1973 and Amendment, 1976

Convention on the International Regulations for Preventing Collision at Sea, 1972

(d) Principal dimension

Length, overall	:	abt. 29.20m
Length, between perpendiculars	:	26.00m
Breadth, molded	:	8.00m
Depth, molded	:	3.30m

Drought, designed, molded : 2.50m

(e) Gross tonnage (International measurement): abt. 177 tons

(f) Tank capacity

Fuel oil tank	: abt. 66m³
Reserve fuel oil tank	: abt. 10m³
Fresh water tank	: abt. 15m³

(g) Speed: On sea trial, maximum abt. 13.0 knots

(h) Bollard pull: On sea trial, maximum abt. 30.0 t

(i) Endurance: Distance of endurance, abt. 1,800 sea mile.

(j) Complement:

Captain	1 person
Chief engineer	1 person
Officer	1 person
Crew	3 persons
Total	6 persons

(k) Hull construction: All welded construction and transverse framing system

(l) Ventilation and air conditioning

Living rooms, mess room	: Cooling system by air conditioner
Machinery room	: Mechanical ventilation
Galley	: Home type exhaust fan
Shower room, WC	: Home type exhaust fan
Stores, etc.	: Natural ventilation

(m) Life-saving equipment

Inflatable liferaft	: 1 set - for 6 persons
Lifejacket	: 8
Lifebuoy	: 2
Satellite EPIRB	: 1

(EPIRB: Emergency Position Indicating Radio Beacon)

Radar transponder	: 1

(n) Deck machinery

Windlass	: 1 - Electric Windlass, 2.5t x 12 m/min
Capstan	: 1 - Electric capstan, 1.5t x 12 m/min
Steering gear	: 1 - El-Hydraulic steering gear for 2 rudders, 7t-m (1-emergency steering hydraulic pump is to be included.)
Deck crane	: 1 - Electric, fixed boom, 1.0t lifting capacity
Towing hook	: 1 - 35.0 t

(o) Anchor, anchor chain and ropes

Anchor	: 2 - 480 kg
Anchor chain	: 19mm dia. 275m in length in total
Tow Line	: 1 - 18mm dia. 180m long, steel wire rope
Towing rope	: 1 - 70mm dia. 80m long, Nylon rope
	: 1 - 70mm dia. 60m long, Nylon rope
Mooring line	: 3 - 13mm dia. 120m long, steel wire ropes
Mooring rope	: 4 - 14mm dia. 40m long, Nylon ropes
Spare anchor	: 1 - 480kg
Spare towing rope	: 1 - 70mm dia. 80m long, Nylon rope
	: 1 - 70mm dia. 60m long, Nylon rope
Spare mooring rope	: 4 - 14mm dia. 40m long, Nylon ropes

(p) Side scuttle and window

Crews accommodation	: Hinged side scuttles with batterfly nut
Wheelhouse	: Square windows, 2 of hinged type, 2 of side sliding and others fixed type.

(q) Painting

Bottom shell	: Chlorinated rubber paint A/C x 2, A/F x 2
Topside area	: Chlorinated rubber paint A/C x 2, T/S x 2
Weather deck	: Alkyd resin paint A/C x 2, D/P x 2
Outside wall of deck house	: Alkyd resin paint A/C x 2, F/P x 2
Ballast tank	: Tar epoxi paint 2 coats
Fresh water tank	: Pure epoxi paint 2 coats

(Remark) A/C: Anti corrosive paint
A/F: Anti fouling paint
T/S: Topside paint

D/S: Deck paint

F/P: Finish paint

(r) Nautical instrument

1 complete set of navigation lights, magnetic compass with shadow pin, azimuth mirror and azimuth circle, helm indicators, marine clocks, barometer, thermometers, clinometers, signal flags, nautical books, binocular, etc.

2 diamond shapes are to be supplied.

(s) Firefighting appliances

Portable fire extinguisher: 6 - Powder fire extinguisher (3.5kg)

Fire hose and nozzle: 2 sets - 50mm dia. x 15m with dual purpose nozzle

(2) Machinery part

(a) Main engine

4-cycle, single acting, vertical marine Diesel engines with reversing reduction gear x 2 sets

Rated output	: abt. 1,200 ps (at 800 - 900 rpm)
No. of cylinder	: 6
Cooling method	: Seawater and fresh water
Fuel oil	: Diesel oil
Starting method	: Compressed air
Operation	: Control of revolution and propeller rotating direction are made from control stand in wheel house remotely. Start and stop of main engine are controlled in engine room.

(b) Shafting

Intermediate shaft	: Forged steel x 2
Propeller shaft	: Stainless steel x 2
Stern tube	: Fabricated steel construction x 2
Propeller	: 4-blade, fixed pitch, Kaplan type of Manganese bronze x 2

(c) Electric generator

Generator	: AC 225V 3 phase 50Hz 65kVA, drip proof self-exciting generator x 2 sets
Prime mover	: Diesel engine abt. 74 ps x 1,500 rpm x 2 sets

(d) Air compressor

Main air compressor:	Generator engine driven air compressor abt. 15m³/h 30 kgf/cm² x 2 sets
Emergency air compressor:	Manual 350 cm³/stroke x 30 kgf/cm² x 1 set

(e) Pumps

Bilge and G.S. pump	x 1
Bilge and fire pump	x 1
Air conditioning cooling water pump	x 1
Fresh water pump	x 1
Fuel oil transfer pump	x 2
Main engine stand-by lub. oil pump	x 1

(f) Oily water separator x 1

(g) Tanks

Main engine starting air reservoir	x 2
Emergency air reservoir	x 1
Fuel oil service tank	x 1
Lub. oil sump tank	x 1
Lub. oil reserve tank	x 1
Bilge tank	x 1
Main engine fresh water expansion tank	x 1
Cleaning oil tank	x 1

(h) Tools

Electric welder	x 1
Gas welder	x 1
Electric grinder	x 1
Electric drill	x 1
Chain block	x 2 (500 kg)
Vice	x 1

Ear plug x 2

Necessary tools for maintenance and repair onboard are to be provided in accordance with manufacturer's standards.

(3) Electric part

(a) Electric distribution

Generator	: AC 225V, 3 phase, 50Hz,	3 wire
Power equipment	: AC 220V, 3 phase, 50Hz,	3 wire
Lighting	: AC 220V, 1 phase, 50Hz,	2 wire
Communication	: AC 220V, 1 phase, 50Hz,	2 wire
Nautical equipment	: DC 24V,	2 wire
Radio equipment	: AC 220V and DC 24V	
Emergency light	: DC 24V,	2 wire

(b) Power generating equipment

Main generator	: AC 225V, 3 phase, 50Hz, 65kVA x 2 sets
Battery	: DC 24V 200AH, x 2 sets

(c) Main switchboard : Dead front, self supporting type

(d) Shore connection : AC 230V, 3 phase, 50Hz, 50A x 1

(e) Navigation and radio equipment

VHF radio telephone	: 1
SSB radio telephone	: 1 (SSB: Single Side Band)
VHF walky-talky	: 2
Citizen band transceiver	: 2
Radar	: 1 (72 miles, electric)
Echo sounder	: 1
Air whistle	: 1
GSP navigator	: 1 (GPS: Global Positioning System)
Navtex receiver	: 1
Anemometer	: 1

(f) Interior communication equipment

Sound powered telephone	: 1 set
Public addresser system	: 1 set

Engine telegraph : 1 set, electric

Signal bell, general alarm system: 1 set

(g) Navigation light: 1 set

(h) Others

Anchored board : 3

Battery lamp : 4, marine type

(4) Special equipment

(a) Firefighting for the other vessel

Fire pump	: 60 m^3 x 120m	x 1 set
Prime mover	: Diesel engine	x 1 set
Fire monitor	: 1,000 l/min	x 1 set (remotely controlled)
Fire liquid tank	: 900 l	x 1
Fire suits	: 1 set	
Fire axe	: 1	
Safety velt	: 1 for climbing	

(b) Pollution control equipment

The following equipments are to be supplied and transported onboard, and stored on shore after arrival at Tonga.

Oil boom	: A-type 1,000m with cover sheet
Portable oil skimming tool	: 1
Oil dispersant	: 400 litter
Oil absorbent	: 100 sheets
Oil fence cover sheet	: 1 set

(c) Equipment for search and rescue

Rescue boat	: Composite type (6 p) x 1
Rocket signal	: 1
Stretcher	: 1
Transister megaphone	: 1

4.4 IMPLEMENTING PLAN

4.4.1 Implementing Policy

After the Exchange of Notices of the project is officially signed, a consultant will be designated. Such designated consultant, keeping close contact and consultation with the Government of Tonga, will work out a detailed design on the basis of the basic design policy for a tug boat, which is to be constructed by the cooperation in the form of Grant Aid, to prepare for inviting tenders by shipbuilders and for execution of construction.

The tug boat is planned to be constructed at a shipyard in Japan, which is decided by bidding. The shipbuilder thus decided will conclude a construction contract and the tug boat will undergo inspections and supervision by the Classification Society and the consultant in order to satisfy the required capabilities sufficiently within the scheduled construction period for delivery to the Kingdom of Tonga.

While the delivery of the tug boat to the Government of Tonga is made at the shipyard in Japan, the tug boat will virtually cruise to the Port of Nuku'alofa in Tonga under her own power at the expense and responsibility of the shipbuilder and delivered to the designated port of Tonga after sea trial to confirm her performance.

4.4.2 Construction Management Plan

Based on the Grant Aid cooperation policy of the Government of Japan, the consultant, bearing in mind the basic design concept, will be required to ensure that the tug boat is smoothly completed by organizing a project team that will work out detailed design and construction management.

For the purpose of its smooth construction, the consultant as a representative of the Ports Administration Department of the Kingdom of Tonga will send proper engineers to approve construction drawings, attend various inspections during the course of construction and witness in workshops equipment to be fitted and attend official sea trials.

4.4.3 Other Matters

During detail design and construction process of the tug boat, careful attentions must be paid to the following matters:

1) No special materials and consumable parts which are considered difficult to procure in Tonga are to be used as far as practicable from the viewpoint of maintenance and repairs after its delivery.

2) In order to develop a good understanding and capability to effectively use the major installations, including main engines, shafting, maneuvering equipment and nautical instruments, the chief engineer is recommended to be trained for two months during the construction period in Japan.

3) The tug boat is to be delivered to Tonga after arrival in Tonga and trials for checking performance on site, and during this period of 1 week, Japanese crew members engaged in the cruise to Tonga will instruct Tongan crew members of the tug boat in operations of important machineries and equipment.

4) In addition to the training above 3), the Japanese captain and the chief engineer will train the Tongan crew members for about 3 weeks after the hand over of the tug boat in Tonga to familiarize them with maneuvering operations.

5) Guidance for maintenance and storage of the oil boom and other equipments for marine pollution control and safety of life at sea will be performed to the Tongan staff in Japan and Tonga.

4.4.4 Cruising Plan for Delivery

The tug boat, after construction in a shipyard in Japan, will be delivered to Tonga by sailing by her own power.

The cruise is the responsibility of the shipbuilder. The actual cruise, however, is undertaken by a contractor specializing in such cruises.

The cruising plan is outlined as follows:

(1) Route of the cruise

Port of departure : wharf of the shipyard of the tug boat in Japan
Port of destination: Queen Salote Wharf, the Port of Nuku'alofa in Tonga
Via : Marianas Islands and Solomon Islands

(2) Cruising distance and days

Cruising distance : approximately 5,000 miles
Planned cruising speed: 9.0 knots on the average
Planned cruising hours: 24 hours a day
Planned cruising days : approximately 25 days

The cruising hours a day and cruising days are subject to change as the tug boat may have to reduce her speed or take shelter owing to rough seas caused by adversed weather or tropical cyclones.

(3) Bunker fuel

Maximum diesel fuel quantity : 76 m^3
Bunkering ports : Guam (Marianas Islands) and Honiara (Guadalcanal Island)

(4) Crew members

6 seafarers in compliance with 'the Law for ship's Officers' of Japan.

(5) Navigation route

The navigation route is as shown in Fig. 4-4-1.

4.4.5 Construction Process Plan

The construction of a tug boat under this project are entirely conducted by a shipbuilder in Japan. Thus,there will be no charges to be absorbed by Tonga. Therefore, the expenses to be borne by Japan will cover the construction work, including detailed design and the cruise for delivery. The period and processes required for the project are shown in Fig. 4-4-2.

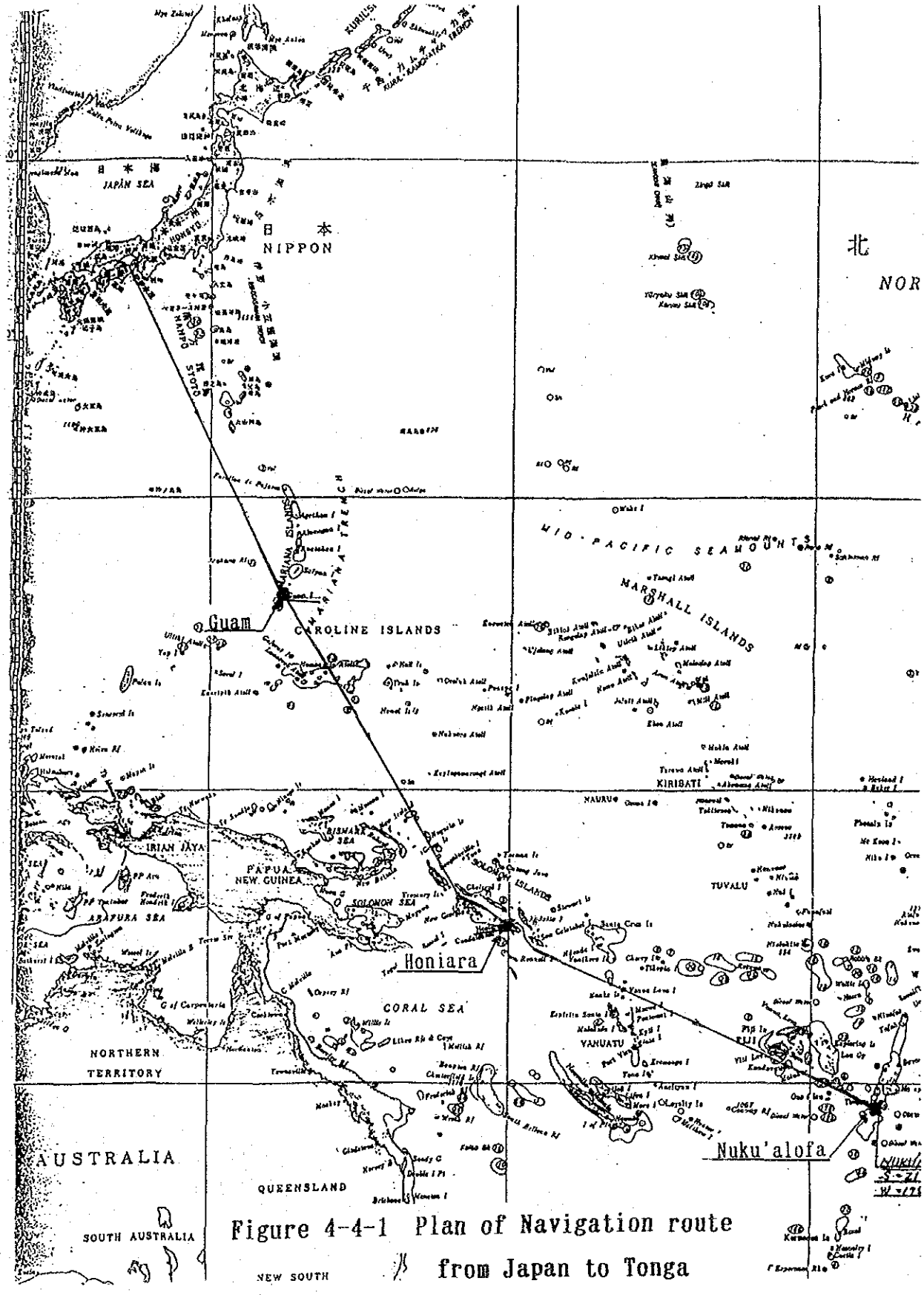


Figure 4-4-1 Plan of Navigation route from Japan to Tonga

CHAPTER 5

EFFECTS OF THE PROJECT AND CONCLUSION

The construction will be one-phase work with a construction period of 11 months after concluding a building contract as shown in Fig. 4-4-2.

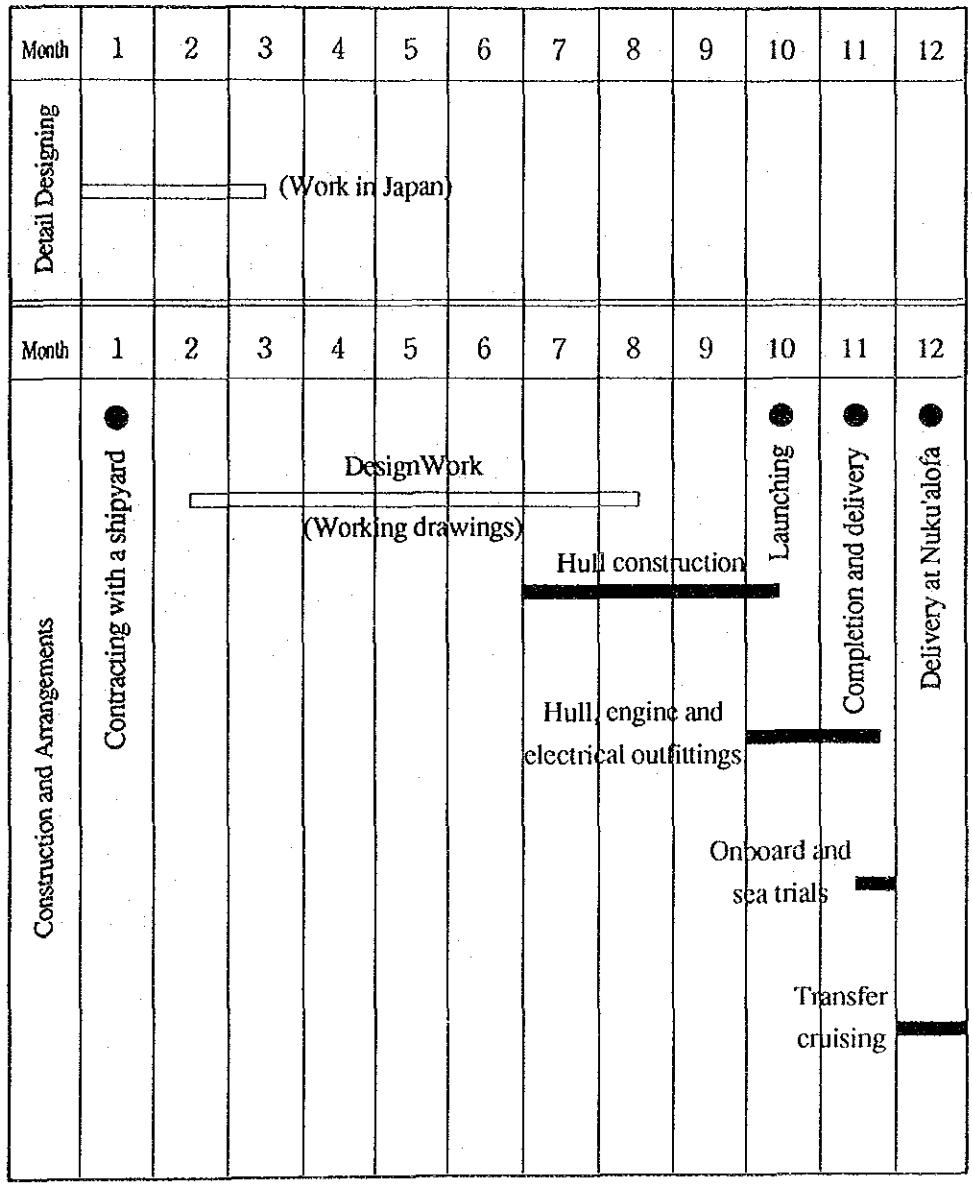


Fig. 4-4-2 Construction schedule

CHAPTER 5 EFFECTS OF THE PROJECT AND CONCLUSION

5.1 EFFECTS OF THE PROJECT

How the implementation of this project brings about effect and improves the actual situation is summarized in Table 5-1-1.

Table 5-1-1 Effects and improvements brought by this project

Current problems	Countermeasures in the project	Effects and improvements by the project
1. All foreign-going vessels berth or unberth in the Port of Nuku-alofa without tug boat assistance. Such maneuvers under their own power may result in damage to the hull, propeller or wharf. There is also a risk of a vessel taking a sheer and running aground.	To provide a tug boat corresponding to the environmental conditions for assisting vessels in maneuvering operations.	The safety of vessel traffic in the port and berthing and unberthing operations to and from the wharf is enhanced. Delays in berthing or unberthing occurring 2 to 3 times a month owing to strong winds may be eliminated, making the management of the wharf more accurate and efficient. Thus, the Port of Nuku'alofa will be rated high as a trading port.
2. Strong winds which blow across No.1 and No.2 berths of the Queen Salote Wharf would make berthing and unberthing operations difficult.	The bollard pull of the tug boat is decided on after fully considering the wind direction and force at the wharf. As a result, the specifications required by Tonga is to be changed.	Statistically, the tug boat will be able to give assistance in berthing and unberthing of vessels against 99% of the winds which blow at the wharf. As to the sizes of vessels the tug-boat may be able to give assistance to all sizes of freighters except large-sized passenger ships in maneuvering at the wharf.
3. There is no facilities to fight fires on board vessels from the sea in case of shipboard fires in the port.	The tug boat is to be equipped with fire-fighting facilities, which are to be highly mobile.	It will be possible to avoid damage to and inoperative conditions of wharf owing to fires in the port.
4. In marine pollution, there is no measures to prevent the spread of polluted area and recover such polluting substances.	Oil booms of a sufficient length are to be provided. The tug boat is to be provided with their storage space, enabling it to carry them to water areas of accidents. Oil recovering devices are also to be provided.	Measures can be taken to cope with pollution by tanker accidents in the port and coastal areas. In addition, international cooperation to prevent marine pollution may be rendered.
5. In the case of marine accidents, the search and rescue operation depends on a small rescue ship of 22 gross tons, which cannot towed back disabled ships in rough weather and sea conditions.	The tug boat is to be provided with a rescue boat.	The tug boat is capable of reporting to the site of an accident even under adverse sea conditions and carrying out rescue operations.

5.2 CONCLUSION

The implementation of the project will, as is described in "5.1 EFFECTS OF THE PROJECT", bring about benefits in a wide range of areas to the people's life and national economy of Tonga. It is thus judged reasonable to put the project into practice by cooperation in the form of Grant Aid.

In addition, in the implementation of the project, there are no conceivable problems on the Tongan side in terms of operating staff, maneuvering capability, maintenance facilities and skills, and ability to cover maintenance costs.

However, in order to make the project more effective, it is desired that the executing organization of Tonga in charge should study and improve the following points:

1) As Tonga is dependent on imports for ships' equipment and materials, the section of the Ports Administration Department in charge of the management and operation of the tug boat should undertake proper daily inventory control and custody of necessary instruments and tools, spare parts and consumables in order to enable the quick and exact supply of a specific thing corresponding to a requisition, thereby to eliminate downtime owing to a shortage of parts, etc.

2) The parts and spares equipped on board the vessel should not be used for repairs of other vessels and must be controlled under strict custody.

3) Wires, fiber ropes, vinyl sheets and the like, if discarded in the vicinity of the wharf, might give damage to the tug boat with her propeller being fouled with such objects. The wharf should be managed so that such unnecessary things will not be discarded into the sea.

4) The oil booms are to be stored on the shore and there is a possibility of their being kept without being used for a long period. Special attention should be paid to their storage. For their custody, full consideration should be given to such points as storage place and

method, and periodical inspections for the purpose of deploying them to the sea as required in emergencies.
Periodical inspections should be given to oil dispersants so that they may be replaced when they become ineffective.

5) Periodical drills should be exercised for effective deployment of oil booms in emergencies.

6) The reservation of a slipway for periodical drydocking should be made well in advance and, in addition, such reservation be periodically checked with the shipyard which owns such slipway to respond to changes in the timing of drydocking, which may possibly occur, because of convenience.

APPENDIX

CONTENTS

1. Basic Design Study Team

(1) Members

Naoki Nakanishi	Team leader Special Assistant to the Director Industries Division, Maritime Technology and Safety Bureau. Ministry of Transport
Yoshihiro Umeda	Maritime Safety Planner, Special Assistant to the Director, Administration Division, Guard & Rescue Department, Maritime Safety Agency
Eiji Iwasaki	Grant Aid Planner & Project Coordinator Second Basic Design Study Division, Grant Aid Study & Design Department, Japan International Cooperation Agency
Tatsuo Mogi	Project Manager Overseas Shipbuilding Cooperation Centre (OSCC)
Koji Karashima	Naval Architect (Hull) OSCC
Yo Kaneko	Naval Architect (Outfitting) OSCC
Shozo Hirano	Naval Architect (Machinery) OSCC
* Akio Kimura	Naval Architect (Cost Estimation) OSCC

* : In charge of studies in Japan

(2) Survey schedule

Order of days	Date	Day	Survey Activities
1	11/23	Mon.	Lv. Tokyo
2	11/24	Tue.	Ar. Nuku'alofa via Auckland
3	11/25	Wed.	Courtesy calls on Ports Administration Department and Ministry of Foreign Affairs. Tour to Berth No.1 & No.2 and Slip way.
4	11/26	Thu.	Discussion with Ports Adm. Dept. Discussion with Ports Adm. Dept. on Technical level of Tongan crews. Meeting with Secretary for Foreign Affairs.
5	11/27	Fri.	Discussion with Ports Adm. Dept. Tour to Tonga Maritime Polytechnic Institute and Work Shop of Shipping Corporation of Polynesia. Visit Ministry of Marine. Meeting with members of Japan Overseas Cooperation Volunteers in Tonga.
6	11/28	Sat.	Study of activities of whalves.
7	11/29	Sun.	Team meeting and reorganization of data. Study of whalves.
8	11/30	Mon.	Discussion with Ports Adm. Dept. Study of tanker berth. Site survey of unberthing ship.
9	12/1	Tue.	Discussion with Ports Adm. Dept. on a draft of Minutes. Technical discussion with Ports Adm. Dept. on the Project.
10	12/2	Wed.	Signing on Minutes.
11	12/3	Thu.	Lv. Nuku'alofa, Ar. Fiji - Official members. Discussion with Ports Adm. Dept. - Consultant members. Site survey of berthing ship.
12	12/4	Fri.	Courtesy calls on Japan Embassy and JICA office in Fiji - Official members. Site survey of whalves - Consultant members.
13	12/5	Sat.	Lv. Fiji, Ar. Sydney - Official members. Tour to repair work shop and study of berthing ship. - Consultant members.
14	12/6	Sun.	Lv. Sydney, Ar. Tokyo - Official members. Study of slip-way, tanker berth and berthing/unberthing ships - Consultant members.
15	12/7	Mon.	Technical discussion with Ports Adm. Dept.

Order of days	Date	Day	Survey Activities
16	12/8	Tue.	Technical discussion with Ports Adm. Dept.
17	12/9	Wed.	Technical discussion with Ports Adm. Dept. Study of work shops for maintenance. Collections of data issued by Tonga Government.
18	12/10	Thu.	Final meeting with Ports Adm. Dept. for settlement of discussions.
19	12/11	Fri.	Lv. Nuku'alofa, Ar. Auckland
20	12/12	Sat.	Lv. Auckland, Ar. Tokyo.

(3) Members of the Tonga side, etc.

Ports Administration Department

Cap. Sione Tu'itupou Fotu : Harbour Master

Mr. Ma'asi Heimuli : Pilot

Ministry of Foreign Affairs and Defense

Mr. Taumoepeau Tupou : Secretary for Foreign Affairs

Ministry of Marine

Mr. Alipate Tufui : Marine Officer

Maritime Polytechnic Institute

Cap. Malakai Tapealava : Principal

Shipping Corporation of Polynesia

Mr. Hafoka : Foreman

Ministry of Works

Mr. Bob Jenkins : Chief Engineer

Mr. Viliami Manu : Mechanical Supervisor

Electric Power Board

Mr. Tatsuya Nitta : Member of Japan Overseas Cooperation Volunteers

Tonga Office, JICA

Mr. Masahiro Kuramata	: Resident Representatives

Japan Embassy in Fiji

Mr. Yasuo Takahashi	: Minister
Mr. Makoto Yamashita	: Second secretary
Mr. Satoshi Nakajima	: Second secretary

Fiji Office, JICA

Mr. Hideaki Ito	: Resident Representatives
Mr. Keiichi Aragane	: Staff

(4) Minutes

MINUTES OF DISCUSSIONS
ON
THE BASIC DESIGN STUDY
ON
THE PROJECT FOR PROVISION OF A SERVICE VESSEL
FOR THE KINGDOM OF TONGA

In response to a request from the Government of the Kingdom of Tonga, the Government of Japan decided to conduct a Basic Design Study on the Project for Provision of A Port Service Vessel for the Kingdom of Tonga(herein-after referred to as ' the Project '), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Tonga a Study Team, which is headed by Mr. Naoki Nakanishi, Special Assistant to the Director of the Division, Technology and Safety Bureau, Ship Machinery Industries Division , Ministry of Transport, and is scheduled to stay in the country from 24th November to 11th December 1992. The Team held the discussions with the officials concerned of the Government of Tonga and conducted field surveys at the study area.

In the course of the discussions and field surveys, both parties have confirmed the main items described on the attached sheets.
The Team will proceed to further works and prepare the Basic Design Study Report.

NUKU'ALOFA, December 2, 1992

Naoki Nakanishi
Leader,
Basic Design Study Team,
JICA

Sione Tuitupou Fotu
Harbour Master
Ports Administration Department
The Government of Tonga

ATTACHMENT

1. Objectives of the Project

   The objectives of the Project is to construct a port service vessel (the Vessel) to improve and maintain safety of maritime transportation in the port especially berthing and unberthing operation.

2. Proposed home port

   The proposed main home port of the Vessel is located at Nuku'alofa. (The proposed main home port map is attached as ANNEX-I)

3. Responsible and executing Organization:

   Ports Administration Department

4. Request by the Government of Tonga

   The request made by the Government of Tonga on the outline specification of the Vessel is shown in ANNEX-II.

   However, the final particulars of the Vessel and items will be decided after further studies.

5. Grant Aid System extended by the Government of Japan

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

   (2) The Government of Tonga will take necessary measures, described in ANNEX-III for smooth implementation of the Project on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study

   (1) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents around March 1993.

   (2) In case that the contents of the report is accepted in principle by the Tonga side, JICA will complete the final report and send it to the Government of Tonga around May 1993.

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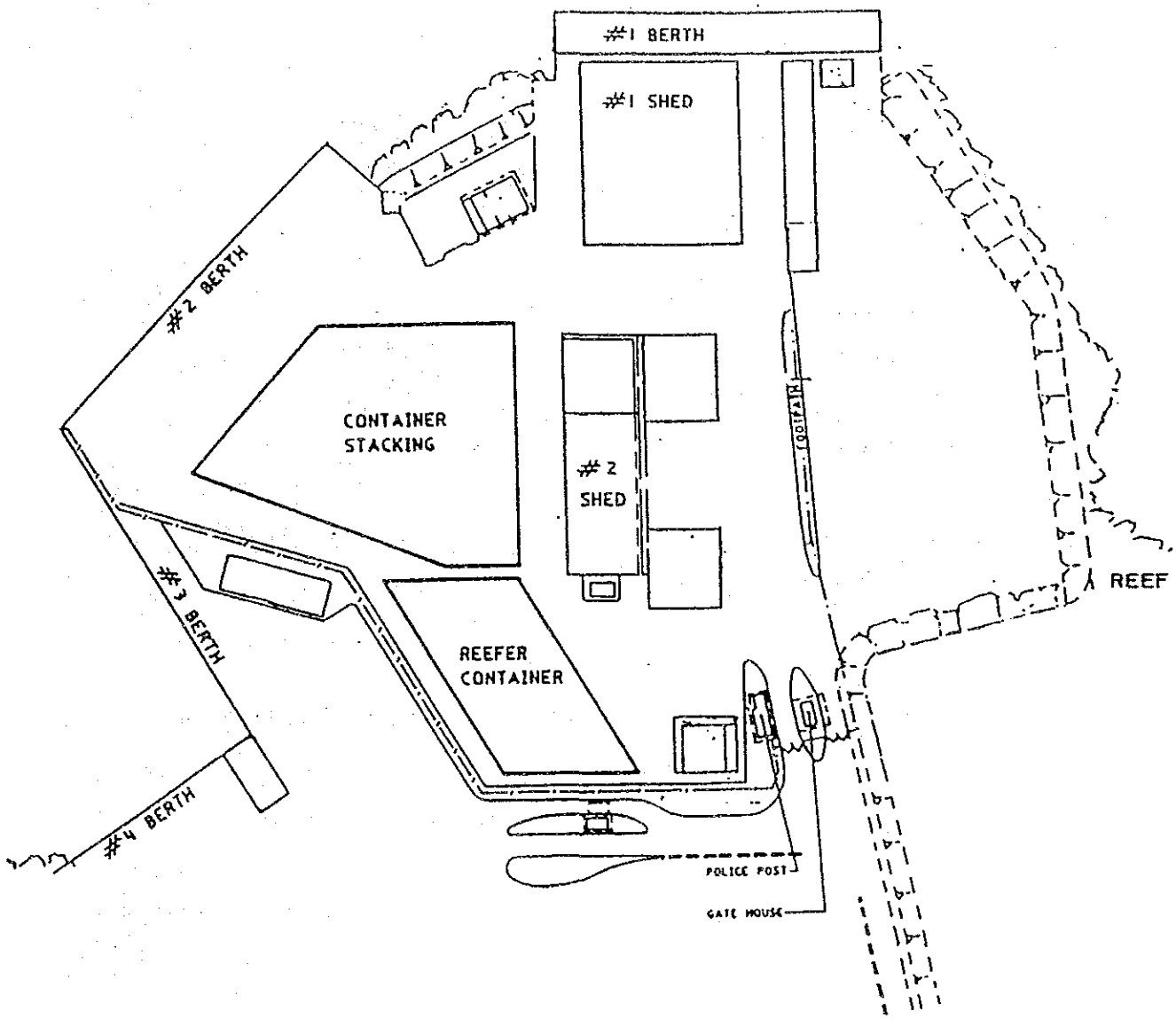
ANNEX- I



0 20 40
Scale in metres

QUEEN SALOTE WHARF

ANNNEX-II

1.	Type of Vessel	: Tug boat with twin screws and steerable Kort nozzles
2.	Number of Vessel	: 1
3.	Principal Dimension	
	Gross tonnage	: about 175 tons
	Length (pp)	: about 26.0 m
	Breadth	: about 7.7 m
	Depth	: about 3.2 m
	Bollard pull	: about 25 tons
	Trial speed	: about 12.5 knots
	Distance of endurance	: about 1,500 s. miles
	Main engine	: Diesel engine, about 1,000 ps x 2 sets
4.	Classification	: Nippon Kaiji Kyokai (NK)
5.	Navigation equipment(extra)	
	EPIRB	: 1 set
	GPS navigator	: 1 set

6. Special equipments and materials necessary for firefighting, pollution control and search/ rescue : 1 set

ANNEX-III

Necessary measures to be taken by the Governmennt of the Kingdom of Tonga in case Japan's Grant Aid is executed.

1. To conclude Banking Arrangement (B/A) with an authorized foreign exchange bank in Japan and open the account after signing of the Exchange of Notes on the Project (E/N).
2. To bear advising commissions of Authorization to Pay (A/P) and payment commissions to the Japanese foreign exchange bank for banking services based upon the B/A.
3. To ensure the following measures for proper and effective operation and maintenance of the vessel purchased under the Grant Aid.
   (a) the necessary amount of budget
   (b) the necessary number of experienced crew
4. To accord Japanese Nationals whose services may be required in conection with the delivery of the Vessel and the services under the verified contract such facilities as may be necessary for their entry into the Tonga and stay therein for the performance of their work.
5. To exempt Japanese Nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Tonga with respect to the implementation of the Project and services under the verified contract.
6. To ensure immediate customs clearance, registration, and other necessary procedures for the Vessel at the time of entry of the home port in Tonga.
7. To bear all the expenses other than those to be borne by the Grant Aid.

2. Draft Report Explanation Team

(1) Members

Minoru Yoshida	Leader Special Assistant to the Director Shipbuilding Division, Maritime Technology and Safety Bureau. Ministry of Transport
Futoshi Takahashi	Grant Aid Study Division Economic Cooperation Bureau Ministry of Foreign Affairs
Tatsuo Mogi	Project Manager Overseas Shipbuilding Cooperation Centre (OSCC)
Koji Karashima	Naval Architect (Hull) OSCC
* Shozo Hirano	Naval Architect (Machinery) OSCC
** Akio Kimura	Naval Architect (Cost Estimation) OSCC

* : Temporary Assistant to OSCC members

** : In charge of studies in Japan

(2) Survey schedule

Order of days	Date	Day	Survey Activities
1	3/2	Tue.	Lv. Tokyo
2	3/3	Wed.	Ar. Nuku'alofa via Auckland
3	3/4	Thu.	Courtesy calls on Ministry of Foreign Affairs. Discussion with Ports Administration Department (PAD) on draft final report.
4	3/5	Fri.	Discussion with PAD on draft final report.
5	3/6	Sat.	Discussion among team members. Rearrangement of data.
6	3/7	Sun.	Discussion among team members. Rearrangement of data.
7	3/8	Mon.	Discussion with PAD on draft final report.
8	3/9	Tue.	Discussion with PAD on draft final report and a draft of Minutes.
9	3/10	Wed.	Visit Ministry of Foreign Affairs and explain results of discussions. Signing on Minutes.
10	3/11	Thu.	Lv. Nuku'alofa Ar. Nadi, Fiji Transport from Nadi to Suva.
11	3/12	Fri.	Visit the Japan Embassy in Fiji and JICA's Fiji Office and report results of explanation of draft final report. Transport from Suva to Nadi.
12	3/13	Sat.	Team meeting and rearrangement of data.
13	3/14	Sun.	Lv. Nadi Ar. Tokyo

(3) Members of the Tonga side, etc.

Ports Administration Department

Cap. Sione Tu'itupou Fotu : Harbour Master

Mr. Tevita T. Afeaki : Wharf Administrator

Ministry of Foreign Affairs and Defense

Mr. Taumoepeau Tupou : Secretary for Foreign Affairs

Mr. Akosita Fineanganofo : Deputy Secretary and Chief Protocal

Japan Embassy in Fiji

Mr. Yasuo Hori	: Ambassador
Mr. Makoto Yamashita	: Second secretary
Mr. Satoshi Nakajima	: Second secretary

Fiji Office, JICA

Mr. Hideaki Ito	: Resident Representatives
Mr. Hajime Watanabe	: Staff

(4) Minutes

MINUTES OF DISCUSSIONS
BASIC DESIGN STUDY ON THE PROJECT
FOR PROVISION OF
A PORT SERVICE VESSEL IN
THE KINGDOM OF TONGA
(CONSULTATION ON DRAFT REPORT)

In November of 1992, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study team on the Project for Provision of a Port Service Vessel (hereinafter referred to as "the Project") to the Kingdom of Tonga, and through discussions, field survey, and technical examination of the results in Japan, has prepared the draft report of the study.

In order to explain and to consult the Tonga side on the components of the draft report, JICA sent to Tonga a Draft Report Explanation team, which is headed by MR. Minoru Yoshida, Special Assistant to the Director of the Shipbuilding Division, Maritime Technology and Safety Bureau, Ministry of Transport, and is scheduled to stay in the country from March 3 to 11, 1993.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Nuku'alofa, March 10, 1993

吉田 稔

Mr. Minoru Yoshida
Leader
Draft Report Explanation Team
JICA

Mr. Sione Tuitupou Fotu
Harbour Master
Ports Administration Department
The Kingdom of Tonga

Attachment

1. Components of Draft Report

The Government of Tonga has agreed and accepted in principle the components of the Draft Report proposed by the team.

2. Japan's Grant Aid System

(1) The Government of Tonga has understood the system of Japanese Grant Aid explained by the team.

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

3. Technical Cooperation

The Tonga side pointed out the need for technical training of Tongan personnel in Japan. They also understood that technical cooperation cannot be requested in the Grant Aid system and that another official request should be submitted through diplomatic channels.

4. Further Schedule

The team will make the Final Report in accordance with the confirmed items, and send it to the Government of Tonga by the end of May 1993.

ANNEX - I

Necessary measures to be taken by the Government of Tonga in case Japan's Grant Aid is executed.

1. To conclude Banking Arrangement (B/A) with an authorized foreign exchange bank in Japan and open the account after signing of the Exchange of Notes on the Project (E/N).
2. To bear advising commissions of Authorization to Pay (A/P) and payment commissions to the Japanese foreign exchange bank for banking services based upon the B/A.
3. To ensure the following measures for proper and effective operation and maintenance of the vessel purchased under the Grant Aid.
   (a) the necessary amount of budget
   (b) the necessary number of experienced crew
4. To accord Japanese Nationals whose services may be required in connection with the delivery of the vessel and services under the verified contract such facilities as may be necessary for their entry into Tonga and stay therein for the performance of their work.
5. To exempt Japanese Nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Tonga with respect to the implementation of the Project and services under the verified contract.
6. To ensure immediate customs clearance, registration, and other necessary procedures for the vessel at the time of entry to the home port in Tonga.
7. To bear all the expenses other than those to be borne by the Grant Aid.

M E M O R A N D U M

BASIC DESIGN STUDY ON THE PROJECT FOR PROVISION OF A PORT SERVICE VESSEL IN THE KINGDOM OF TONGA

Both parties, the Government of Tonga represented by the Ports Administration Department and the Japanese Draft Report Explanation team have agreed the following modifications of the Basic Design.

1. Firefighting equipment
   Fire monitor shall be remotely controlled from wheelhouse by means of electric system.

2. Communication equipment
   Two sets of citizen band transceiver shall be provided for communication to the base on land and other ships.

3. Cover for oil boom
   The cover sheet shall be provided for storage of oil boom on land. The basement for storage shall be installed by Tonga side.

4. Management organization
   The organization of the Ports Administration Department and the responsibilities for maritime safety of the government administrations concerned have been confirmed and clarified.

5. Training of Tongan crews
   The training programs have been discussed and revised that training of a master and a chief engineer for each one month shall be changed to train a chief engineer for two months during the construction period in Japan and the study on board during the cruise to Tonga shall be cancelled.

3. List of Data Collected

1. Sixth Development Plan 1991 - 1995
2. QUARTERLY BULLETIN
   National Reserve Bank of Tonga
3. STATISTICAL ABSTRACT 1989
4. BUDGET STATEMENT 1992-93
5. BALANCE OF PAYMENTS 1979/80 - 1988/89
6. BALANCE OF PAYMENTS 1988/89 - 1990/91
7. SURVEY ON BUSINESS ACTIVITIES 1987/88
8. INCOME TAX STATISTICS 1983/84
9. STATISTICAL BULLETIN ON CONSUMER PRICE INDEX AUGUST 1992
10. MANUFACTURING OUTPUT, EMPLOYMENT AND WAGES/SALARIES 1991
11. FOREIGN TRADE REPORT FOR 1987
12. ANNUAL FOREIGN TRADE REPORT FOR 1988
13. ANNUAL FOREIGN TRADE REPORT FOR 1989
14. ANNUAL FOREIGN TRADE REPORT 1990
15. ANNUAL FOREIGN TRADE REPORT 1991
16. QUARTERLY FOREIGN TRADE REPORT FOR JANUARY - MARCH 1992
17. QUARTERLY FOREIGN TRADE REPORT FOR APRIL - JUNE 1992
18. MONTHLY TRADE REPORT JANUARY 1992 - JUNE 1992
19. BULLETIN OF COASTAL SHIPPING STATISTICS 1988
20. BULLETIN OF COASTAL SHIPPING STATISTICS 1989
21. BULLETIN OF COASTAL SHIPPING STATISTICS 1990
22. BULLETIN OF COASTAL SHIPPING STATISTICS 1991
23. AIR TRANSPORT STATISTICS ANNUAL REPORT FOR YEARS 1989, 1990 AND 1991
24. REPORT OF The PRIME MINISTER for the year 1990
25. REPORT of The MINISTER OF AGRICULTURE for the year 1990
26. The climate and weather of TONGA
27. Crews in Tongan ships
28. Ports Administration Revenues & Expenditures 1987/1992
29. VESSELS SLIPPED OVERSEAS
30. VESSELS SLIPPED LOCALLY
31. Statistical data of accidents in harbour in past 5 years
32. AN ACT TO AMEND THE HARBOURS ACT
33. SEARCH AND RESCUE FOR MISSING VESSELS
34. Shipping and Navigation Regulations (SECTION 206)
35. TIMES AND HEIGHTS OF HIGH AND LOW WATERS
36. NEIAFU HARBOUR AND APPROACHES

4. Maps of Tonga Islands