MINISTRY OF TRANSPORT

SAMOA

BASIC DESIGN STUDY REPORT

ON

THE PROJECT FOR CONSTRUCTION OF

THE INTER - ISLANDS NAVIGATION VESSEL

IN

SAMOA

August 1997

Japan International Cooperation Agency

Fisheries Engineering Co., Ltd.

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PREFACE

In response to a request from the Government of Samoa, the Government of Japan decided to conduct a basic design study on the Project for Construction of the Inter-Islands Navigation Vessel and entrusted the study to the Japan International Cooperation Agency (JICA).

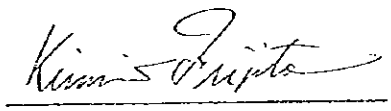
JICA sent to Samoa a study team from March 8 to April 1, 1997.

The team held discussions with the officials concerned of the Government of Samoa, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Samoa in order to discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Samoa for their close cooperation extended to the teams.

August, 1997



Kimio Fujita
President
Japan International Cooperation Agency

August, 1997

Letter of Transmittal

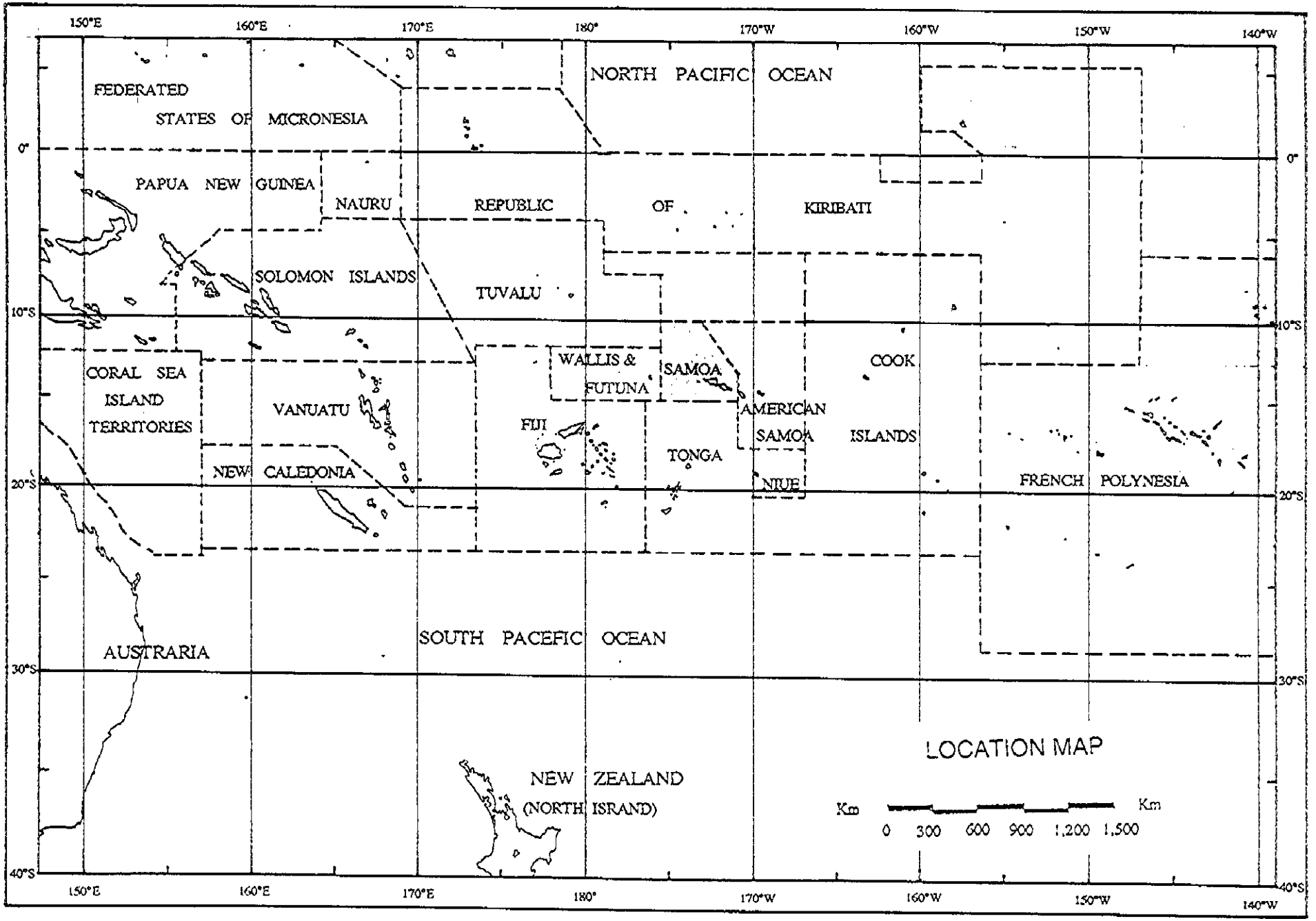
We are pleased to submit to you the basic design study report on the Project for Construction of Inter-Islands Navigation Vessel in Samoa.

This study was conducted by Fisheries Engineering Co.,Ltd., under a contract to JICA, during the period from February 28 to September 4, 1997. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Samoa and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Kuniaki TAKAHASHI
Project Manager,
Basic design study team on the Project for
Construction of the Inter-Islands Navigation Vessel
Fisheries Engineering Co.,Ltd.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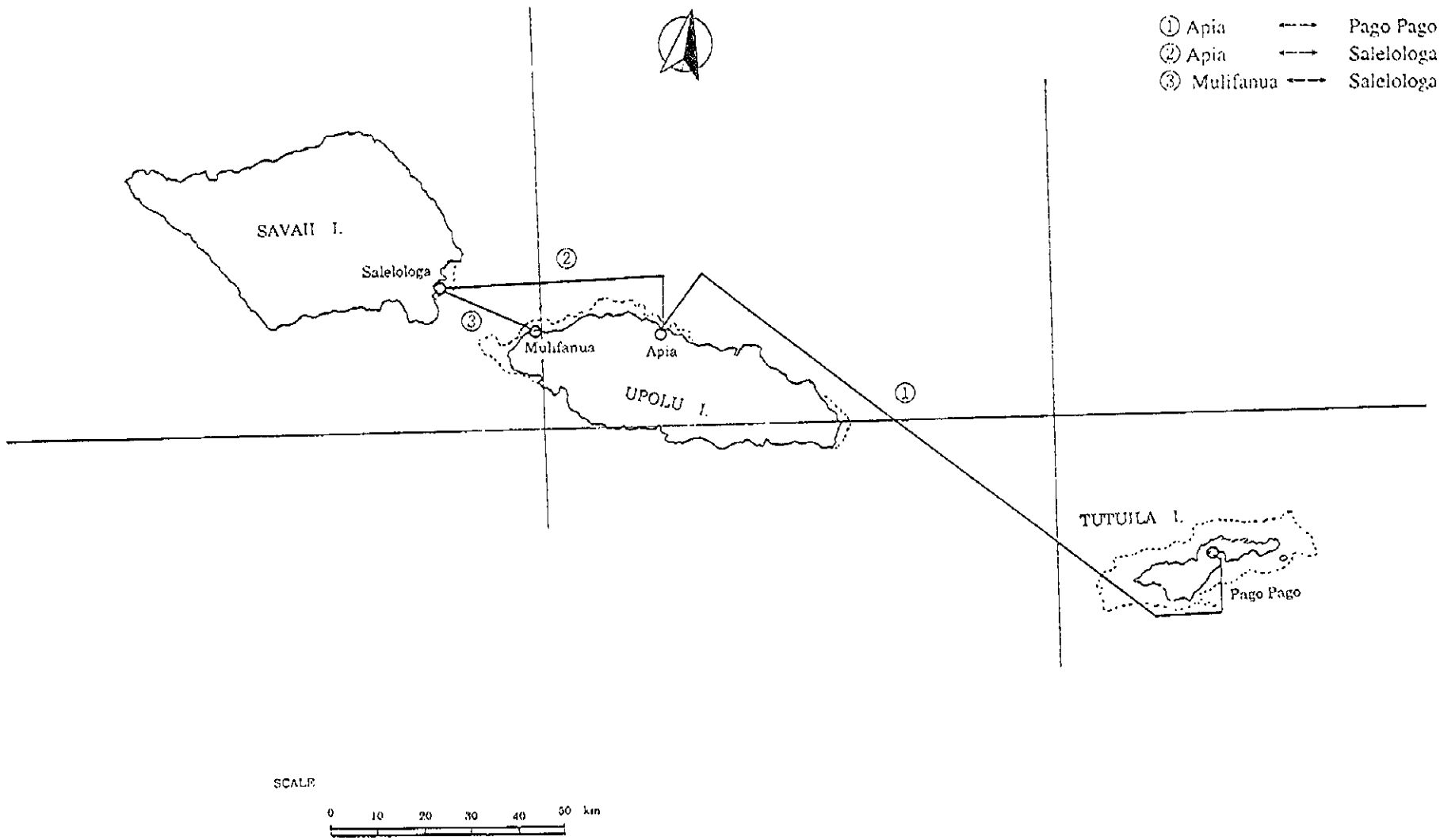
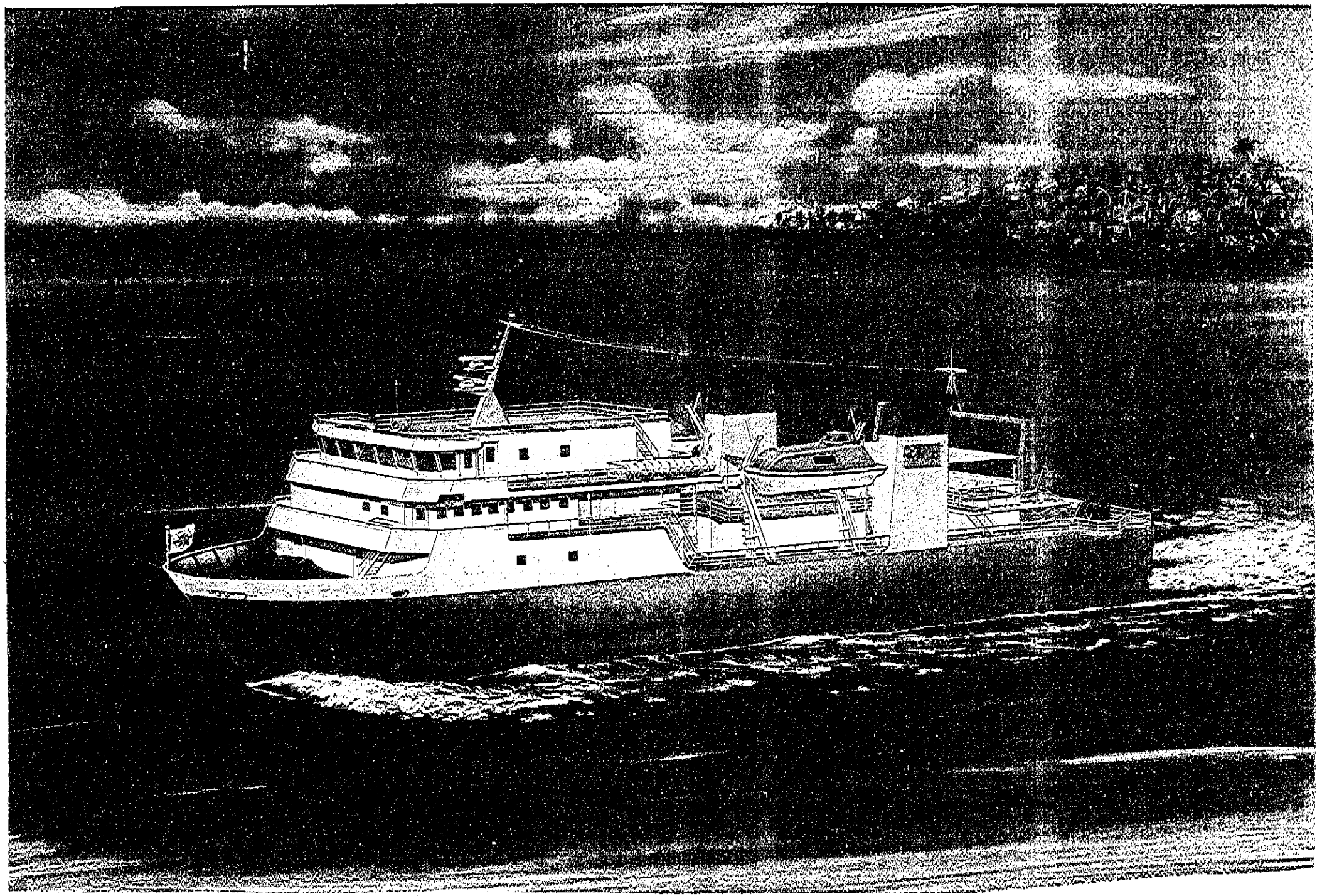
SERVICE ROUTES





Abbreviations

COLREG	Convention on the International Regulations for Preventing Collisions at Sea
CPP	Controllable Pitch Propeller
DWT	Dead Weight Tonnage
EGC	Enhanced Group Call
FPP	Fixed Pitch Propeller
GMDSS	Global Maritime Distress and Safety System
GOC	General Operator's Certificate
GT	Gross tonnage
ICLL	International Convention on Load Lines
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
ISM	International Safety Management Code
ISO	International Organization for Standarization
Lo-Lo	Lift on Lift off
MARPOL	International Convention for the Prevention of Pollution from Ships
NAVTEX	Navigation Telex
NK	Nippon Kaiji Kyoukai
Ro-Ro	Roll on Roll off
SOLAS	International Convention for Safety of Life at Sea
TM	International Convention on Tonnage Measurement of Ships
USCG	United States Coast Guard
VHF	Very High Frequency
WSSC	Western Samoa Shipping Corporation Ltd.

CONTENTS

Appendices

1. Background of the Request

Samoa is an island nation in the Southwest Pacific, comprising Upolu Island, Savai'i Island, and seven small islands. The Samoa economy is based on primary industries, mainly agriculture and fisheries. Exports consist primarily of agricultural produce; while export volume is small in comparison with that of imports (mainly durable consumer goods and foodstuffs), import shipment as well as that of export shipments are heavily dependent on marine transport, which, in an island nation, plays a major role not only in economic activity but also in daily life. Some 11% of the country's 200,000 annual arrivals and departures are by water, with more than 60% of the total comprising residents of either Samoa or American Samoa. While the two Samoas are politically separate and distinct, they share common ethnic, cultural, and societal roots, with close ties of consanguinity. As a result, travel between the two Samoas is perceived by Samoans as interregional in nature, rather than international, forming a natural part of their everyday lives.

Foreign liner serving Samoa do not essentially handle passengers or small cargoes between Samoa and American Samoa. Although marine transport demand in Samoa is growing, potential profits from this activity do not yet justify commercial investment. Since private carriers find it difficult to enter this market, at the present time, the only company offering passenger and small cargo services to American Samoa is the Western Samoan Shipping Corporation Ltd.(WSSC), which is owned by the Samoa Government. The only WSSC ferry providing international passenger service on this route is the M/V Queen Salamasina, but this vessel ran aground during the severe cyclone that hit the country in 1990, resulting in severe damage to the hull, engine, and electrical facilities which left it inoperable. Although the vessel was later repaired and returned to service, the original damage was so extensive that, even after this restoration work, the maintenance costs required to insure operational safety have continued to escalate. This burden has not only had a major impact on vessel's contribution to WSSC but, as a result of safety inadequacies based on SOLAS (International Convention for the Safety of Life at Sea), the present vessel is soon likely to be denied permission by the U.S. Coast Guard to enter the harbor in American Samoa. Under the circumstances, the Samoa Government has drawn up a plan for constructing a replacement vessel for the M/V Queen Salamasina, titled " Project for Construction of the Inter-Islands Navigation Vessel In Samoa".

The Samoa Government has requested a grant-aid from the Government of Japan to implement the subject project, with WSSC, the company that operates the Queen Salamasina, designated as the implementing organization. The contents of the Request from the Government of Samoa were as follows :

Passenger ferry engaged in international route		1 vessel
Gross tonnage	about 990 t	
Length over all	about 46.00 m	
Designed draft	about 2.35 m	
Number of Passenger	220 p	
Service speed	about 11 knot	

Upon receiving the above Request from the Samoa Government, the Government of Japan entrusted a Basic Design Survey on the subject project to the Japan International Cooperation Agency (JICA). JICA, in turn, dispatched a Basic Design Survey Team to Samoa from March 8 to April 1, 1997.

This Team validated the contents of the Request with respect to the subject project and, for purposes of evaluating its suitability as well as the appropriate scale of the Plan vessel, carried out a field survey to gain an understanding of main transport conditions and problem areas in Samoa, with particular reference to domestic and international ferry services, vessel administration, operating plans, and maintenance management systems.

During its stay, the Team held a series of discussions with officials of the Samoa Government, and the basic understandings reached therein were compiled into a Minutes of Discussion, copies of which were signed and exchanged. After returning to Japan, the Team analyzed the survey findings, evaluated the socioeconomic benefits that the Plan would bring to Samoa, and prepared a Basic Design Outline, including the optimum scale of the Plan vessel along with machinery and equipment specifications. The contents of this Basic Design have been compiled into the Draft Report.

In order to explain and discuss the contents of the Draft Report on the Basic Design, JICA dispatched a second Survey Team to Samoa from May 25 to June 3, 1997. The Team reviewed and discussed the contents of the Draft Report with concerned parties .

Based on the above findings, this Report incorporates the Basic Design for the Inter-Island Navigation vessel which has been deemed most appropriate for Plan implementation along with a project implementation plan and a project evaluation. Details on Team composition, discussants in Samoa, the field survey itinerary, and the Minutes of Discussion are shown in the Appendices following the body of the Report.

2.Contents of the Project

2.1.Objectives of the Project

The Queen Salamasina offers the only convenient international passenger ferry service between the island nation of Samoa and American Samoa. However, owing to cyclone damage and superannuation, this vessel has found it increasingly difficult to provide efficient and economical transport service on this key route. The Project, therefore, is intended to enhance Samoa's economic performance in the marine transport sector by providing a new replacement vessel for the Queen Salamasina.

The Queen Salamasina was originally designed for short-range domestic service within Samoa. With a small cargo-carrying capacity and limited loading space for vehicles, as well as passenger

facilities that are quite unsuitable for long voyages, operations are not economically viable, and so the vessel is considered to be quite inefficient. In this sense, while it is true that the cyclone damage was the direct catalyst for the Request to replace the Queen Salamasina, the project should be viewed not simply as a plan to construct a replacement vessel but rather as one to provide an efficient and economically viable vessel, designed for and capable of meeting the demand on the intended courses.

Some 90% of the Samoa population is of Polynesian stock sharing a unique traditional culture with American Samoa. Although Samoa has been politically separate from American Samoa since 1899, when the Eastern Samoan islands were placed under American rule and Western Samoa under German, in view of their common ethnic roots and social culture, the two Samoas retain extremely close blood ties, resulting in thriving human and economic contacts. Travel between the two Samoas, as perceived by the Samoans, is not considered international in nature but rather regional intercourse within a single country and so plays a key role even in their everyday economic life. The subject Plan, accordingly, involving the construction of a passenger ferry indispensable to the nation's transport network, has a high degree of need and urgency. By greatly enhancing convenience and economic efficiency, it can be expected to increase the flow of people and goods between Apia and Pago Pago in American Samoa.

Furthermore, if, as a result of this Plan, the number of days required for vessel inspections and maintenance are reduced, permitting a corresponding increase in vessel operating days, in addition to the present weekly service between Apia and Pago Pago, vessel routes can be expanded also to Salelologa on Savai'i Island, and Mulifanua in Upolu Island leading to expansion of agricultural shipments from that island. This would, in turn, contribute to a reduction in both transport time and costs for export produce from that island, thereby responding to two key development goals of the Samoan government : export expansion and the economic development of Savai'i Island.

2.2.Basic Concept of the Project

2.2.1.Contents of the Request

The principal contents of the Request for the Plan vessel are shown below :

Classification of the vessel: Roll on - Roll off cargo passenger vessel engaged on international voyage

Principal particulars of the Plan vessel, as shown in the Request, along with those of the main existing vessels operated by the WSSC (Western Samoa Shipping Corporation Ltd.) are given Table 1-1.

Table 1-1 Principal particulars of the requested plan vessel and the WSSC fleet

	the Plan Vessel	M/V Queen Salamasina	M/V Lady Samoa II
Length over all	about 46.00 m	43.00 m	43.30 m
Breadth, molded	11.40 m	10.20 m	11.50 m
Depth, molded	3.80 m	3.10 m	3.90 m
Designed draft	2.35 m	2.30 m	2.25 m
Gross tonnage	about 990 t	714 t	867 t
Dead-weight	165 t	120 t	
Main engine	800ps/900rpm x 2	390ps/900rpm x 2	1200ps/900rpm x 2
Generator	225 kVA x 2	90 kVA x 2	130 kVA x 2
Propeller	FPP x 2	FPP x 2	FPP x 2
Service speed	about 11 knot	about 9.5 knot	11 knot
Endurance	about 2,500 n.m.		
Crew	17 p	14 p	12 p
Passenger	220 p	206 p	480 p
Cargo gear on board	crane: 3 t fork lift: 3 t	fork lift: 2 t	no
Bow thruster	fitted	fitted	fitted
Water maker	3 t/day	no	no
Classification Society	NK or Lloyd	Lloyd	NK, changed to Lloyd

2.2.2. Service Routes for the Plan Vessel

The primary route traveled by the Queen Salamasina, the vessel that is to be replaced under the subject Plan, is a weekly round trip between Apia and Pago Pago In addition, when the Lady Samoa II is laid up for maintenance works, it also provides supplementary ferry service between Mulifanua and Salelologa. And, subject to emergency requests, the Queen Salamasina may also be mobilized for charter service when other vessels are unavailable for this requirement.

Not only do the majority of the people of Samoa and American Samoa share the same ethnic and cultural roots, but more than half are said to have relatives on the other side of the line, creating a brisk traffic in both people and goods. Lower-to-middle income groups in Samoa are particularly dependent on low-cost marine transportation. The Queen Salamasina, which is the present vessel on the Apia - Pago Pago route, is already 20 years old and superannuated; and, since it has not been completely repaired following a reef-grounding accident in the wake of the 1990 cyclone, it does not satisfy the safety requirements imposed by the latest SOLAS (International Convention for the Safety of Life at Sea) edition and amendments. It is feared, therefore, that, after March, 1998, the U.S. Coast Guard will no longer sanction the use of this vessel on the Apia - Pago Pago service. A replacement vessel is, thus, essential for this vital service.

With respect to the domestic service between Mulifanua and Salelologa, at present, the Lady Samoa (867 gross tons) makes 3 round trips daily. However, since the vessel must undergo

regular maintenance checks every Tuesday, only one round trip voyage is possible on that day, with the remaining two crossings handled by the Tausala Salafai (122 GT) and the Fotu-o-Samoa (272 GT). However, owing to the very limited cargo capacity of these substitute vessels, their use causes considerable inconvenience to the transport service between Savai'i and Upolu Islands. The new vessel will, therefore, be obliged to serve the domestic route between Savai'i and Upolu Islands on days when the Lady Samoa II is idled by maintenance works.

The development of Savai'i Island has been made a priority issue in the National Development Plan as a means of rectifying economic disparities within the country, and so the development of agriculture and export products from this island has become a policy imperative for the Samoa government. Under present conditions, export produce from Savai'i Island is first shipped to Mulifanua on the Lady Samoa II and then moved by road to Apia, where it is reloaded aboard the Queen Salamasina for export to American Samoa. This situation not only introduces major inefficiencies in terms of transshipment costs and waiting times but also raises overall transport costs. If a direct route were to be opened between Savai'i Island and American Samoa, this would be effective in developing agricultural exports and reducing transport costs thereon, which, in turn, could be expected to result in major economic benefits.

Based on the above considerations, the calling ports for the new vessel will comprise Apia, Mulifanua, Salelologa, and Pago Pago. The Plan routings are shown in the following figure.

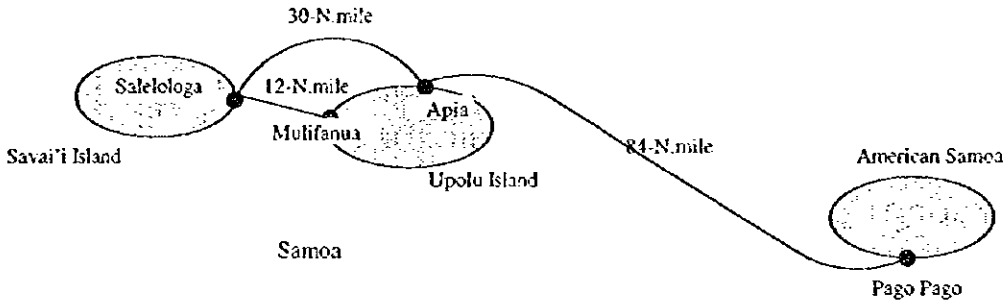


Fig. 2.-1 The Plan routings

The Apia - Pago Pago sailing will depart Apia at midnight Wednesday, arriving at Pago Pago Thursday morning. After unloading and reloading passengers and cargo, the return voyage will leave Pago Pago Thursday evening, arriving in Apia harbor at midnight. The Apia - Salelologa route will be served by 4 round trips a week -- on Monday, Tuesday, Wednesday, and Thursday --, while 2 round trips per week, on Monday and Tuesday, are planned for the Salelologa - Mulifanua service. The weekly service plan is shown in the following chart.

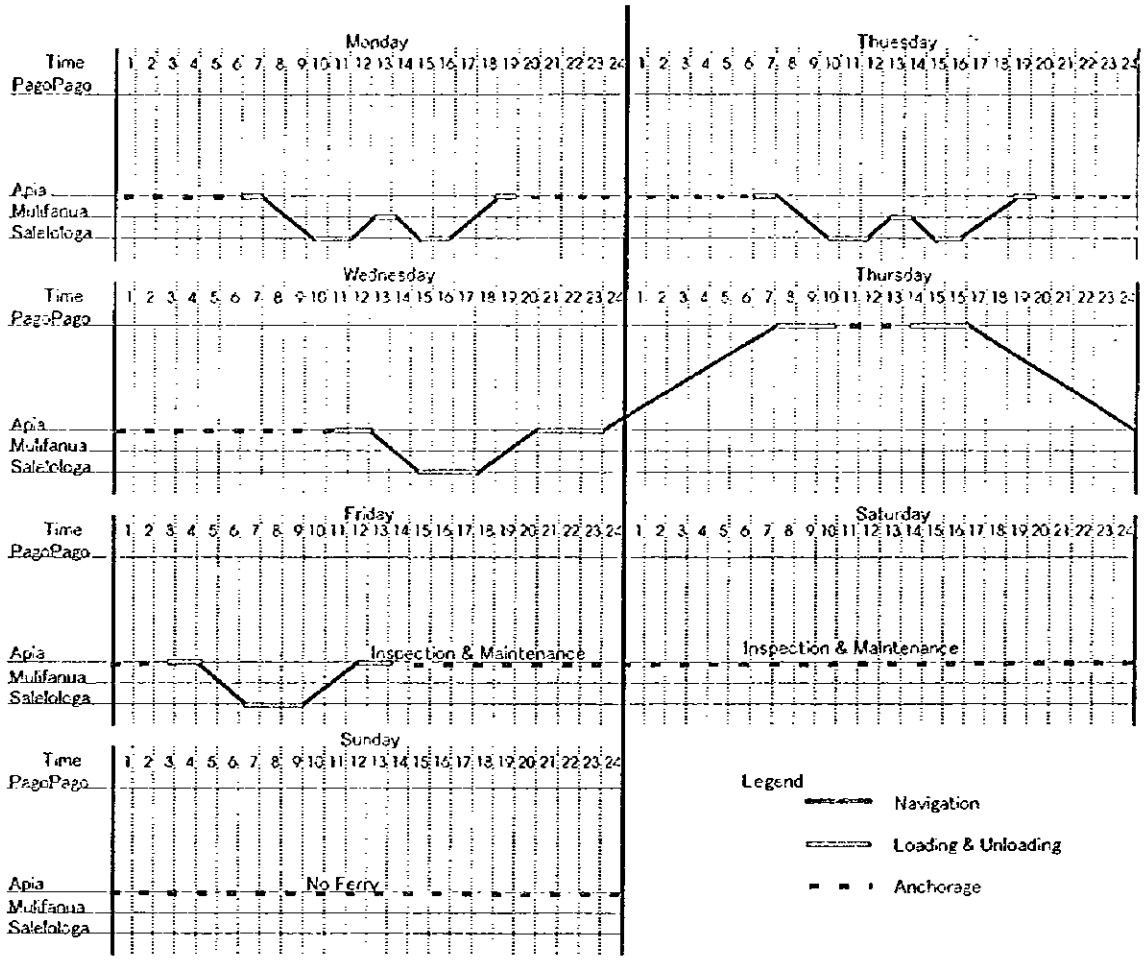


Fig. 2.-2 The weekly service plan of the Plan Vessel

2.3.Basic Design

2.3.1.Design Concept

(1) Safety Maintenance

Following the major accidents involving M/V Scandinavian Star, M/V Herald of Free Enterprise and M/V Estonia, IMO (International Maritime Organization) and the various Classification Societies revised their regulations pertaining to passenger ferries on international voyages in a determined effort to insure strict safety. The subject Plan vessel is to be donated, under a grant-aid, by the Government of Japan as a passenger vessel, and so special attention will be given to safety considerations, in accordance with the international maritime regulations which set international standards in this area. The vessel, accordingly, will conform to the strict SOLAS Convention governing international maritime operations and will be designed to provide maximum safety and stability, equipped with fire-prevention and fire-fighting apparatus,

lifesaving equipment, navigation gear, radio equipment, and engines. In the case of a passenger vessel, there can be a range of interpretations among responsible agencies in connection with SOLAS, and, with respect to the Plan vessel, careful consideration must be given from the basic design stage to the SOLAS interpretations of the Classification Society, which will serve as proxy for the Samoa Government, and those of the USCG, based on the fact that the vessel will be making regular trips to American Samoa.

(2) Vessel Amenities :

The amenities aboard M/V Queen Salamasina are quite poor, as evidenced by the very cramped passenger compartments, the lack of air conditioning or canteen, and the limited number of toilets. The ship is, therefore, the target of constant criticism from passengers. In designing the Plan vessel, careful attention will be paid to these factors so as to provide proper amenities for a long sea voyage in term of both time and distance.

The Queen Salamasina, moreover, has become a basic mode of transportation for lower-to - middle income families in Samoa who travel to Pago Pago to visit relatives or shop for daily necessities. And since the vessel is also used by many elderly and handicapped persons, in order to provide ready access by wheelchair to the bathroom, the shop, and other facilities, thresholds and uneven floor levels will be eliminated, with hand railings to be provided in the toilet for physically disabled passengers.

SOLAS rules on vessel stability will be strictly observed to prevent capsizing. In addition, to avoid severe rolling so as to keep seasickness to the minimum, special care will be take in connection with the bilge keel to make it as wide as possible but not to project from the sides nor bottom.

(3) Rationalization of Cargo Handling

Under existing conditions, an inordinate amount of time is consumed for loading and discharging general cargo. Handling efficiency is poor for general merchandise, which is the major category of cargo, characterized by sundry sizes and weights in a variety of packages and containers which are loaded on the cargo deck, preventing efficient use of effective deck capacity . And in the absence of weighing scales, and with the loading rush prior to sailing by passengers and shippers, exact weights are unknown, with shipping charges assessed on the basis of rough estimates, leading to major disparities between documented and actual weights. There is an urgent need for improvement also in cargo loading, unloading, and other transport functions. In this connection, consider will have to be given in this Plan to rationalization of loading and unloading

operations through containerization and a reduction in operating times, subject to local conditions. These containers will also be necessary for purposes of improving loading efficiency. Thus, the size of the cargo hold in the new vessel will be set so as to accommodate the stacking of containers and other types of unit cargoes, with broken spaces to be held to an absolute minimum.

(4) Maintenance Function :

In the hull and rigging work, we will consider the partial use of highly durable materials in components subject to severe wear and tear, such as the use of corrosion-resistant materials in the piping work. In particular, if coatings are applied to the interior surfaces of sea water pipes, while this would inevitably increase material costs, it would be truly advantageous in the long run, since it would eliminate the need for pipe replacement work on the ship bottom every few years, resulting in sizable maintenance economies after the vessel is placed in service. Particularly since the Plan vessel, as a passenger vessel, will be obliged to abide by SOLAS regulations, one regular inspection will be mandatory each year. The vessel must, therefore, be economically outstanding in terms of inspection costs (reducing docking-time and the requirement for repair materials in dry docking), fuel and other operating costs, repair costs, and maintenance charges.

Parts procurement can be inconvenient in the island nations of the South Pacific and, when equipment breaks down, it is often difficult to obtain prompt maintenance assistance ; so that even a small breakdown can result in a suspension of operations. In order to overcome such problems, WSSC, under the guidance of a JICA expert, has drafted a maintenance program designed to prevent breakdowns and damage, a portion of which has already been implemented. Under this program, propeller shaft bearings and other items that are subject to severe wear are replaced at periodic intervals, creating a requirement for an unusually large inventory of spare parts. Consideration will also be given in this Plan to providing sufficient spare parts to meet the parameters of the parts control system adopted by WSSC.

(5) Rules to apply

To design and construct the Plan vessel, following rules and regulations including international conventions shall apply, and the certificate of compliance shall be obtained upon completion of the vessel.

Table 1-2 List of rules to apply

Rules and Regulations	Contents	Ratification by Samoa
International Convention for the Safety of Life at Sea (SOLAS) (1974 edition and amendments thereafter)	Safety regulations, e.g. watertight integrity, machinery & electric, fire safety, lifesaving, radio, navigation aids, etc.	Ratified
International Convention for the Prevention of Pollution from Ships (MARPOL) (1973 edition and amendments thereafter)	Prevention of pollution by oil, chemical, sewage, garbage, etc. from ships.	Under working for ratification
International Convention on Load Lines (ICLL) (1966 edition and amendments thereafter)	Internationally unified formula to determine maximum draft, for equal standard of cargo loading and for avoiding excessive loading.	Ratified
International Convention for the Prevention of Collision at Sea (COLREG) (1972 edition and amendments thereafter)	Rule of sea traffic and navigation lights arrangement to avoid collision at sea	Ratified
International Convention on Tonnage Measurement of Ships (TM) (1969 edition and amendments thereafter)	Internationally unified formula to determine gross tonnage and net tonnage, which are base for port duty, etc.	Under working for ratification
U. S. Coast Guard (USCG) Control Verification for passenger vessels	Inspection by USCG for passenger vessels who call U. S. port.	-
USCG Regulation for pollution prevention and navigation	Regulation imposed to foreign flag vessels who call U. S. port.	-
South Pacific Maritime Code	Unified regional rules in the South Pacific island countries	-
Samoa Shipping Act	Fundamental Shipping Rules of Samoa	-
Japanese Maritime Regulations	Referred to in such a scope as not covered by above rules	-

While Samoa has not ratified some of the above international treaties, Samoa Shipping Act stipulates that vessels serving international voyages will be subject to all international treaties. While, even though the flag state is not the member country of the convention, when entering foreign ports, the vessel will require that these international treaties be applied.

2.3.2. Demand Forecast of Passenger Traffic and Cargo Volume for the Plan Vessel Vessel Scale

2.3.2.1. Priority Factors in Determining Vessel Scale

The Queen Salamasina is the only passenger ferry in international service that the Samoan people can conveniently use. However, as a result of cyclone damage and superannuation, this vessel has found it difficult to maintain efficient and economical operations. Under the subject Plan, therefore, a new vessel will be replaced for the Queen Salamasina with a view toward stimulating

the country's economy through the marine transport sector. In order that the Plan vessel can at the same time cope with the growing demand for domestic ferry transport, it will also serve the ports of Mulifanua and Salelologa, though this service will be of a supplementary nature when the existing vessel serving these ports, Lady Samoa II, is idled by inspections and maintenance or during particularly busy periods. Accordingly, the priority factors determining vessel scale will be the conditions prevailing on the international service between Apia and Pago Pago.

2.3.2.2. Current Conditions on the WSSC Apia - Pago Pago Service

In February, 1990, Samoa was hit by Cyclone Ofa , followed by Cyclone Val in the following year. The two cyclones caused severe damage throughout the country, with particularly heavy damage inflicted on the marine transport sector -- ports and vessels alike. Two WSSC vessels -- the Queen Salamasina, operating mainly between the capital, Apia, and Pago Pago in Americans Samoa, and the Lady Samoa II, providing domestic ferry service between Upolu and Savai'i Islands -- were incapacitated after running aground on reefs.

After extensive repairs, both vessels were returned to service, but transport on both the domestic and Pago Pago routes suffered a devastating blow. The following chart shows trends in operating revenues from the Pago Pago service. The data from 1990 to 1993 showed chaotic fluctuations, making it difficult to establish a firm time series. 1994 data were unavailable but are presumed to follow the same trend line as for 1995 and 1996.

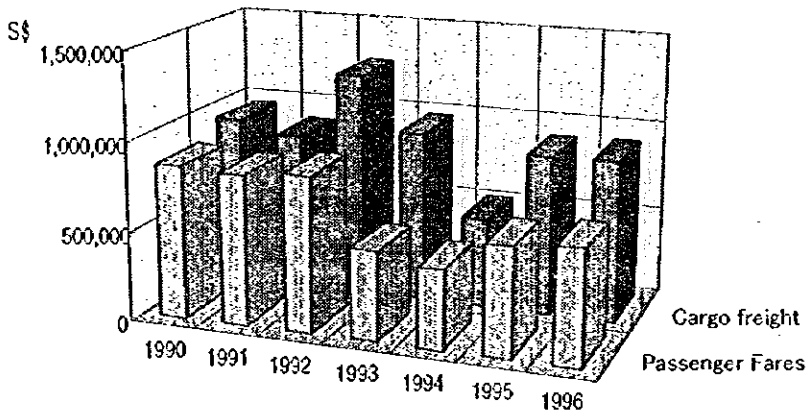


Fig. 2.-3 The trends in operating revenues from the Pago Pago service

The operating performance of the Queen Salamasina on the Apia - Pago Pago service in 1996 was as shown in Table 1- 3.

Table 1-3 The operating performance on the Apia - Pago Pago service (1996)

Route	Number of Trips	Total Number of Passengers	Median Number of Passengers
Apia – Pago Pago	57	10,198	206
Pago Pago – Apia	61	8,867	147

Passenger traffic is particularly heavy on this route, with bookings often exceeding rated capacity, so that almost every sailing is solidly booked. This is reflected in the fact that, although the Queen Salamasina has a rated capacity of 206 passengers, this figure is also the median passenger load per trip. Demand on this route has also shown sharp seasonal increases and, at peak periods, up to 253 persons had been boarded by special authorization. The following chart shows the trend in]

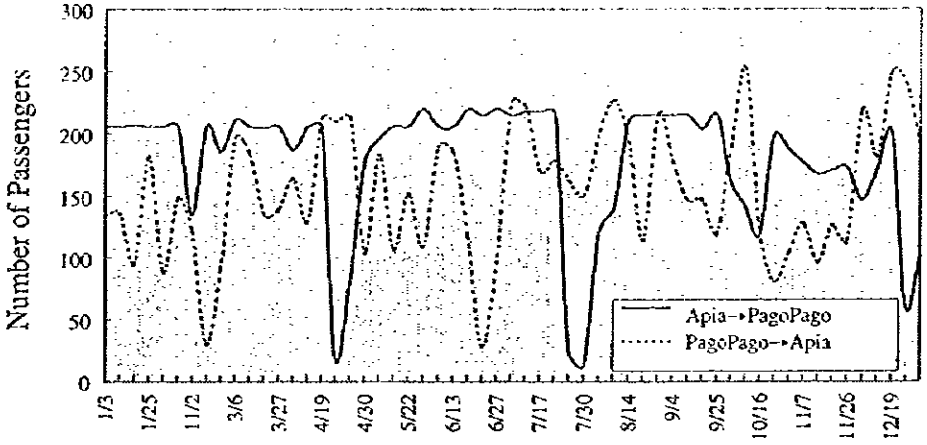


Fig. 2.-4 The trend in Passenger loads per trip on Apia - Pago Pago route for 1996

No figures are available on cargo volume on the WSSC Apia - Pago Pago service. The following figure shows cargo revenue per voyage for 1996. Cargo revenue from Pago Pago to Apia are about double those from Apia to Pago Pago. Unit rates from Pago pago to Apia are shown in USdollars, for example, unit rates of a small baggage from Apia to Pago Pago is given in eight Samoan Tala, whereas those from Pago Pago to Apia is shown in seven US dollars (1US$ = S$2.4 : Mar. 1997)

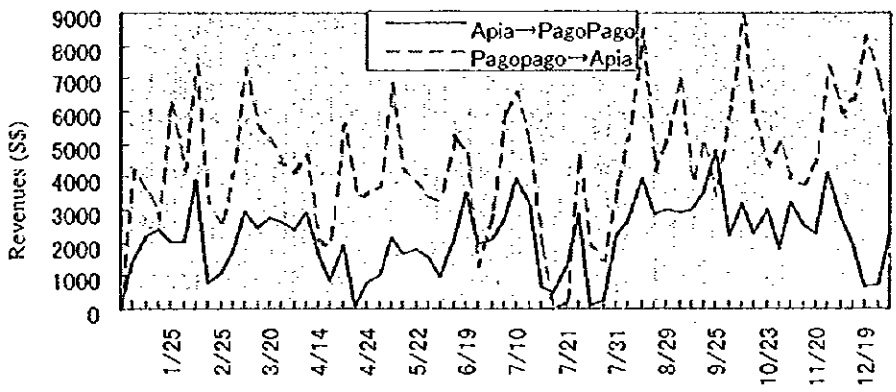


Fig. 2.-5 cargo revenue per trip for 1996

2.3.2.3. Demand Forecasts for Passenger Traffic and Cargo Volume for the Pago Pago Service

The past operating record of the Queen Salamasina is shown in the following chart. Since the ship ran aground on a reef in 1990 and, as a result of progressive aging, sailing frequencies have been decreasing. But it is eminently clear that this decline has been less the result of demand shifts based on changes in the external environment than that of physical constraints in the vessel itself. As it has been difficult to foresee a demand based on a time series from past performance, particularly in the absence of data for 1994. Data for 1996 is adopted to prepare a demand forecast.

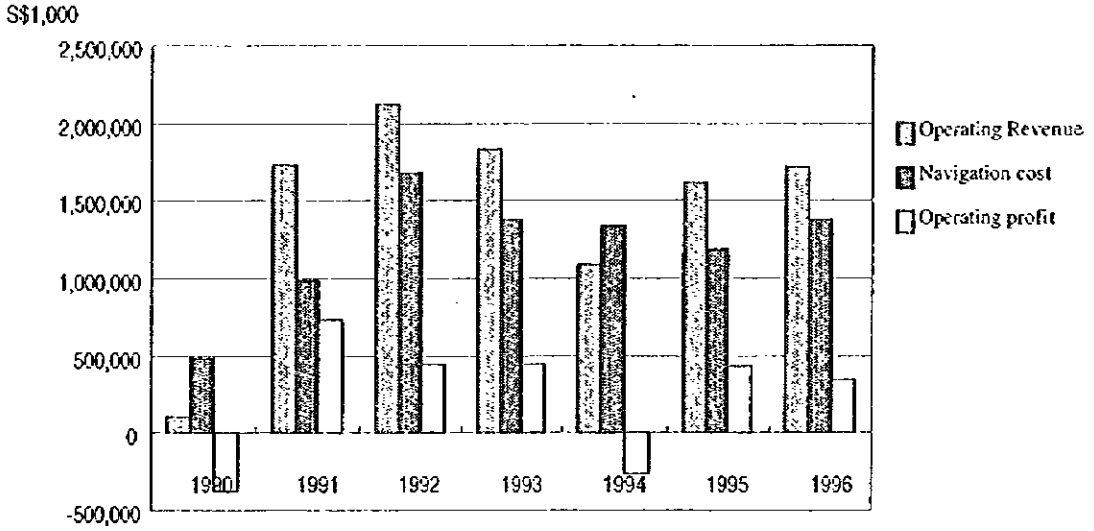


Fig. 2.-6 The past operating record of the Queen Salamasina

(1) Passenger Traffic :

In determining passenger traffic, a major constraint is the international nature of the route, which imposes severe conditions, such as safety requirements. In this analysis, since traffic from Apia to Pago Pago is consistently higher than that in the opposite direction, traffic projections have been set on the basis of 1996 passenger traffic from Apia to Pago Pago. In that year, the total number of passenger carried in the outbound direction came to 10,198, spread over 57 voyages, resulting in an average of 178.9 persons per trip, with a maximum of 220, a minimum of 12, a median of 206, and a standard deviation of 52.13 passengers. The following chart shows the frequency distribution of passenger traffic per voyage from Apia to Pago Pago.

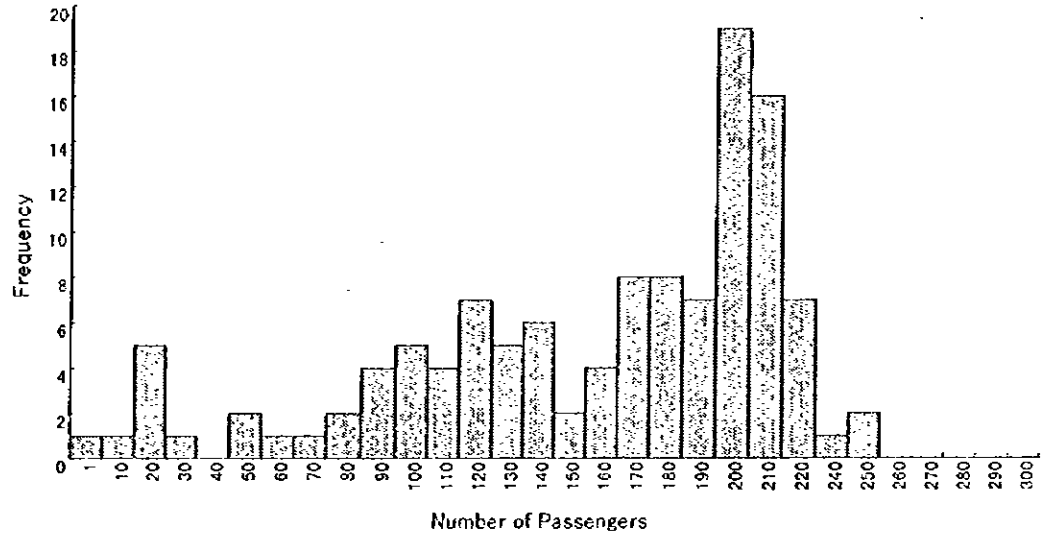


Fig. 2.-7 The frequency distribution of passenger traffic per trip

The rated passenger capacity of the Queen Salamasina is 206 persons, though loads exceeding capacity have been recorded during busy periods, based on special authorization. At present, the U.S. Coast Guard is intensifying its restrictions on passenger overloading, with a fine imposed of US $1,000 per excess passenger. As a consequence, even with an excess of bookings, the capacity limit is being respected. If, for argument's sake, there were no capacity limits, so that the frequency distribution of the passengers actually carried could be considered a Gaussian distribution, a capacity of 260 persons would be required to satisfy passenger demand on 85% of total trips, whereas, with a capacity of 220 persons, it would only be possible to meet demand on 60.64% of total trips. Thus, the 220 person capacity shown in the Request, viewed against present passenger loads, cannot be considered excessive.

(2) Cargo Volume

Taking account of the relationship between cargo revenue from Apia to Pago Pago in 1996, shown in Fig.2.-5, and the cargo revenues and weights taken during the boarding survey, a frequency distribution chart is shown below based on an estimated conversion from unit cargo rates to cargo weight. Since cargo rates from Apia to Pago Pago are shown in Samoan Tala, whereas those from Pago Pago to Apia are given in US dollars, the effective unit rate from Pago Pago to Apia is about double that in the other direction.

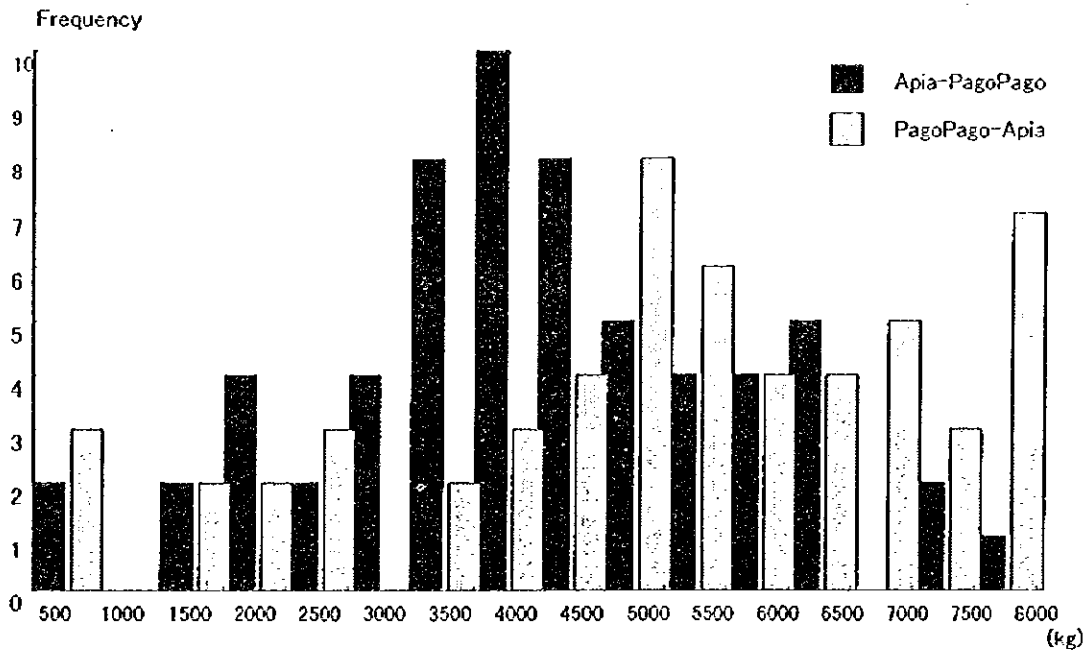


Fig. 2.-8 The frequency distribution of Cargo Weight per voyage

The median cargo load from Apia to Pago Pago is 50,305 kg, with a standard deviation of 22,720, whereas the median figure from Pago Pago to Apia is 39,116 kg, with a standard deviation of 16,627. Since, as in the case of passenger data, the cargo weight on the Apia - Pago Pago run is higher than on the return leg, the former figure has been considered as the design condition.

In the case of passengers, even when boarding is denied due to capacity overload, the stranded passengers have the option of using one of 9 daily flights, albeit at a higher fare. But, in the case of cargo, only one vessel a month provides scheduled foreign liner service and so, in effect, cannot be used for cargo that is not organized quantitatively to permit container loading. For this reason, it is planned to cover cargo demand for at least 85% of island trips. In order to meet this cargo demand via 85% of total sailing between Apia and Pago Pago, the median load works out to 50,305 kg, standard deviation of 22,720. On this basis, a carrying capacity of 74 tons will be required. With this 74 ton capacity, it is estimated that left-behind cargoes would be eliminated on 98.2% of total voyages on the Pago Pago - Apia route. If we further consider the relationship between cargo capacity and projected vessel revenue, we see that, when capacity exceeds 74 tons, unit revenues start to decline. On this basis as well, under present conditions, the 74 ton capacity figure is economically appropriate.

The following chart shows cargo capacity, cargo volume, and project revenue for the Plan Vessel.

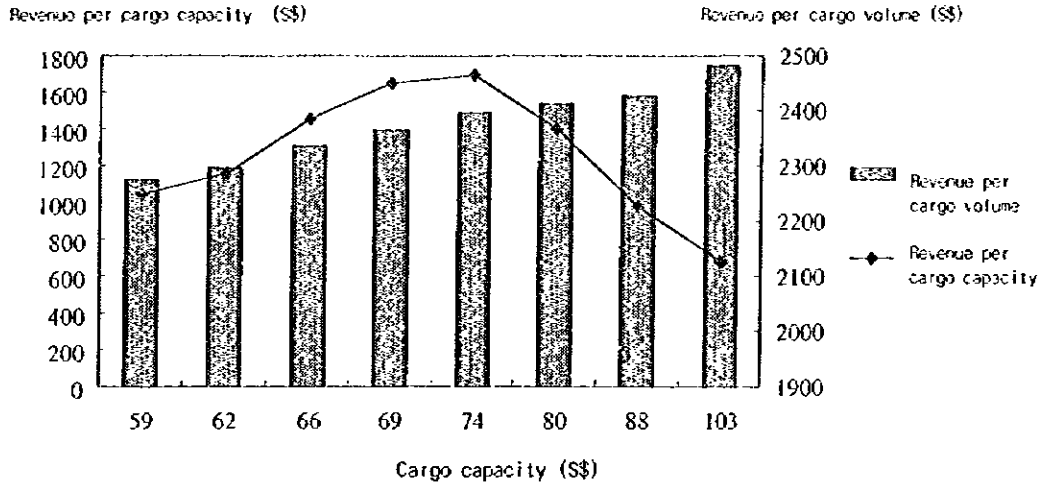


Fig. 2.-9 Cargo capacity, cargo volume and project revenue for the Plan Vessel

2.3.2.4.Domestic Service

(1) Passengers

In this Section, forecasts will be made of passenger traffic and vehicles carried on domestic routes together with the share of each category projected for the Plan vessel as a basis for revenue calculations.

The following figure shows the revenues earned on the domestic ferry route between Mulifanua and Salelologa from 1990 to 1996, along with future projections. The approximate curve for actual values is expressed by the formula : Y = 545925 log e X + 1313000. From this approximation equation, the 1999 passenger revenues from domestic ferry services have been projected at S$ 2,520,672.

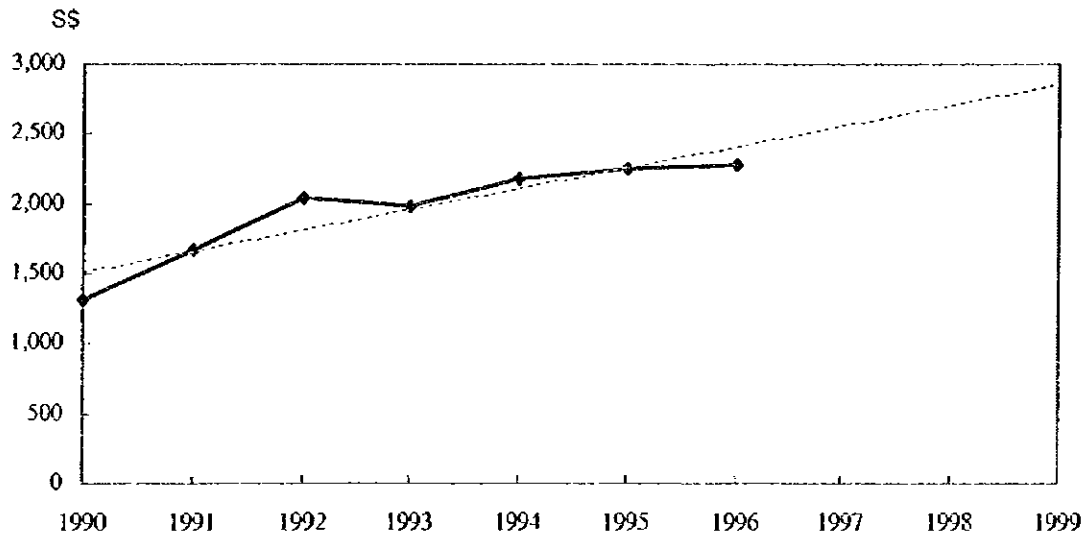


Fig. 2.-10 The passenger fares earned on the domestic ferry route

The actual passenger traffic for 1995 and 1996 was 409,367 and 419,873 respectively, with 81% of the total adult passengers and 19% children and students in uniform. Based on these figures, the total forecast for 1999 passenger traffic comes to 464,212, comprising 376,012 adults and 88,200 children. The Lady Samoa II makes 3 round trips daily (except Tuesday) between Mulifanua and Salelologa, with one on Tuesdays, yielding a total of 19 trips per week, while the Plan vessel will make 2 round trips per week. On this basis, the total passenger load per round trip works out to 425, comprising 344 adult and 81 students. Accordingly, the annual passenger volume for the Plan vessel on the Mulifanua - Salelologa run is projected as follows : Total 44,200 /yr

Adults	344 persons	x	2 RT / week	x	52 wks / year	=	35,776 /yr
Children & Students in uniform	81 "	x	2 RT / week	x	52 wks / year	=	8,424 /yr
							Total 44,200 /yr

Since there are presently no scheduled sailing between Salelologa and Apia, it is understood that the bulk of the ferry passengers between Mulifanua and Salelologa are bound for Apia, though no actual figures on these movements are available. Once these two cities are linked by regular sailing, the new route will become most convenient, and so it may be presumed that the majority of travelers between these cities will use the direct ferry. Assuming that at least 30% of domestic ferry passengers will utilize the new Salelologa - Apia route, with 4 direct round trip sailing per week on this route, annual passenger traffic may be projected as follows : Total 26,416 / yr

Adults	163 persons	x	4 RT / wk	x	52 wks / yr	=	21,424 / yr
Children & Students in uniform	24 "	x	4 RT / wk	x	52 wks / yr	=	4,992 / yr
							Total 26,416 / yr

(2) Domestic Vehicle Transport

During 1996, 35,439 vehicles were carried on domestic ferry routes; their breakdown by types and percent distribution are shown in the following table.

Table 1-4. The breakdown of vehicles by types

types	Result of 1996	Percent distribution
Sedan	10,857	30.6%
Pickup	12,482	35.2%
Track (Small)	2,548	7.2%
Track (Medium)	8,806	24.8%
Track (Large)	611	1.7%
Trailer	135	0.3%
Total	35,439	100%

In terms of vehicles per RT voyage, there were 11.7 sedans, 12.73 pickups, 2.60 small trucks, 8.98 medium- size trucks, 0.62 large trucks, and 0.14 trailers.

The following chart shows the revenues from vehicle transport between Mulifanua and Salelologa from 1990 to 1996 together with future projections. The equation for actual values is expressed as :

$$Y = 173{,}093\ X + 617{,}728$$

Based on this equation, the projected volume for 1999 is 46,983 vehicles.

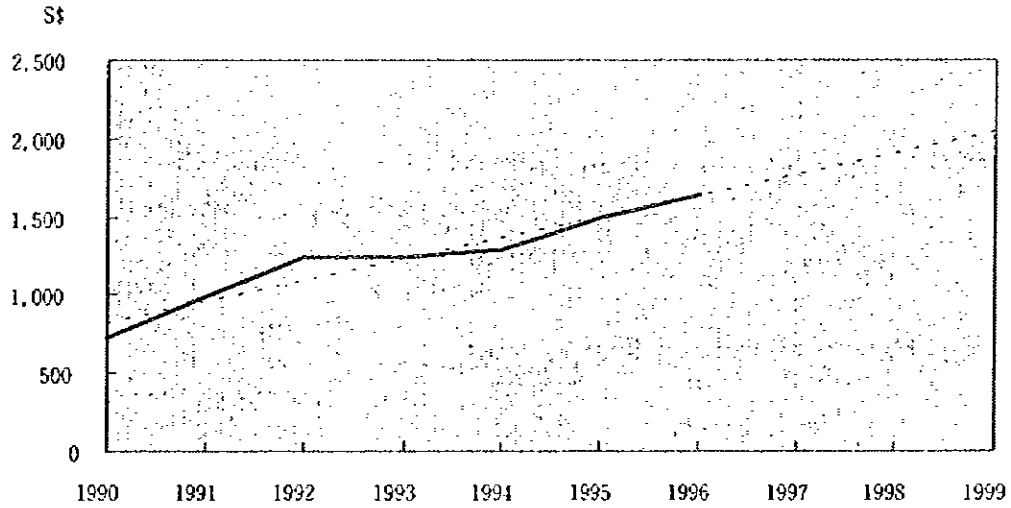


Fig. 2.-11 The revenues from vehicle transport

Accordingly, the demand for vehicle transport per trip on the Mulifanua - Salelologa route becomes 6.6 sedans, 7.6 pickups, 1.5 small trucks, 5.3 medium-size trucks, 0.4 large trucks, and 0.1 trailers. However, owing to space constraints on the vehicle deck in the Plan vessel, the maximum number of vehicles that can be accommodated will be 3 sedans, 3 pickup trucks, 1 small truck, and 5 medium-sized trucks.

In view of the present lack of scheduled sailing between Salelologa and Apia, most of the vehicles using the ferry service between Mulifanua and Salelologa are destined for, or originate from Apia, although again no actual data are available by either destination or origin. As in the case of passengers, assuming that at least 30% of the vehicle transport demand for domestic ferries will shift to the new Salelologa-Apia route, with a planned frequency of 4 round trips per week, a total of 2,684 vehicles are expected be carried on this service, comprising 822 sedans, 946 pickups, 193 small trucks, 657 medium- size trucks, 46 large trucks, and 10 trailers.

2.3.3.Basic Plan

2.3.3.1.Category of the Vessel

The routes to be engaged by the Plan vessel will link Apia, Mulifanua, Salelologa, and Pago Pago. The domestic portion of this network is intended to strengthen domestic transport services in Samoa, while the addition of Salelologa to the present international route between Apia and Pago Pago is expected to encourage the development of Savai'i Island, which has lagged behind that of Upolu Island. Accordingly, in the international maritime regulations, the vessel is classified in a category of "Passenger vessel engaged on international voyage" to transport passengers between Samoa and American Samoa, with service limitation of "Short international voyage". All international maritime regulations will apply according to this classification and service limitation of the Plan vessel.

In addition, as the United States will be the counterpart nation on the vessel's international routes, the vessel, as a passenger carrier, will be subjected to the special inspection performed on passenger vessels by the U.S .Coast Guard (USCG).

2.3.3.2.Type of Vessel ; Cargo Handling Systems

Possible loading systems for the Plan vessels include Ro-Ro (whereby loading is performed by vehicles under their own power), Lo-Lo (where loading is done by crane), and a combined Ro-Ro - Lo-Lo system. The factors determining the choice of system include the types of cargo to be handled, their shape, loading equipment on shore, and the configuration of the dock at which the vessel is to be regularly moored. Two members of the Survey Team boarded the ferry from Apia to Pago Pago, surveying in detail the conditions under which the Queen Salamasina operates.

On the outbound voyage, a total of 206 passengers were carried, along with a full load of 8.7 tons of general cargo, including 7 vehicles, taro, bananas, and coconuts. (These figures were as reported in the Cargo Manifest. The vessel left Apia port at 10:00 P.M., entering Pago Pago port at 6:30 A.M. the following morning. At 8: 00 AM, the passengers disembarked, the cargo was discharged, the return cargoes loaded, and the return passengers boarded. The vessel departed Pago Pago at 4:00 P.M., returning to Apia at 12:00 midnight. The returning passengers totaled 159, with a full load (9.7 tons) of general cargo loaded down to the water line, including 10 vehicles, spare parts, sundry goods, and foodstuffs,

Even after taking on this full load, a substantial portion of the general cargo assembled for loading had to be left behind. After studying the cargo transport records of the Queen Salamasina on this route , it was noted that there is a considerable demand for vehicle space; that, while general cargo on the outbound voyage consisted of agricultural products, that on the return trip comprised

mainly everyday necessities; that there is a wide diversity of package sizes and shapes, which would make the Lo-Lo method particularly inefficient; that the docks are designed to serve Ro-Ro vessels exclusively; and that there are no Lo-Lo loading facilities on shore. Based on these observations, the Ro-Ro method has been chosen as the loading system for the Plan vessel. However, a supplementary Lo-Lo system, including a small crane, should be added for use in case of high swell when landing shore ramp is not available and to load/unload from/to barge.

2.3.3.3.Classification Society

The Classification Society is an important organization. Not only does it inspect the hull structure and other items; it also serves as proxy for the Samoa government in conducting statutory inspections for various international maritime conventions and issuing certificates on behalf of the Samoa government. Regarding the inspection and issuance of certificate on behalf of Samoa government, it was confirmed by the Ministry of Transport of Samoa that the letter of authorization will be duly issued upon application. Domestic ferry M/V Lady Samoa II (867 tons gross), donated under the grant aid from Japan in 1988, was built and delivered under NK classification survey. However shortly after the vessel arrived in Samoa, the classification society was changed from NK to Lloyd, to make classification society same as M/V Queen Salamasina, who had been already in service for international voyage under Lloyd's classification. This policy was adopted to eliminate the extra expenses that would have been entailed if separate inspectors had to be invited from NK and Lloyd to conduct regular inspections on the two vessels. On the other hand, with regard to the inspection of a passenger vessel at the time of construction, if this were to be commissioned to the Lloyd Classification Society, the inspection would be conducted by its London headquarters, whereas, under the NK Society, it would be handled by NK's Tokyo headquarters. As a result, NK is clearly the logical choice, in terms of both time and cost, to conduct the construction inspection for a vessel built in Japan. For this reason, the vessel will be entered in the NK Classification Society for purposes of the construction inspection, though there is no reason why WSSC could not subsequently change over to the Lloyd Classification Society, if it so desired.

2.3.3.4.Service Speed

The condition governing the service speed of the Plan vessel is the cruising time established for the Apia - Pago Pago crossing. Based on port regulations at Pago Pago, normal office hours for Immigration and Customs personnel are from 8 :00 A.M. to 4 :30 P.M. As a matter of course, any work performed outside regular hours would be subject to overtime charges but, under Pago Pago port regulations, any workday which begins before regular opening hours would entail overtime rates for all hours worked on that day. If, therefore, the Plan vessel were to arrive in port in the early morning, before 8 :00 AM, this would only serve to increase WSSC's costs and so should be scrupulously avoided. For this reason, it is vital that the boat depart Apia as late as

possible and arrive in Pago Pago at the start of regular business hours.

Of course, when considering the traveler convenience, the departure time from Apia cannot be unduly late, with 12:00 midnight the absolute limit. On this basis, the cruising time from Apia to Pago Pago must be set at 8 hours. The distance between the two ports is 84 nautical miles and so, allowing for reduced speeds in narrow passages and within port, a cruising speed of 11 knots will be required. Even in the face of a certain amount of bottom fouling, wave action, or vessel aging, a speed of 11 knots must be maintained to meet schedules.

Navigation hours and port hours in the intended service routes of the Plan vessel have, accordingly, been planned, as shown in the following table, on the basis of a service speed of 11.0 knots.

Table 1-5 Navigation hours and port hours

Navigation hours	Apia - Salelologa	2 hours 30 min.
	Salelologa - Mulifanua	1 hour 15 min
	Apia - Pago Pago	8 hours
Port hours	Domestic services	1 hour 30 min
	International service (Apia ports)	3 hours
	International service (Pago Pago port)	4 hours

Regarding bottom fouling, marine growth as the cause of bottom fouling is moderate in the sea around Samoa. Tin-free SPC anti-fouling paint applied on M/V Queen Salamasina is working well resulting in loss of speed due to bottom fouling almost nothing.

With regard to sea condition, based on data on wave heights in the subject waters from the Ship Dynamics Division, Ship Research Institute, Ministry of Transport of Japan, significant wave height values in Samoan waters show a seasonal range of about 1.5 m to 2.2 m, averaging 1.86 m over the year. The latter value is even higher than the annual average for the Japan Sea, but slightly below the annual average of 2.1 m for Japan's Pacific coastline north of Tokyo. The South Pacific directly below the Equator can scarcely be called a calm sea, and the Queen Salamasina often arrives well behind schedule owing to heavy sea. Thus, in planning the new vessel, we shall use a sea margin (engine load increase due to heavy sea) somewhat higher than the 15% employed in conventional designs and anticipate setting this at about 30%, as used in the design of liner plying Pacific Ocean routes.

With regard to the loss due to vessel aging, this is largely a function of main engine maintenance and the application of superior bottom paint. With respect to the former, WSSC has already instituted a maintenance program, while, in regard to the latter, if superior paint is incorporated into the vessel specifications, the effects of aging can be effectively controlled. Accordingly, we do not intend to allow any special margin for changes due to vessel aging.

2.3.3.5.Main engine

The main engine should be of medium speed from view to accommodate in engine room, and of robust construction with engine speed not faster than 900 rpm.

It is concluded that the main engine horse power is required 1,200 ps (2 units) at each shaft to obtain 11 knots with 30 % sea margin, from the calculation of water resistance by the hull of 785 tons displacement and corresponding block coefficient of 0.680 and further adding the calculation of propeller efficiency.

Speed and power curve is as shown below.

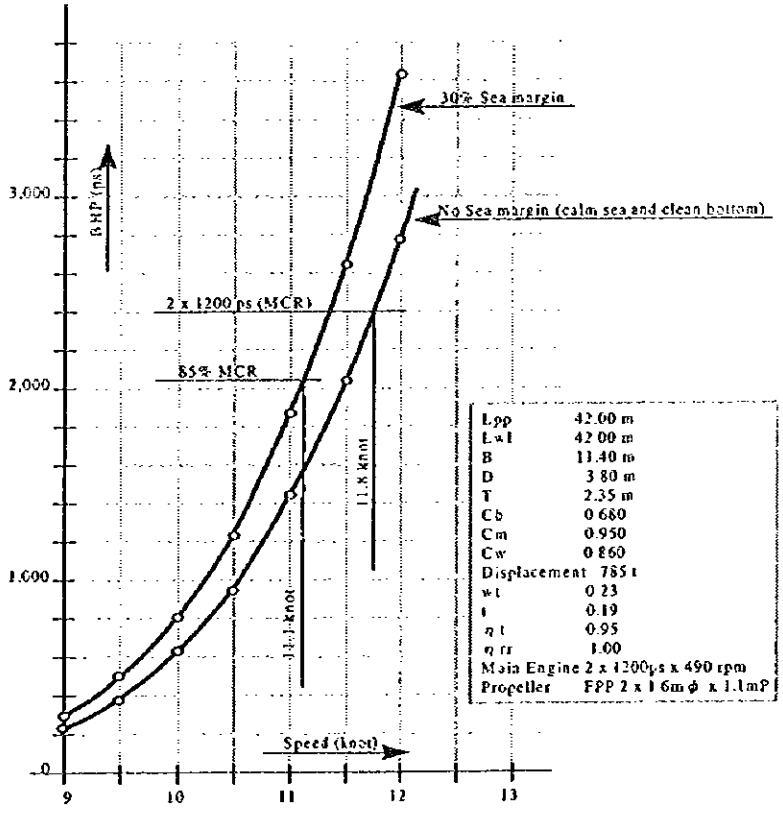


Fig. 1-12 Speed and power curves

2.3.3.6.Electric generator

Preliminary electric power balance calculation to determine the capacity of electric generator is summarized as follows.

Table 1-6 Electric power balance

Conditions		At sea	Maneuvering in harbor	Maneuvering in harbor (preferential trip)
E. load except bow thruster	kW	95	120	100
Bow thruster load	kW	0	77	77
Total e. loads	kW	95	197	177
Rated generator capacity	kVA			250
Power factor	%			80
Rated generator capacity	kW			200
No of running generator		1	2	1
Load rate of generator	%	48	49	89

Generator capacity is determined according to the electric loads of maneuvering in harbor executing preferential trip, as shown on the table above.

The generators are to consist of two identical sets, employed as follows.

At sea One set to carry all sea loads

Maneuvering in harbor Normally, two sets to run in parallel to carry all loads including bow thruster.

When one set is out of order, due to failure or overhaul, other one set is able to start bow thruster motor, by cutting non-essential electric loads, e.g. air conditioning system, under the preferential trip circuit.

One set of harbor generator and one set of emergency generator shall be provided. The emergency generator is installed according to SOLAS requirement, as electric loads in an emergency is too much to be fed from storage battery.

The electric source on board the vessel shall be 440 V, 3 phase, 50 Hz and 220 V, three and single phase, 50 Hz.

2.3.3.7.Capacity of fuel oil tank

Fuel oil consumption rate of the Plan vessel is estimated as follows.

Table 1-7 Specific fuel oil consumption

	At sea	Maneuvering in harbor
Main engine	1,200ps x 2 x 0.60 x 143g/ps.h x 10^{-6} = 0.205 ton/hr	-
Generator engine	300ps x 1 x 0.48 x 154g/ps.h x 10^{-6} = 0.022 ton/hr	300ps x 2 x 0.49 x 154g/ps.h x 10^{-6} = 0.045 ton/hr
Total	0.227 ton/hr	0.045 ton/hr

According to the weekly sailing time table of the Plan vessel, total sailing hours a week is 40.6 hours, and number of leaving and entering ports is 28 times. At every leaving and entering ports, two generators run to maneuver using bow thruster. Assuming maneuvering time at each time as 30 minutes, fuel oil consumption per one week will be:

0.227 ton/hr x 40.6 hr/week = 9.22 ton/week in the sailing time;

0.045 ton/hr x 28 times/week x 0.5 hr/time = 0.62 ton/week in the maneuvering time,

therefore, total 9.8 tons consumption per one week.

Assuming fuel oil filling at every four weeks, as M/V Queen Salamasina does so to spare dead-weight capacity to the cargoes as much as possible by limiting quantity of fuel oil, carriage of fuel oil on board the Plan vessel will be, considering 20 % allowance,

9.8 ton x 4 weeks x 120 % = 47 tons.

The Plan vessel, however, has wide space in double bottom, fuel oil tank of 110 cu. m. (95 tons), well more than the necessary capacity, is available. Void space in the double bottom requires bilge suction arrangement at additional cost, and has risk of corrosion at additional maintenance cost. Therefore, in the design of Plan vessel, void space in the double bottom will be avoided, and fuel oil tank will be made greater in capacity although full tank capacity is not employed in the regular voyages. Thus fuel oil tank volume shall be 110 cu.m.

Endurance using 95 tons of fuel oil is:

Cruising day = 95 ton / (0.227 ton/hr x 24 hr) = 17.4 days

Endurance = 17.4 day x 11 knot x 24 hr = 4,594 nautical miles

Considering 10 % allowance, practical endurance will be 4,594 x 0.9 = 4,135 n.m.

As distance from Japan to Samoa is about 4,000 nautical miles, the Plan vessel without cargo on board but filled with fuel oil can sail directly from Japan to Samoa without calling port for refueling.

2.3.3.8.Capacity of fresh water tank

Considering the consumption by showers on board, fresh water tank should be ensured in the Plan vessel. As carriage of fresh water should be limited, insufficient quantity must be compensated by fresh water generator. As fresh water consumption is mainly by showers, reverse osmosis type fresh water generator, whose fresh water salinity is rather high but capacity is great, is considered suitable.

During 8 hours sailing in the Pago Pago service, the fresh water consumption is estimated at:

Fresh water consumption by shower = 3.6 litters/min/shower

Practical consumption = 3.6 x occupied rate = 3.6 x 1/3 = 1.2 litters/min/shower

Fresh water consumption in 8 hours = 1.2 x 8 hr x 60 min x 7 shower = 4,000 litters (4TON)

Accordingly, 8 tons of fresh water is consumed in the round trip to Pago Pago. In the services other than Pago Pago, shower will not be used, therefore fresh water consumption is 8 tons per one week. As in the case of refueling, filling of fresh water will also be at each 4 weeks, then total

fresh water consumption per 4 weeks will be 32 tons. Adding other consumption, e.g. cooking and hand washing, total about 40 tons of fresh water is necessary for 4 weeks. On the other hand, quantity of fresh water allowed to carry on board under the limitation of dead-weight capacity is about 12 tons. Therefore, insufficient 28 tons has to be supplied by fresh water generator. The capacity of the fresh water generator should be, considering port rest in the night and in the week end:

28 ton/28 day/running rate = 28 / 28 / 0.25 = 4.0 ton/day

Also in the arrangement of fresh water tank, considerably greater space than necessary quantity is available in the double bottom. Avoiding void space to eliminate bilge suction arrangement and risk of corrosion in the void, space of the fresh water tank will have to be maximized. Carriage of fresh water must be limited in the regular voyages, but greater capacity can be utilized in the exceptional long voyage. Therefore fresh water tank volume shall be 30 cu.m.

2.3.3.9.Passenger Compartments

While the voyage from Apia to Pago Pago is an overnight journey of 8 hours, the living conditions on the existing vessel are substandard and hardly suitable for such a long trip. In the questionnaire survey conducted among passengers by the Basic Design Survey Team, respondents voiced strident complaints about the narrow compartments and corridors, uncomfortable chairs, and the lack of air conditioning.

In the Plan vessel, consideration will be given to all of these problems in an effort to bring amenities up to a standard appropriate for such a long voyage. The Queen Salamasina has become an everyday medium of transport among the nation's low-to-middle class families, who use the vessel to visit relatives in America Samoa and shop for daily necessities in Pago Pago. And since aged or disabled users are included, consideration will also be given to wheelchair access.

General passengers will stay in the seated passenger space on the passenger deck. Seating will be made more comfortable to insure a pleasant journey. The available space on the passenger deck will accommodate 104 seats.

On a long overnight trip in these waters, particularly from Apia to Pago Pago, vessels are prone to severe rolling, owing to heavy swells, so that passengers who are prone to seasickness need a place where they can sleep or lie down. The Queen Salamasina is presently being remodeled to provide bunks for this purpose and, in the Plan vessel as well, rooms with double-bunks will be provided. These bunk areas will accommodate 116 persons and will be positioned in the upper deck forward and on tanktop, in a section that is not open to the outside.

Seating will also be placed on the exposed deck, but these will be smoking seats and so will not

count toward the rated capacity when the vessel is on an international voyage. Smoking will be strictly prohibited in enclosed areas throughout the ship..

Dimensions of seating and bunks will be based on the typical Samoan physique, which is estimated to be : height --1.70 ~ 1.75 cm, and weight -- 90 kg.

Seating: Molded plastic with arm rest, width of 475 mm and pitch between seats of about 900 mm.

Seating of M/V Queen Salamasina is of wooden bench, but in the Plan vessel seating with arm rest is suitable as long wooden bench may be occupied by a few passengers lying on the bench during crowded periods.

Seating on open deck: wooden bench

Bunks: Width of 600 mm and length of 2,000 mm, referring also to the Japanese regulation.

Number of passenger will then become as follows:

Bunk passengers	116 persons
Ordinary passengers	104 persons
Total	220 persons

Sickroom cabins will also be required on the new vessel to transport ill persons to and from medical facilities in American Samoa. These sickrooms will be semiprivate (2-person) cabins, located in the bridge deck next to crew accommodation.

There are only 6 toilets for the 206-person rated capacity on the Queen Salamasina. Since this number is inadequate, the Plan vessel will be fitted with as many toilets as the layout permits. There are no showers on the Salamasina, but they will be installed on the new ship in deference to the long overnight journey.

In response to the strong desire expressed by respondents to our passenger questionnaire for a canteen on the Plan vessel (there is no such facility on the present ship), we plan to provide a canteen to sell such items as hamburgers, instant noodles, snacks and confectioneries, and beverages. However, alcoholic beverages will not be sold, owing to the policy of the Samoa Ministry of Transport.

Video is an effective means of informing passengers on vessel safety procedures, including emergency evacuation procedures and routes in the event of such accidents as fire and flooding and the proper use of life-saving gear. Passenger quarters will, therefore, be equipped with a TV-video player and a public addressing arrangement.

2.3.3.10.Amenities for the Physically Handicapped

To permit ready access on the passenger deck to the canteen and the bathroom, thresholds and uneven floor levels will be eliminated, with hand railings to be provided in the toilet for use by handicapped passengers.

Throughout the vessel, inclination of stairway will be made moderate, i.e. 45 degree.

2.3.3.11.Air conditioning

According to weather statistics in the Samoa, air conditioning system will be designed under the following condition.

Ambient: air temperature 32°C
sea water temperature 30°C
humidity 80%

Room: air temperature 27°C (5°C cooled down from outside)
humidity about 50%

2.3.3.12.Rolling in heavy sea

Samoan sea is often rough causing severe rolling motion on ship and many of passengers on board are suffered from sea sickness. Answers to the Questionnaire are telling that in Apia - Pago Pago voyage 30% of passengers are always in sea sickness and 70% are occasional and that in Pago Pago - Apia voyage 36% of passengers are always in sea sickness and 48% are occasional.

From the requirements on stability by SOLAS, center of gravity of the vessel tends to become lower. This means that the vessel is very stable difficult to capsize, but on the other hand from view of comfortableness on board, vessels of excessive stability with low center of gravity rolls quickly causing heavy acceleration on deck, and further the vessel becomes easier to respond to waves. Accordingly, in designing the Plan vessel, attention has to be paid for center of gravity not to be excessively low, and bilge keel should be made wider as much as possible to check rolling motion. Bunks should be arranged longitudinally as much as possible, to make vertical acceleration due to rolling moderate for head.

2.3.3.13.Cargo to carry

1) General cargo

At present general cargoes are piled rather in a jumble: volume efficiency to stow on board is low, and work efficiency throughout cargo handling (handling at quay side, loading and placing of each item and discharging) stands out low.

WSSC proposes containerized system, to stow general cargoes and passengers luggage beforehand in small containers. It is considered that establishment of the proposed container system is important to rationalize and modernize the carriage of general cargoes on board.
The container is, unlike large standard sea freight containers, small in size of about 2m cube, piled two high in cargo hold of about 4.2 m headroom. Construction will be similar to that of standard ISO sea containers with corner castings to allow twist lock securing. Gross weight will be 3.0 tons .

Required number of containers are: 20 boxes carried on board, another 20 boxes are distributed in each ports, allowing cargo check-ins before arrival of the vessel and quick loading/discharging. Since chilled / refrigerated meat are also handled as a cargo, two of the containers on board are of refrigerated containers. To handle containers in the cargo hold, one unit of 3 tons capacity fork lift is required.

2) Vehicles
Kind of vehicles to carry is various: cars, 4WD, large truck, etc. Ro-Ro cargo hold will be sized suitable to stow large truck (L x B x H = 29' x 8' x 7').

3) Dangerous goods
Dangerous good subject to IMDG (International Maritime Dangerous Goods) shall not be carried by the Plan Vessel, hence no special provisions to carry dangerous goods are necessary.

2.3.3.14.Maneuvering system

Good maneuverability is important for the Plan vessel to maneuver in the narrow channels in Mulifanua and Salelologa.
The hull shape must be of good course keeping stability, and the actuators for maneuvering would better be of similar arrangement as present vessels whose maneuverability are satisfactory and crew are well familiar with the system. The actuators will consist of followings.

Propeller	2 shafts, independent speed control, fixed pitch (FPP)
Rudder	2 rudders, parallel working
Bow thruster	Electric motor driven, the capacity should be increased considering standard wind speed of 25 knots (12.8 m/s) whereas M/V Lady Samoa's bow thruster is of capacity to withstand wind force of 10 m/s.

Propeller guard shall be installed in the outside of the propellers to protect propeller blades from damage.

2.3.3.15.Ro-Ro access arrangement

The system shall comprise, as adopted in M/V Queen Salamasina, stern ramp and watertight door which are independent. Recent big disasters of Ro-Ro passenger vessel in Europe are all from incomplete watertightness of watertight door to Ro-Ro deck. In such system as common stern ramp and watertight door, permanent deformation from repeated vehicle loads after years will be getting greater and risk of incomplete watertightness becomes greater.

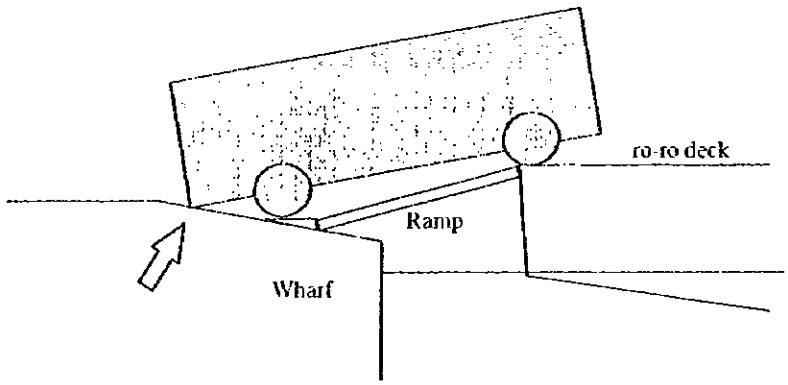


Fig. 1-13 Relation of quay and vehicle tail

In M/V Queen Salamasina and M/V Lady Samoa II, geometrical relation between stern ramp, draft and quay height is not ideal, resulting in frequent damage at tail of trucks. The design of the ramp should take into account of quay height.

2.3.3.16.Auxiliary Lo-Lo cargo gear and gangway

Auxiliary Lo-Lo cargo gear is used for cargo handling to barge in harbor or at Lo-Lo quay when the vessel can't land its shore ramp due to heavy swell.

Gangway is used for disembarkation of passengers when the vessel can't land its shore ramp due to heavy swell.

The crane shall be of three tons SWL (Safe Working Load) capacity, suitable to handle WSSC container, and employed for handling gangway in Lo-Lo quay.

2.3.3.17.GMDSS (Global Maritime Distress & Safety System)

From Post & Telecommunication Department of Samoa Government, procedure for opening radio station on board the Plan vessel was confirmed as follows.

1) Radio station license, call sign and ID numbers of radio apparatus on board are issued by Post & Telecom. Dept.

2) Radio inspection is conducted by the organization which Post & Telecom. Dept. has nominated (a classification society or Japanese Government).

3) Safety Radio Certificate of SOLAS is issued by the classification society on behalf of Samoa Government.

Apia -Pago Pago route is beyond the VHF radio coverage, therefore the range defined in GMDSS becomes A2, which requires GMDSS safety radio telephone system of medium frequency.
As simple medium frequency radio telephone is not available in the market actually, medium/high frequency radio telephone system will have to be installed.
When radio telephone of medium frequency is installed on board, GOC class radio operator is required on board. Now the captain of M/V Queen Salamasina possesses GOC license.
The vessel is required to complete GMDSS installation and NAVTEX instrument should be equiped.

Notes GMDSS:	*Global Maritime Distress & Safety System* *New safety radio system for ships of whole world, scheduled to start to work from February 1st 1999.* *Instead of radio telegraph system with Morse code, e.g. SOS, new system of recent technology employing satellite communication is used.*
A1,A2 sea areas:	*Sea areas defined by GMDSS. A1 is about 50 nautical miles from shore. A2 is about 150 nautical miles from shore.*
GOC:	*General Operator's Certificate, as internationally recognized operator's license.*
NAVTEX:	*Navigation Telex. Instrument to receive maritime safety information broadcasting. Valid in the sea area of about 300 nautical miles from shore.*
EGC:	*Enhance Group Call. Instrument to receive maritime safety information broadcasting. To cover all sea areas by satellite.*

2.3.3.18.Lubricating oil management

Corresponding to contamination and deterioration, in the Plan vessel, independent LO fine filtering equipment will be installed to maintain LO quality.

2.3.3.19.Propeller shaft bearing

In Mulifanua and in Salelologa harbor, propeller running close to sea bed of sand base blow up sands, then sands penetrate into propeller shaft bearing, resulting in quick wearing of sleeve bearing of propeller shaft. Considering risk of wearing and oil leakage in oil bath lubrication

bearing, Sea water lubrication system shall be adopted. Withdrawal of propeller shaft is ordinary at every 4 - 5 years, but in Samoa worn sleeves have to be replaced at every other year.

2.3.3.20.Engine monitoring system

Engine monitor room shall be provided like M/V Lady Samoa II. Engine monitoring shall be for exhaust gas temperature, cooling water temperature, etc. of main and auxiliary diesels. Trend data should be memorized in the system.

2.3.4.Basic Design

2.3.4.1.Design of major items

1) Main dimensions and gross tonnage

Main dimensions of the Plan vessel were determined, under the limitation of gross tonnage below 1,000 tons as follows.

Table 1-8 Main dimensions of Plan vessel

Item		Plan vessel	Original request	M/V Queen Salamasina
Gross tonnage	t	990	990	714
Length over all	m	46.5	46.0	39.6
Length over all under water	m	43.0	46.0	
Length between perpendiculars	m	42.0		
Breadth, molded	m	11.4	11.4	10.35
Depth, molded	m	3.8	3.8	3.35
Designed draft	m	2.35	2.35	2.14

Gross tonnage measurement is detailed as follows.

Table 1-9 Tonnage measurement

Item	Measurement (cu.m)
Hull below 2.35 m draft *note below	762
2.35 m draft - Cargo deck	689
Cargo deck - Upper deck	1,036
Upper deck - Pax deck	386
Upper deck - Cargo hold trunk	290
Pax deck - Bridge deck	264
Bridge deck - Compass deck	187
Funnel	19
Emergency generator room	12
Fan room	7
Sum of measurement = V	3,652
$C = 0.2 + 0.02\log_{10}V$	0.2713
Gross tonnage = CV	990

*Note: Measurement volume 762 cubic meters corresponds to displacement of 785 tons.

2) Dead-weight

Typical dead-weight detail is considered as follows.

Table 1-10 Dead-weight detail

Item		Weight (t)
Crew and their effects: 100kg x 16p		1.6
Passengers and their luggage: 110kg x 220p		24.2
Cargo		74.0
	Cargo container: 3 t x 20 x 2/3	30.0
	Break bulk cargoes	6.0
	Truck: 10 t x 6 x ½	30.0
	Car, 4WD: 2 t x 8 x 1/2	8.0
Fuel oil: 9.8 t/week x 4 week x 120 %		47.0
Fresh water		12.0
Lubricating oil		3.0
Shop items		0.5
Provision for crew		0.5
Stores		2.0
Total dead-weight (DWT)		164.8 =165

2.3.4.2.Estimated light ship weight and full displacement

Light ship weight is estimated from similar size vessel and full displacement, considering dead-weight and draft, are shown below.

Table 1-11 Light weight and full displacement

Item		Weight (t)
Light ship weight (WL)		620
	Hull weight	350
	Outfitting weight	110
	Machinery weight	150
	Electric weight	10
Dead-weight (DWT)		165
Full displacement (△ = WL + DWT)		785
Block coefficient (Cb = △/(Lpp x B x d x 1.025))		0.680

2.3.4.3.Fire safety regulations for passenger vessels

Upgrading of fire safety regulations for passenger vessels has been discussed in IMO (International Maritime Organization) after the motion was raised from the big fire accident of M/V Scandinavian Star on 1990. The upgraded regulations was adopted on December 1992 and has come in force from October 1994 in all over the world.

The upgrading of the regulation was made in mind of large cruise vessels in Europe and America, and regulations has become stringent even for large cruise ships. The question is to apply the new regulation on very small passenger vessel of gross tonnage below 1,000 tons. Upon designing the

vessel, study of the new regulation including interpretative study will be made with NK classification who is to issue international convention certificate on behalf of Samoa Government. Followings are the important items affecting basic design of the vessel.

(1) Sprinkler system compulsory for accommodation

So far upgrading of non-combustible accommodation structure allowed omission of sprinkler system, but now sprinkler system is compulsory for all passenger vessels. Pressure tank to send water to sprinkler heads must be of 2,800 liters which is same capacity irrespective of vessel's size. In the Plan vessel, position of this large pressure tank is found in bow thruster room.

(2) To upgrade safety of escape route in an emergency, dead end corridor, which so far allowed up to 13 meters, has prohibited completely. Besides, escape passage shelter of continuous and wide which lead directly to lifeboat and liferaft embarkation deck from each cabin is required.

On tank top, additional escape stair casing is required and small cabins at the end of short corridor can not be arranged, by prohibition of dead end corridor.

Passengers' accommodation had to become large compartment.

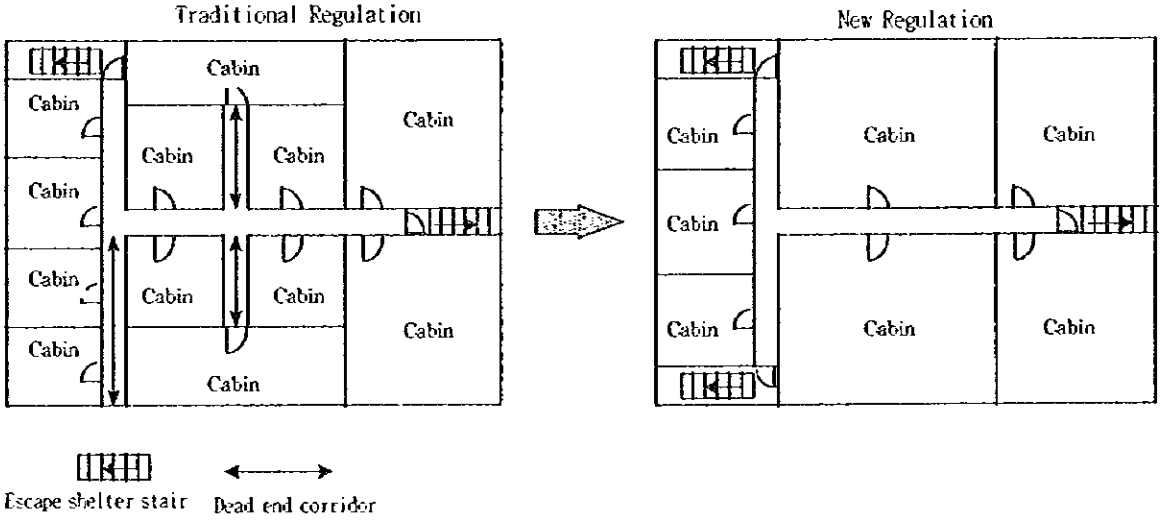


Fig 1-14 Dead end corridor

Direct escape shelter stair casing from each cabin to lifeboat and liferaft embarkation station without connecting stair casing by corridor is required as following sketch.

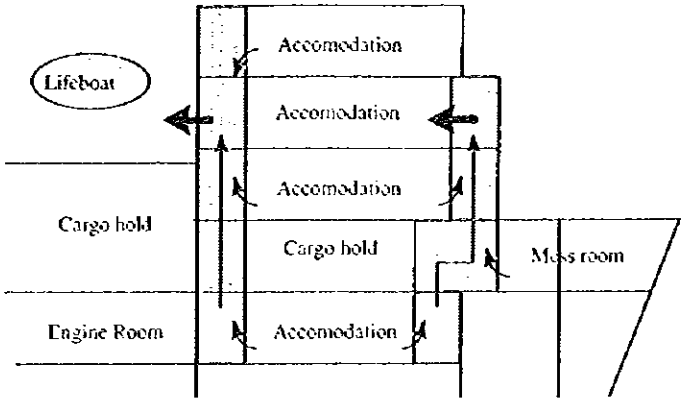


Fig. 1-15 Direct escape route

Further, width of stair casing, inclination, landing area in stair casing, etc. for size of the escape route are specified in detail.

Working out with cooperation of NK classification, from interpretation of SOLAS regulation to accommodation layout, finally area for emergency escape have to occupy great portion in the accommodation as shown on the proposed general arrangement plan.

2.3.4.4.Preliminary calculation of SOLAS subdivision regulation

Passenger vessels engaged on international service is required to be stable even in case of flooding by collision or aground, and very detailed calculation is specified by SOLAS. Here as a preliminary study, simple flooding calculation was made to confirm adequacy of compartment subdivision.

Compartment		
1	Fr.66 - F.E.	FPT for water ballast
2	Fr.58 - Fr.66	Bow thruster room
3	Fr.51 - Fr.58	Pax accommodation
4	Fr.34 - Fr.51	Pax and crew accommodation
5	Fr.24 - Fr.34	Auxiliary engine room
6	Fr.13 - Fr.24	Main engine room
7	Fr.4 - Fr.13	Shaft tunnel and tanks
8	A.E. - Fr.4	Steering gear room and store

Equilibrium draft conditions after flooding from original draft of 2.35 m even keel.

Calculation was made at permeability of 0.95.

Table 1-12 Flooding calculation

Flooded compartment	Draft at FP	Draft at AP
1 + 2	3.20 m	2.02 m
3	3.46 m	3.20 m
4	3.62 m	2.48 m
3 + 4	5.14 m	2.20 m
5	2.65 m	2.78 m
6	2.28 m	3.13 m
5 + 6	2.63 m	3.78 m
7 + 8	1.77 m	3.52 m

Calculation shows that the water lines after flooding do not exceed bulkhead deck of 3.80 m, and the arrangement of the compartments were found adequate, although engine room and tank top accommodation have to be divided in two halves.

PRINCIPAL PARTICULARS

LENGTH (O.A.)	44.50m
LENGTH (B.P.)	41.50m
BREADTH (MAX.)	15.40m
DEPTH (MAIN DECK)	6.00m
DEPTH (UPPER DECK)	9.00m
DRAFT (SCANT.)	4.20m
DRAFT (SUMM.)	4.40m
GROSS TONNAGE	4900
NET TONNAGE	1500
SERVICE SPEED	12.00KTS
CLASS	NK
PASSENGER	1220
CREW	117

NO.	DATE	AMENDMENTS

BRIDGE DECK

COMPASS DECK

BOAT DECK

UPPER DECK

VEHICLE DECK

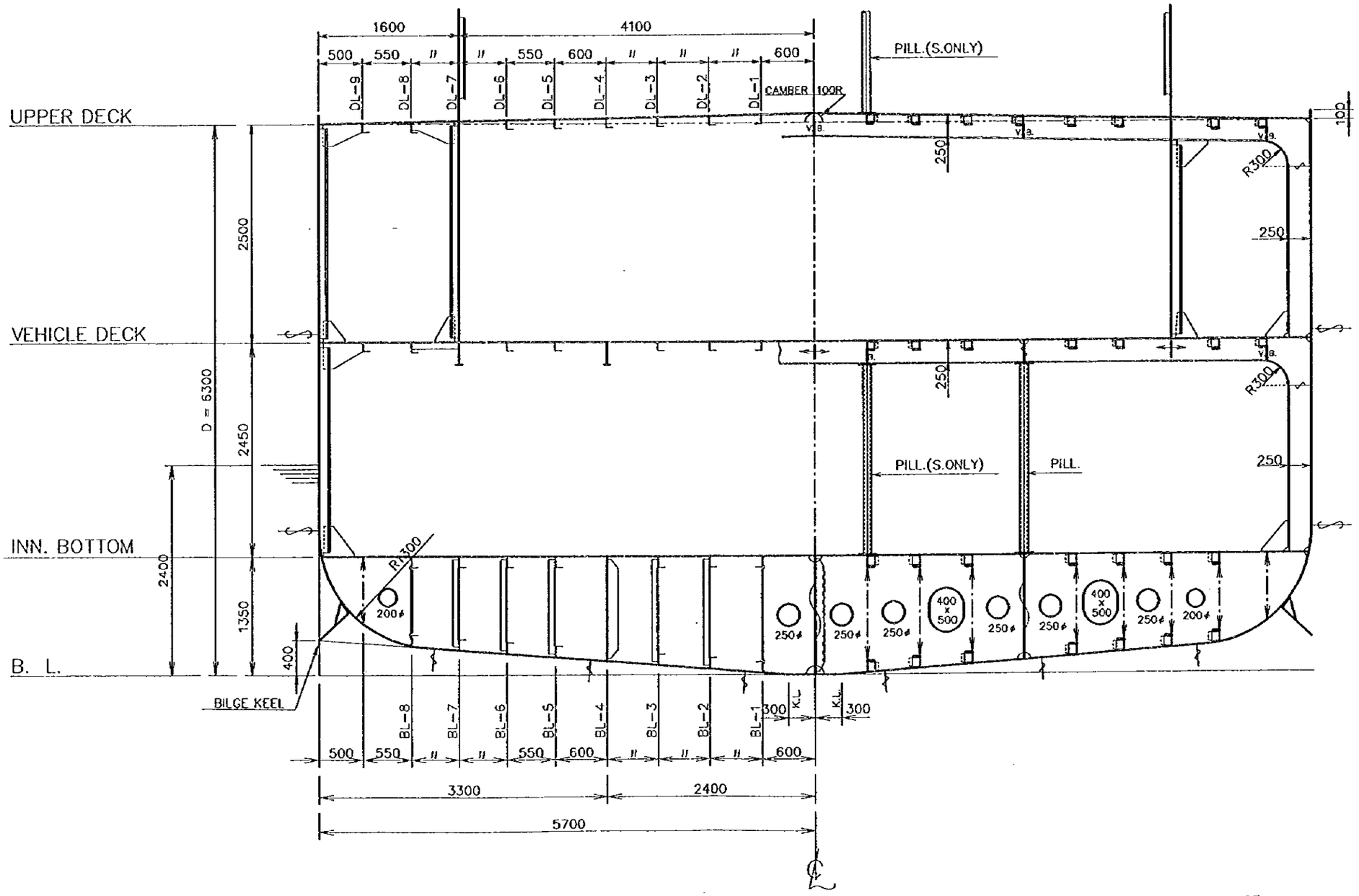
LOWER DECK

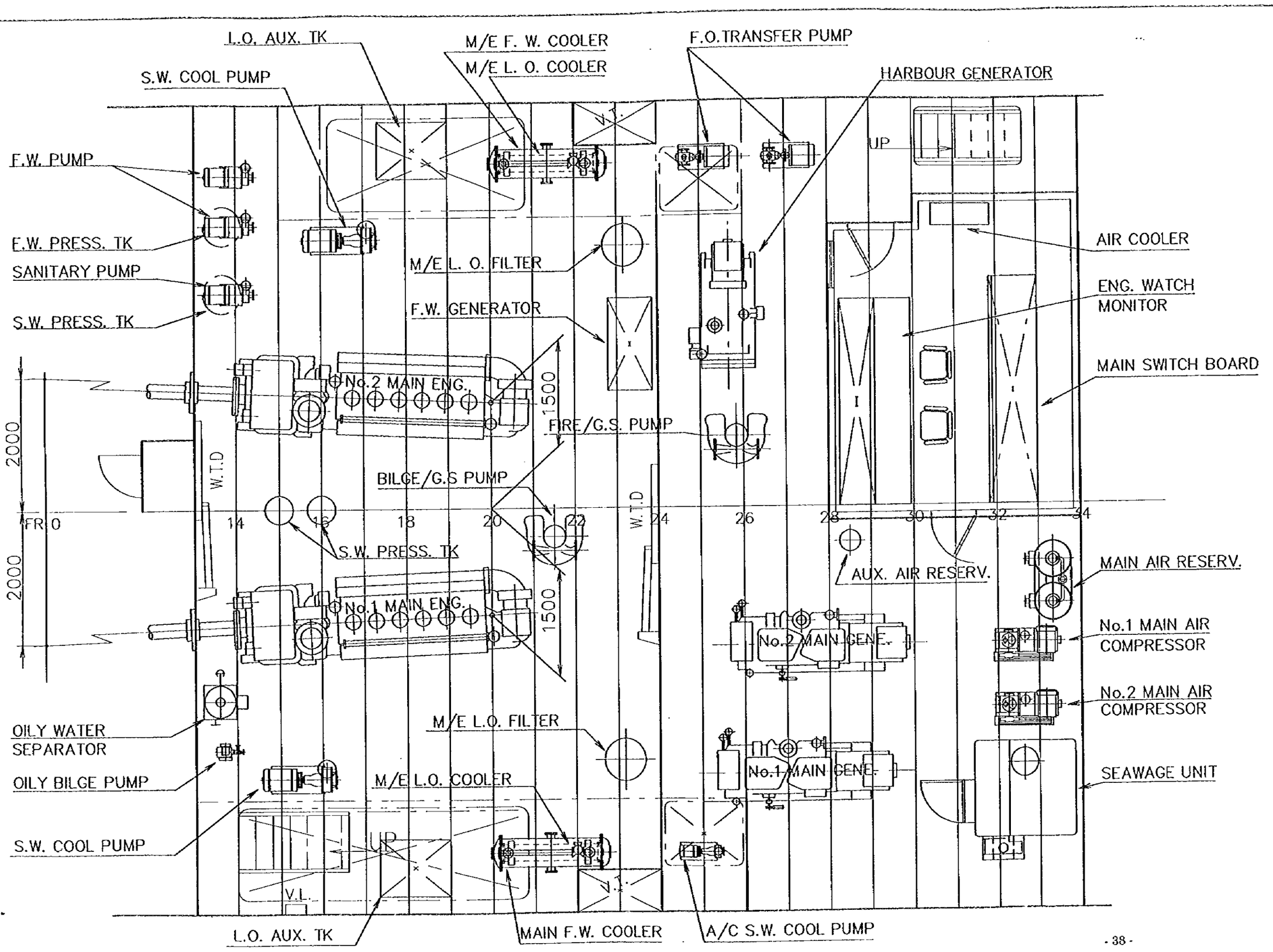
CONSULTANT	
DRAWING NO	
DRAWING TITLE	GENERAL ARRANGEMENT
PROJECT TITLE	990G/T INTER-ISLAND NAVIGATION VESSEL
SCALE	
PROJECT NO	
DATE	
CHECKED	
DRAWN	

MIDSHIP SECTION

ORDINARY SECTION

WEB SECTION (EVERY 4 FRAME SPACE)




L.O. AUX. TK
M/E F. W. COOLER
M/E L. O. COOLER
F.O.TRANSFER PUMP
S.W. COOL PUMP
HARBOUR GENERATOR
F.W. PUMP
UP
F.W. PRESS. TK
SANITARY PUMP
S.W. PRESS. TK
M/E L. O. FILTER
AIR COOLER
ENG. WATCH MONITOR
F.W. GENERATOR
MAIN SWITCH BOARD
No.2 MAIN ENG.
1500
FIRE/G.S. PUMP
2000
W.T.D
BILGE/G.S PUMP
FR 0
14
16
18
20
22
24
26
28
30
32
34
S.W. PRESS. TK
AUX. AIR RESERV.
MAIN AIR RESERV.
No.1 MAIN ENG.
No.2 MAIN GENE.
No.1 MAIN AIR COMPRESSOR
No.2 MAIN AIR COMPRESSOR
OILY WATER SEPARATOR
M/E L.O. FILTER
No.1 MAIN GENE.
SEAWAGE UNIT
OILY BILGE PUMP
M/E L.O. COOLER
S.W. COOL PUMP
UP
V.L.
L.O. AUX. TK
MAIN F.W. COOLER
A/C S.W. COOL PUMP

2.3.6.Hull and machinery particulars

2.3.6.1.Main Particulars

Type of vessel	Ro-Ro passenger ferry
Range of operation	Short international voyage
Flag	Samoa
Length over all	46.50 m
Length between perpendiculars	42.00 m
Breadth molded	11.40 m
Depth molded to vehicle deck	3.80 m
Depth molded to upper deck	6.30 m
Draft designed	2.35 m
Draft maximum	2.40 m
Gross tonnage	990 t (less than 1,000 t)
Dead-weight	165 t
Cargo deck area	not less than 220 sq.m
Fuel oil tank	not less than 110 cu.m
Fresh water tank	not less than 30 cu.m
Passenger, berthed	116 p
seated	104 p
total	220 p
Crew	16 p
Sick room	4 p
(not included in the licensed complement)	
Service speed, 85% MCR, 30% sea margin	11.0 knots
Main engine	880 kW (1,200 ps) x 2 sets
Propeller	FPP x 2 sets
Genset	250 kVA x 445 V x 50 Hz x 2 sets
Classification	Nippon Kaiji Kyokai (NK) NS* MNS*
	"Ro-Ro passenger ferry"

Rules to apply
- Classification rules
- SOLAS 1974 + amendments
- MARPOL 1973 + amendments
- ICLL 1966 + amendments
- COLREG 1972 + amendments
- TM 1969 + amendments
- International Telecommunication and Radio Regulation, 1982 + amendments
- USCG Control Verification for passenger vessels
- USCG regulation to prevent pollution from ships
- South Pacific Maritime Code
- Samoa Shipping Act
- Japanese Maritime Regulations (for the scope not covered by above Rules)

2.3.6.2.Class equipment and safety items

Bower anchor	3	abt. 1140 kg, JIS type
Anchor chain		abt. 385 m x 30 mm dia., Grade U2
Mooring ropes	3	abt. 140 m x 93.2 kN, synthetic rope
Tow line	1	abt. 180 m x 223.6 kN, SWR
Working mooring rope	4	50m x 60mmϕ, polypropylene, one end eye-spliced
Lifeboat cum rescueboat	2	Partially enclosed, min. 36p (or max. allowed in the capacity of the boats)
Lifeboat davit	2	Gravity hinge, e.motor recovery
Liferaft	9	Inflatable, 25p, float-free
Evacuation slide	2	P and S for liferaft embarkation
Lifejacket	265	For adults
	24	For children
Lifebuoy	8	
Line-throwing apparatus	1	
Distress signal	1 set	
CO_2 fixed fi-fi system	1	For engine rooms
Smoke/fire detector and manual call points	1 set	Cargo hold and accommodation
Accommodation sprinkler system	1 set	Automatic operation
Sprinkler tank	1	2.8 m^3
Sprinkler pump	1	abt. 11 kW self-priming centrifugal pump
Hold drenching system	1 set	Manual operation
Drenching pump	1	abt. 11 kW self-priming centrifugal pump
Portable fire-ext.	1 set	
Fireman's outfits (general use)	6 set	
Fireman's outfits (dangerous goods use)	1 set	Breathing apparatuses and protective cloths
Window sprinkler	1 set	To cool windows along escape route
Watertight sluice door	3	1 x M/E room - shaft tunnel 1 x M/E room - G/E room 1 x Tanktop pax space
Do. control system	1	Local open/close and close from wheelhouse
Door indicator	1	In wheelhouse for WT sluice doors and fire doors
TV surveillance monitor	1	To monitor hold from wheelhouse
Safety signs	1 set	SOLAS standard pattern Photoluminescent strip indicators along corridor and escape route

2.3.6.3.Deck machinery

Windlass	1	With chain wheels, hawser reels and warping heads, hydraulic oil motor driven abt. 38 kN x 11 m/min at chain wheel abt. 20 kN x 15 m/min at hawser reel
Mooring winch	2	With hawser reel and warping head Hydraulic oil motor driven abt. 20 kN x 15 m/min at hawser reel
Stern ramp	1	Hydraulic cylinder operated, abt. 4.5 m clear width x abt. 5.7 m length including 1.1 m flap

		Two axle loads of each abt.80kN (40ft trailer axles)
Stern gate door	1	Weathertight, guillotine type, hydraulic operation, tightening by gravity force, upper and lower stoppers, hoisting and lowering by wire rope. 8.2 m clear width and abt. 4.2 m clear height
Cargo crane	1	3t SWL at 6 m radius, max. radius of about 10 m at reduced lifting capacity, hydraulic oil operated
Hydraulic source		2 x 50% capacity
No.1 system	1	Fore: windlass and lift
No.2 system	1	Aft: mooring winches, stern ramp, stern gate door, and cargo crane
Ventilators		
Cargo hold	2	Supply/exhaust vent, explosion free, abt. 2.2 kW, to allow air change rate of: 10 times/hr at sea by one ventilator 20 times/hr in the harbor by two ventilators
Main engine room	2	Supply/exhaust, abt. 3.7 kW, remote damper
Auxiliary engine room	1	Supply, abt. 1.1 kW, remote damper
Galley	1	Exhaust vent, canopy over range, 0.2 kW
Sanitary space	5	Exhaust, 0.2 kW
Shop	1	Exhaust, 0.2 kW
Stair casing	2	Supply, 0.2 kW
Hydraulic pump room (aft)	1	Supply, 0.2 kW
Bow thruster space	1	Supply, 0.4 kW
CO_2 bottle room	1	Exhaust, 0.2 kW
Rudder	2	Spade rudder, each about 1/40 Lpp x d
Steering gear	1	Parallel working, 2 x 35°, 28"/75° 2 x 100% hydraulic pump
Bow thruster	1	90 kW e.motor driven, about 13.5 kN lateral thrust, CPP, with electronic soft starter
Air conditioning system		Outside 32°C/80%RH, inside 27°C/50%RH Sea water temp 30°C, fresh air intake 30% To be separated into zones.
Air conditioner for engine monitor room	1	
Gangway	1	6m, aluminum, fixed handrails, handled by crane

2.3.6.4.Accommodation

Accommodation paneling		Steel cassette system
Deck covering		Vinyl flooring on deck composition
Furniture		Timber or plywood
Pax seats		Indoor: plastic with armrest, seat width = 475mm, seat pitch = abt. 900 mm, n=116 Outdoor: plastic, seat width=abt.500mm, seat pitch = abt. 875 mm, n=100
Pax bunks		Timber, 2,000mm x 600mm, 2 tiers, n=104
Window and scuttle	1 set	A-class fire retarding along escape route
Galley		
E. range	1	Total abt. 8kW top plates
Rice steamer	1	abt. 2 kW

Water boiler	1	abt. 10 lit., 1 kW
Refrigerator	1	abt. 500 lit
Garbage disposer	1	Under sink, abt. 0.9 kW
Sink	1	
Cupboard	1 set	
Canteen		
Microwave oven	1	
Refrigerator	1	abt. 500 lit
Food warmer	1	
Water boiler	1	abt. 10 lit., 1 kW
Sink	1	
Counter	1	
Storage		
Chilled water fountain	4	
TV monitor	1	For safety instruction, with video, boat deck
	1	Mess room

2.3.6.5.Sanitary accommodation

Bridge lavatory		WC, shower and wash basin for pax and officer
Upper deck lavatory		WC, shower and wash basin for pax WC, shower and wash basin for handicapped
Vehicle deck lavatory	1	WC and wash basin for pax WC, shower and wash basin for crew
Hot water supply		Electric local water heater at each shower
Laundry machine	1	4 kg
Tumble dryer	1	3 kg

2.3.6.6.Engine room machinery

Main engine	2	880kW x rpm≦800^{-1}, to burn MDO
Gearbox	2	With reversing clutch, output rev = about 490rpm
Propeller	2	FPP, 1.60 m diameter
Tail shaft bearing		Sea water lubrication
Main genset	2	250kVA x 445V x 50Hz x 1500rpm Prime mover abt. 220kW (299ps) x 1500rpm, to burn MDO
Harbor genset	1	abt. 40kVA x 445V x 50Hz x 1500rpm Prime mover abt. 36kW (49ps) x 1500rpm Radiator cooled, same as emergency genset
Emergency genset	1	abt. 40kVA x 445V x 50Hz x 1500rpm Prime mover abt. 36kW (49ps) x 1500rpm Radiator cooled
Main air compressor	2	abt. 3.7kW, 13m^3/h x 3MPa
Emergency air comp.	1	Hand operated
Main air reservoir	2	abt. 200lit x 3MPa
Auxiliary air reservoir	1	abt. 45lit x 3MPa
Cooling S. W. pump	2	Centrifugal, abt. 5.5kW
Fire/bilge/G.S. pump	2	Centrifugal, abt. 15kW
Emergency fire pump	1	Centrifugal, abt. 5.5kW、in bow thruster room
Fresh water pump	2	Centrifugal, abt. 2.2kW

Sanitary pump	1	Centrifugal, abt. 2.2kW
A/C cooling S. W. pump	1	Centrifugal, abt. 1.5kW
M/E L.O. priming pump	2	Gear, abt. 1.5kW
F.O. transfer pump	2	Gear, abt. 2.2kW
Bilge pump for oily water separator	1	Piston, abt. 0.4kW
Sludge transfer pump	1	Screw, abt. 1.5 kW
Oily water separator	1	$0.5m^3/h$ x 15PPM, with oil discharge monitoring and auto stop device, IMO and USCG approved
Sewage treatment system	2	Aeration bacteria treatment Type IMO and USCG approved
Main engine L.O. filter	2	CJC type, bypass system
L.O. heater	2	
L.O. pump	2	
Fresh water generator	1	Reverse Osmosis type, 4 tons/day
Fresh water sterilizer	1	UV ray type
Fresh water hydrophore	1	
Sea water hydrophore	1	
Drilling machine	1	
Electric arc welder	1	
Gas welder	1 set	
Marine growth preventing system (MGPS)	1	

2.3.6.7.Electric system

Main switchboard	1	2-gen.panel, 1- synchronizing panel 1-group starter panel, 1- harbor generator panel
Emergency switchboard	1	In emergency generator room
Electric distribution		440V 3 ϕ AC50Hz, 220V 1/3 ϕ AC 50Hz, 24V DC
Transformer	1 set	445/225V
Engine watch monitor	1	In engine monitor room, 14" CRT display to watch exhaust temp for diesels, LO pressures, cooling water temp, etc.
Storage battery	1 set	For radio, temporary supply and emergency genset starting
Battery charger	1 set	
Shore connection	1	440V A.C. 50Hz

2.3.6.8.Lighting

Hold lights	1 set	Including explosion proof lights
Deck flood lights	1 set	
Search light	1	1kW, lever operation from inside bridge
Room lights	1 set	
Navigation lights	1 set	

2.3.6.9.Navigation aids

Magnetic compass	1	With periscope from bridge
Gyro compass	1	
Gyro repeater	3	Both wings, steering gear room
Steering control and autopilot	1	With automatic gyro compass pilot

Radar	1	9 GHz, IMO standard, with ARPA (non IMO), about 20", 25kW
Small radar	1	9 GHz, IMO standard, about 14", 10kW
GPS	1	
Echo depth sounder	1	
Speed log	1	Doppler
Wind meter	1	
Air horn	1	With automatic time controller
Navigation light control	1	
Public addresser	1	Dual system
Engine order telegraph	2	
Rudder angle indicator	3	Wheelhouse and wings
Shaft revolution indicator	6	Wheelhouse and wings
Telephone (common battery)	1 set	W/H - E/R, Steering gear room
Telephone (auto-exchange)	1 set	W/H-Eng. watch room-M/E room-Galley-Mess-Shop-Stern gate
Window wiper	3	
Bridge control console	1	Main engine control, bow thruster control, engine telegraph, PA, telephone
Bridge wing control	2	Main engine speed control, steering control, bow thruster control, PA

2.3.6.10.Radio equipment

GMDSS system (A1 and A2)		
VHF radio com	1	
VHF DSC alert	1	Ch.70
VHF DSC watchkeeping	1	Ch.70
MF/HF radio com	1	
MF/HF DSC alert	1	2,187.5kHz, etc.
MF/HF DSC watchkeep	1	2,187.5kHz, etc.
EPIRB	1	Via satellite
Two-way VHF radio	3	With battery charger
Radar transponder	2	
NAVTEX	1	
Two-way transceiver	2	Aeronautical frequency 121.5MHz and 123.1MHz
Walky talky	4	
Weather fax	1	

2.3.6.11.Cargo carrying system

Cargo deck strength	Uniform load: per Class Vehicle load: 2 x 80kN axle load (40ft trailer axles) Fork lift tire print load: abt. 6t axle load WSSC container point load: 3 t x 2 tiers
Ro-Ro vehicle securing	Forward half: WSSC containers, cars and break bulk After half: WSSC containers, trucks and break bulk
Chain lashings for trucks	30 pieces
Wheel chocks for trucks	60 pieces
Belt lashings for cars	50 pieces
Wheel chocks for cars	100 pieces

WSSC containers	40 boxes of WSSC containers to be supplied. Sized 2.0m x 2.0m x 1.9m, gross weight of max. 3 t, with standard corner castings. 2 boxes in 40 are refrigerated containers fitted with air cooled refrigerating unit. On cargo deck to be fitted with sunken corner casting for WSSC containers in two high. 50 pieces of twist-locks to be supplied for securing containers.
Fork lift	1 x 3 t lifting capacity, LPG engine driven fork lift to be carried on board for handling WSSC containers and break bulk cargoes on board.

2.3.6.12.Material

Hull construction	Steel
Pipe materials:	
Sea water pipe	Steel
Cooling sea water pipe	Steel pipe lined with plastic inside, from sea chest valve to pump inlet
Fresh water pipes	Stainless steel or plastic
Hot water pipes	Stainless steel or copper
Hydraulic oil pipes	Stainless steel (weathered), steel (not weathered)
Painting materials:	
Bottom shell	Tar epoxy anti-corrosive and tin-free self polishing anti-fouling at 2.5 years life
Shell topside	Epoxy
Ro-Ro cargo deck	Epoxy
Superstructure	Modified epoxy
Deck	Modified epoxy with non slip surface finish
Engine room bottom	Tar epoxy
Compartment inside	Alkyd resin
Fresh water tank	Epoxy
Ballast water tank	Tar epoxy
Cathodic protection	2.5 years life zinc anodes

3.Implementation Plan

3.1.Implementation Plan

3.1.1.Implementation Concept

If this Plan is carried out on the basis of a grant-aid from the Government of Japan, construction of the Plan vessel will proceed in the following sequence :

1) Exchange of Notes between the Government of Japan and the Government of Samoa.

2) Conclusion of a Consultant Contract between a Consultant recommended by JICA and the Government of Samoa or its designated authority.

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

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

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

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

7) The Consultant will assist in contract negotiations between the Government of Samoa and the successful tenderer and will witness the Building Contract.

8) Verification of the Building Contract by the Government of Japan.

9) Based on the Building Contract, the Ship Builder will build, conduct trial runs for, and deliver the Plan vessel. The Consultant will, in accordance with the Consultant Contract, provide construction supervision, conduct tests, and be present at the hand-over of the vessel.

The following basic items must be carefully considered in connection with project implementation.

1) The Main Project Implementing Bodies :

The agency responsible for this Project within the Government of Samoa is the Ministry of Transportation, while the implementing agency is the WSSC. In connection with project implementation, the WSSC will review bidding qualifications, approve tender plans, technical specifications, and contract documents, receive monthly reports on construction supervision, and take delivery of the Plan vessel. WSSC will also serve as the liaison window in all dealings with concerned agencies of the Government of Samoa with regard to such matters as the issuance of a Provisional Certificate of Nationality and import procedures.

2) The Consultant

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

3) Ship Builder:

The Ship Builder will be selected in accordance with the following process. After evaluating the tender qualifications of companies of Japanese nationals responding to Tender Notice, competitive bids will be solicited, based on bidding and contractual procedures established in advance. The successful bidder under this process will sign a blanket Building Contract with the government of Samoa. The Ship Builder will then build the Plan vessel, conduct trial runs, and sail the ship to Samoa.

4) Construction Plan :

In connection with the vessel construction plan, the Ship Builder will, based on the Contract and attached technical specifications, design the hull and outfitting in a manner corresponding to conditions at its shipbuilding facilities.
The sequence of vessel construction stages, following preparation of the construction designs by the Ship Builder, will be as follows: hull construction, outfitting work (deck work, equipment work, electrical work), all tests, and sailing to Samoa., The followings points should be given careful consideration when examining the Building Plan.

① Assuming that this Plan is implemented on the basis of a grant-aid from the Government of Japan, scrupulous adherence to the construction schedule will be a major premise. The

construction plan, therefore, must be prepared so as fulfill all contract conditions within the term of validity stipulated in the Exchange of Notes.

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

③ Various tests are to be carried out, as determined by the Classification Society, or on behalf of the Ministry of Transport. The required trial runs are to be performed upon completion of the construction phase to certify vessel performance.

④ At the final stage of the construction phase, the master and the chief engineer will be invited from WSSC to be present during the trial runs and turnover inspection. These engineers will also travel aboard the new vessel to Samoa, receiving appropriate guidance en route so as to acquire competence in and familiarity with new vessel operations.

3.1.2.Special Considerations with regard to the Building Work

In order to comply with applicable international maritime regulations and meet the requirements of the Classification Society along with the conditions set forth in the construction specifications, it is assumed that the shipyard in charge of the construction work will have the technical ability to satisfy the rigorous conditions stipulated in the above regulations. The Plan vessel will be classified as a passenger vessel operating on short international voyages, and so it is essential that the following points, in particular, be thoroughly understood in connection with the construction program, tests, and trial runs.

1) In comparison with a domestic passenger vessel, careful preparations must be made for the various tests, for which conditions are exceptionally rigorous, while care must also be taken to avoid any setback in the project schedule.

2) A prime prerequisite to enable the Plan vessel to serve American Samoa is to receive necessary certificates of USCG Control Verification Examination. It is, therefore, vital to avoid any inspection problems with USCG.

3.1.3.Allocation of Building Responsibility

3.1.3.1.Responsibilities to be Assumed by the Government of Japan

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

① Construction of the Plan vessel

② Procurement of equipment and materials

③ Sailing the Plan vessel to Samoa

④ Consultant services, including the Detail Design, assistance with the bidding process as well as building supervision

3.1.3.2.Responsibility to be assumed by the Samoa government

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

3.1.4.Building Supervision Plan

Following conclusion of the Ship Building Contract, the Consultant, based on the Consultant Contract with the Samoa government, will approve the construction plans and conduct inspections on equipment manufacture. In addition, it will implement a program of construction supervision by dispatching engineers to the shipyard for required periods of time. Also, as construction progresses, the Consultant will dispatch personnel in charge of outfitting and equipment to manufacturing plants and the shipyard for short periods of time for attendance during inspections and tests.

3.1.5. Procurement Plan

(1) Main Items of Fitting

Machinery and equipment, switchboards, and other electrical supplies are expected to be sourced in Japan, since Japanese products have been found to be advantageous from the standpoint of quality, stability of supply, and price in Japan. Following are the planned procurement arrangements for the main classifications of outfitting items incorporated in the Project.

Table 2-1. Direct escape route

Main Outfitting	Sourses
Main engine	Japan
Generator engine	Japan
Radio navigation aids	Japan
Deck winch	Japan
Paint	Japan
Other equipment of outfitting	Japan

(2) Onboard Cargo Gear

Among the items of onboard cargo gear, forklifts are to be sourced in Japan. With regard to containers, it is planned to procure either Japanese products or those from third countries

(Republic of Korea or Southeast Asia) whose quality has been fully demonstrated by wide acceptance on the Japanese domestic market.

3.1.6.Implementation Schedule

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

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

① Hull work

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

② Outfitting

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

③ Installation of Equipment phase

This phase will comprise rigging work on the main engine, generator engine and generator, and power pumps in the engine room, along with incidental facilities and piping work. From the standpoint of enabling the vessel to sail under its own power, this is one of the most critical phases of the entire construction process.

④ Electrical work

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

⑤ Tests to be conducted during or following the construction process

Pursuant to the above construction phases, a series of tests will be performed, as required by the Classification Society and the Ministry of Transport, along with trial runs. Inspections will also be

made to certify the basic performance of the ship in motion, including seaworthiness, safety, and speed.

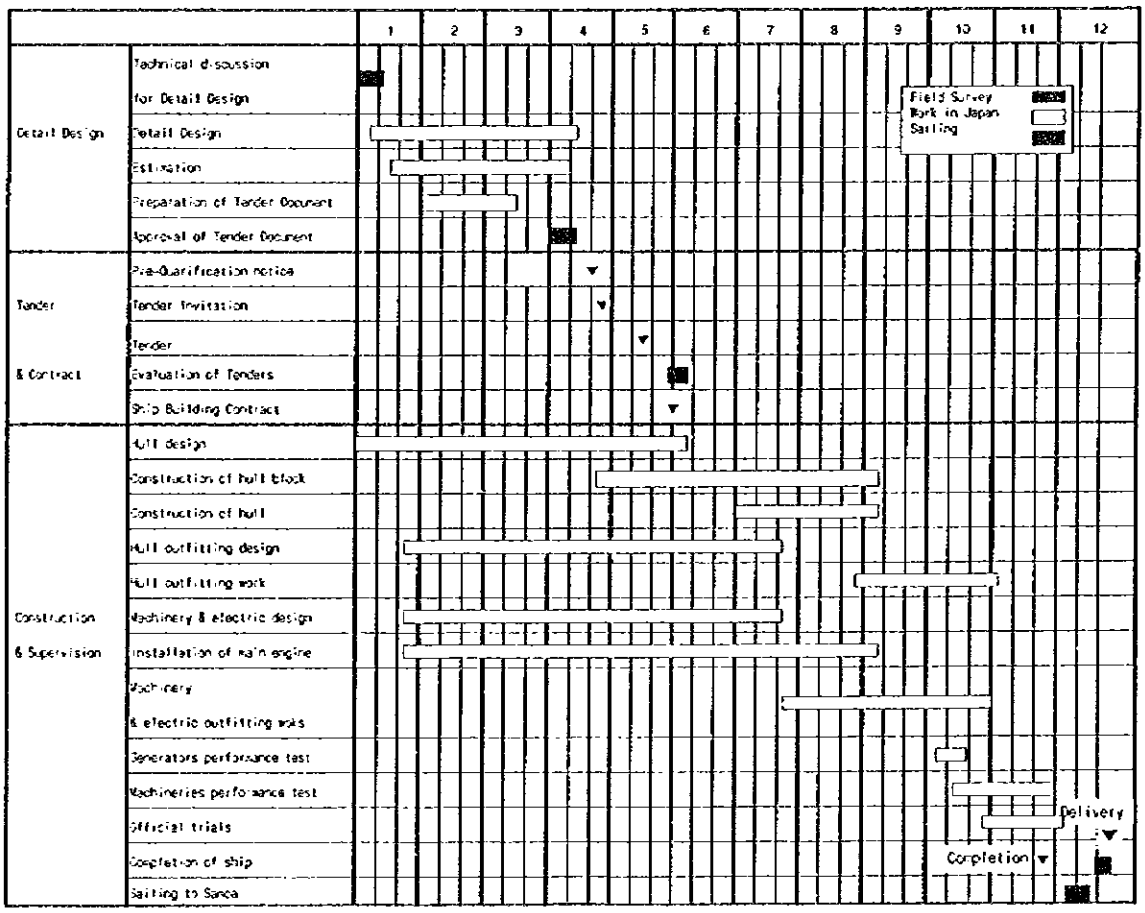
⑥ Sailing Plan

Following completion of construction at the shipyard and the trial runs, the Plan vessel will be delivered to the Samoa government. The Ship Builder is responsible under the contract for sailing the vessel from the shipyard to Samoa. Sailing time from Japan to Samoa, via the Central Pacific route, will be about 20 days.

The time required for project implementation is estimated at about 4 months for the Detail Designs (including tender procedures), about 4 months from contract and hull design at the shipyard through the keel laying, 4.5 months from the start of steel plate processing through launching, and about 2.5 months from launching to trial test operations. The delivery period for cargo gear will be approximately 6 months, while sailing time is expected to take about 20 days

The construction progress schedule is shown in the following table.

Table 2-2. Construction progress schedule



3.1.7. Obligations of recipient country

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

1) Maintenance of base facilities, water channels, berthing jetty, and mooring areas, as required for Plan vessel operations

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

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

4) Exemption from taxes and surcharges on Japanese nationals rendering project-related services in Samoa.

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

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

3.2.Transport Revenue Projections for the Plan Vessel

3.2.1.Pago Pago Service

The current S$30 one-way passenger fare between Apia and Pago Pago has been left unchanged for several years, reflecting the pricing policies of the Samoa government. And in view of the consensus that the WSSC passenger service is a public service for the country's low-to-middle income groups, the freeze on fares is likely to continue for the foreseeable future. On the other hand, however, WSSC, though owned completely by the government, is still a corporation and, while not under pressure to earn large profits, cannot be allowed to incur operating deficits either. In the developmental strategy of the Samoa government as well, it is expressly stated that the efficient utilization of infrastructure facilities built with public funds should be predicated on both efficient management by the responsible corporation and the users bearing a fair share of the operating costs.

WSSC is working under the concept that profits accruing from operation of the Plan vessel will be plowed back into a reserve fund dedicated to construction of a new vessel sometime in the future. In this connection, based on the income and outgo forecasts predicated on continuation of the present fare structure, it has become clear that operations of the Plan vessel alone would

make it difficult even to cover general administration expenses, let alone build up a vessel replacement fund. In the Appendix 5-1 following the body of this report, we have shown a comparison between revenue and expenditure forecasts based on (1) establishing new fare categories ; and (2) continuation of a flat fare policy.

While consideration must continue to be given to low-income groups, there is at the same time a strong desire for better service among social strata that can afford it. In fact, at an WSSC passenger conference which the Study Team attended during the field survey, there were many participants who felt that, in return for improved service, a modest fare increase would be unavoidable. It is, therefore, essential that separate fare categories be established which would properly reflect service quality differentials so as to increase overall profits without increasing the burden borne by low-income users.

We have, accordingly, proposed a separate fare structure on the Plan vessel for standard seats and bunks. However, considering the competition from air travel, these fares would clearly have to be set at amply competitive levels. The present round-trip air fare between Apia and Pago Pago is S$183, and it is felt that marine transport would lose its competitive edge if fares were to exceed 50 % of air travel. On this basis, it would be appropriate to leave the round-trip fare for standard seats at the present S$60, while setting the bunk fare at S$90. Following are the proposed passenger and cargo rates for the Apia - Pago Pago route.

Table 3.-1 The proposed passenger and cargo rates for Apia - PagoPago route

	Apia to PagoPago (S$)	PagoPago to Apia (US$)
Passengers Fares		
Adult (Upper 12 years old)	30	25
Children (6 to 11 years old)	15	12.5
Infant (Under 5 years old)	8	5
Bunk	45	37.5
Vehicles Freights		
Pick up truck	225	210
Small truck	265	258
Truck and Bus	450	432
Cargoes Freights		
Small size	8	-
Large size	16	-
Under 600 pound	90	75
Under 2,000 pounds	150	125
Baggage (Small)	8	7
Baggage (Large)	16	14
Bill of lading	5	2

Under the proposed structure, the current cargo rates would be left unchanged, along with the S$ 60 round-trip fare for standard seats, while the bunk fare would be set at S$90. Projected annual revenues and expenditures on the Pago Pago route, based on the above table, are as follows .

The passenger load factor per outbound voyage (from Apia to Pago Pago) is set at an average

rate of 96% of passenger capacity, totaling 212 persons, broken down as follows : bunk passengers (94), standard seat passengers (100), children (5), and infants (13).

The load factor per voyage on the return segment has been set at 72%, with a total of 159 passengers : bunk (71), standard seat(75), children (4) and infants (9). In addition, the average cargo load per outbound voyage has been set at 62,780 kg, and that per return voyage at 59,695 kg.

PagoPago Service	(S$)
Passenger Fares	963,066
Cargo Freights	2,205,008
Total Revenue	3,168,074

3.2.2.Domestic Service

At present, there is one scheduled sailing daily between Mulifanua and Salelologa, but the Salelologa - Apia route is served only on an unscheduled basis. As a result, fares on the latter route have been established only for vehicles, with passenger fares not yet set. Since the bus fare between Mulifanua and Apia is S$3.00, a vessel rate of 1/3 the bus fare should be competitive. Accordingly, the passenger fare between Salelologa and Apia has been set S$1.00 higher than that between Mulifanua and Salelologa.

The Plan vessel will make 2 round-trip voyages per week between Mulifanua and Salelologa, with an average passenger load of 344 adults and 81 children. As shown in Section 2.3.2.4 (Domestic Service), the total number of vehicles carried per year on this route is 4,475, comprising 1,371 sedans, 1,576 pickups, 322 small tracks, 1,112 medium-size trucks, 77 large trucks, and 17 trailers.

The Mulifanua-Apia service will operate 4 days a week, with the projected average passenger load per trip set at 85 adults and 20 children and the annual vehicle load at 42,237 units : 685 sedans, 788 pickups, 161 small trucks, 556 medium-size trucks, 39 large trucks, and 9 trailers.

The annual revenue and expenditure projections for these domestic routes are as follows.

Domestic Service	(S$)
Passenger Fares	380,328
Vehicle Freights	687,402
General Cargo Freights	27,694
Total Revenue	1,095,424

3.2.3.Operating and Maintenance Costs

In calculating operating expenses for the Plan vessel, reference was made to the operating costs for the Queen Salamasina.

3.2.4.Forecast of Net Operating Revenues

Following are the projected operating costs for the Plan vessel in 1999.

Table 3.-2 The projected operating costs for the plan vessel in 1999

A. Revenue	(Unit : S$)
Pago pago Service	
Passenger Fares	963,066
Cargo Freights	2,205,008
Sub - total	3,168,074
Ferry Service	
Passenger Fares	380,328
Vehicles Freights	687,402
Ordinary Cargo Freights	27,694
Sub - total	1,095,424
Total of revenue	4,263,498
B. Traffic expense	
International Service	
Port charge	109,212
Traffic office expense	62,401
Agent cost	110,250
Sundry	28,625
Sub - total	310,489
Ferry Service	
Port charge	3,723
Traffic office expense	4,771
Sundry	5,000
Sub - total	13,494
Total Traffic Expense	323,983
C. Net Operating Revenue(A－B)	3,939,515
D. Vessel Operation Cost	
Salary	254,200
Life saving equipment	10,000
Dry Docking Provision	230,000
Fuel	401,233
Lube oil	58,043
Insurance H & M	960,000
Insurance P & I	180,000
Vessels lease cost	465,000
License fee	5,000
Repair & maintenance cost	312,000
Stores	29,120
Sundry	6,000
Survey Fees	8,000
Uniforms	4,800
Total	2,923,396
E. Other expenses	
Crew training	16,250
Engineering Workshop	288,000
MTC Contribution	17,125
Indirect operating expense	47,800
Total	369,175
F. Total income (C-D-E)	646,944
G.Overhead	
Head office operating cost	397,437
Interest cost	67,600
TotalOverhead	465,037
H. Vessel Replacement Fund (F-G)	181,907

Under Japanese tax law, vessels are depreciated over 15 years and, in this analysis as well, the project period has been set at 15 years, starting in 1999.
It is assumed that passenger and cargo loads on the Pago Pago route will grow after 1999 at the rate of increase that was recorded from 1995 to 1996, and this forms the basis for estimating net operating revenues. The number of passengers carried on the Pago Pago route is expected to grow at 4.5% per annum, and cargo volume at 1%. Demand growth for passengers and vehicle transport on domestic routes has been projected via the same equation as shown in section 2.3.2.4 (Domestic Services).

In as much as the average passenger load for the Plan vessel from Apia to Pago Pago in 1999 is already forecast at 96%, vs. a passenger capacity of 220 persons, in order to satisfy anticipated passenger demand in the year 2000, the number of trips would have to be increased, but this, of course, would entail additional operating costs for fuel, crew wages, port charges, and other items.

The major portion of operating revenues for the Plan vessel will be derived from cargo carried on the Pago Pago route. However, the rate of increase in cargo traffic, based on performance to date, can be expected to be small relative to that for passenger traffic. In addition, since there is still surplus passenger capacity on the return voyage from Pago Pago to Apia, even if the number of voyages for the Plan vessel were increased, the rate of growth in transport revenues would not be large relative to the expenditures thereby incurred.

Trial calculations, based on 2 sailings per week, as shown in the Appendix 5-2-1, project a deficit in transport revenues for fiscal 2000. On the other hand, if the once-a-week schedule is maintained, despite the expected increase in passenger demand, this deficit can be eliminated, since the fall in revenues would be more than offset by the decline in expenditures from a twice-a-week schedule. Tentative calculations, based on one sailing per week, are also shown in the Appendix. 5-2-2. With a twice-a-week schedule, revenues would expand after the year 2000 from increases in both passenger and cargo loads; however, the cumulative Vessel Replacement Fund in the last fiscal year of project life, based on the preceding assumptions, is projected at S$ 4,520,616, which is less than the S$5,501,179 anticipated under a once-a-week schedule.

Owing to the public service nature of the Plan vessel, it is, of course, not possible to establish a transport plan which ignores passenger demand while seeking to maximize revenues. WSSC is, nevertheless, urged to develop a service plan for the new vessel that reflects a suitable balance between passenger demand and transport revenues.

3.2.5.Maintenance Management System

For safety of life and prevention of pollution, SOLAS convention has been so far laying importance mainly on securing safety of the hardware as the vessel, but supplementary regulation was added in SOLAS requiring software to manage vessel, i.e. ISM (International Safety Management) Code is imposed for companies managing vessel to establish management system for safe operation.

Maintenance management system according to ISM Code strictly requires periodical inspection of hull and machinery by the company team, report from the team, overhauling and repair and record.

SOLAS requires ISM Code be applied:

For passenger vessels and tankers	from July 1st 1998
For ordinary cargo vessel	from July 1st 2002

WSSC has worked out to establish crew management system and vessel maintenance system based on ISM Code under the guidance of the JICA expert. The vessel maintenance system is made under the concept that hull and machinery be systematically and periodically inspected and maintained not waiting for breakdown. In the machinery maintenance, working parts are exchanged with spare parts periodically, i.e. taken out parts are sent to workshop to prepare in a good condition and stowed as spare parts, after certain predetermined time maintained spare parts are again exchanged with working parts, taken out spare parts are again maintained, with this maintenance cycle repeated continuously thereafter. Under this system, parts life can be expected to be substantially extended, as opposed to a conventional system of parts replacement only after the installed component has been damaged or worn out.

WSSC is seeking to establish a vessel maintenance management system based on ISM, and a portion of this new system has already been implemented. There are 20 maintenance technicians and engineers in the WSSC Workshop who perform checks, repairs, and maintenance on WSSC vessels, using a mobile workshop and machine tools donated by the Government of Japan.

Based on a survey of maintenance conditions for the Queen Salamasina, operating conditions at the WSSC workshop, and the weekly maintenance program for the Lady Samoa II, it has been concluded that, excluding only dry-dock and other major work, the WSSC has ample capability for routine maintenance on the Plan vessel. Moreover, the shipbuilding yard in Pago Pago is fully capable of doing regular dry-dock maintenance, other than highly specialized work, on vessels comparable in size to the Plan vessel.

4. Project Evaluation and Recommendation

4.1. Verification of Project Appropriateness and Project Benefits

The subject project is intended to enhance transport services in Samoa by furnishing a replacement vessel for the superannuated vessel presently serving the Apia - Pago Pago route, designed for and capable of meeting the projected demand on this key international route. The new vessel will make possible significant qualitative and quantitative improvements in transport services between Samoa and neighboring American Samoa, which share common cultural and ethnic roots, while also supplementing and extending the domestic service between Upolu and Savai'i Islands currently provided exclusively by M/V Lady Samoa II.

We have summarized, as follows, the problems areas in the marine transport sector that the subject project seeks to resolve, along with the scope and scale of the benefits that can be anticipated from project implementation. This project is deemed to be fully compatible with the guidelines for grant-aid cooperation established by the Government of Japan to be assumed by the government of the beneficiary country.

(1) Since the existing vessel does not satisfy the safety equipment standards prescribed by the SOLAS Convention, it is feared that, after March, 1998, the U.S. Coast Guard (USCG) will no longer sanction the use of the M/V Queen Salamasina on the Apia - Pago Pago service. And, considering its advanced age, remodeling the vessel to conform to SOLAS standards would not be an economical proposition.

In the course of constructing the new Plan vessel, all necessary procedures will be followed in connection with the USCG Control Verification Examination; based on this USCG certification, vessel access to Pago Pago Port can be maintained. Moreover, owing to cyclone damage, passenger and cargo safety cannot presently be assured; however, the new vessel will be designed to provide the requisite stability prescribed by the latest international maritime conventions and regulations, such as SOLAS and those imposed by the USCG, and will also be equipped with fire-prevention and fire-fighting apparatus, lifesaving equipment, navigational and radio gear, engines, and electrical equipment conforming to these standards. This will eliminate the present hazards with respect to passengers and cargoes, leading to a reduction in insurance premiums.

(2) The existing vessel is so superannuated and the amenities so poor that it has become quite unsuitable for the long overnight journey from Apia to Pago Pago, as evidenced by the very cramped passenger cabin and uncomfortable chairs. It is also prone to severe rolling, inducing frequent seasickness, which is a perennial source of passenger dissatisfaction. On the Plan

vessel, air-conditioned cabin and corridor space will be secured, with a major improvement in chair comfort to ease the discomfort of the long crossing.

Double-decked bunks will also be installed for use during the night passage and to accommodate passengers who are prone to seasickness. The improvement in cabin amenities can be expected to lead to an increase in passenger traffic. Additionally, owing to the reduced capacity of the superannuated engines on the existing vessel, it has been difficult to maintain economical speeds during inclement weather but, with an improvement in engine capacity, schedules can be properly maintained, thereby reducing unnecessary costs, such as overtime payments to port personnel.

(3) With the present vessel, passenger and cargo capacities are clearly inadequate to meet demand. As a result, passengers and cargoes must often be left behind. And since general cargoes are loaded haphazardly, cargo handling efficiency is poor at all levels, from handling on the dock through loading, stowing on board, and unloading operations.

On the new vessel, however, small containers will be used, with a forklift to be provided on board to move these containers. This should improve cargo handling efficiency and reduce the time required for loading and discharging. By improving loading efficiency on the cargo deck, it is anticipated that the problem of unloaded cargoes will be eliminated. Also, by shortening loading and unloading time, wasteful use of auxiliary engines can be avoided, thereby eliminating intrusions on crew rest periods while maintaining accurate operating schedules.

(4) The projected increases in rated passenger and cargo loading capacity are expected to expand passenger and cargo revenues on the Pago Pago route. These revenue gains, combined with a reduction in the maintenance cost burden, can be expected to increase operating earnings on the subject route.

(5) Under existing conditions, the additional costs associated with transshipments and waiting times are preventing an expansion of agricultural exports from Savai'i Island. Based on the enhanced operating efficiency on the Plan vessel, not only will it be able to substitute for the Lady Samoa II when the latter is idled by regular inspections but the new capacity will also permit the establishment of a new direct route from Salelologa to Apia, thereby linking Savai'i island with American Samoa. The improved shipping convenience for agricultural shipments from Savai'i Island is expected to result in a reduction of shipping costs, thus expanding the island's agricultural exports and contributing to its economic development.

(6) The subject project is designed to insure the continuing development of the state-owned marine transport service, operated by WSSC for the benefit of the Samoa people and predicated on the twin principles of an efficient corporate management structure and having users bear their fair

share of the cost of transport infrastructure built with public funds.

The Plan vessel, as a replacement for the M/V Queen Salamasina, plans to draw its crews from those serving the existing vessel. The main and auxiliary engines and navigation and radio equipment to be installed on the new vessel are all items mandated by international maritime treaties and regulations, and the vessel crews and WSSC employees are amply qualified and experienced in the operation of this equipment.

(7) It is expected that operating expenses for the Plan vessel, including regular inspections, will be defrayed out of passenger, cargo, and vehicle transport revenues. In addition, it is anticipated that the expected annual surpluses will be put aside as a construction reserve fund, which can be applied to a portion of the construction cost of a new vessel in the final fiscal year of the subject project.

(8) Since the Plan vessel is intended to enter service on the route to American Samoa, it will be equipped to satisfy the severe vessel displacement standards imposed by the United States, and so there are no special requirements related to protection of the marine environment.

4.2. Recommendations

As discussed above, implementation of the subject project is not only expected to increase the flow of people and goods between Apia and Pago Pago but also to lead to an expansion of agricultural shipments from Savai'i Island. This would, in turn, contribute to a reduction in both transport time and costs for export produce from that island, thereby helping to solve two pressing problem areas in the National Development Plan: export expansion and the economic development of Savai'i Island.

It has been determined, therefore, that there would be considerable significance in implementing this project under a grant-aid from Japan.

No problems are anticipated with respect to either the operating structure or manpower plan developed by the West Samoa side, with maintenance and administrative costs expected be fully covered out of transport revenues from the Plan vessel. In carrying out the subject project, however, we believe that results could be even further entranced by adopting the following suggestions and approaches.

(1) Reduction in Cargo Handling Time and Rationalization of Services :

With a view to raising utilization efficiency on the cargo deck, where general cargoes are packed and loaded in sundry sizes and shapes and loading and unloading operations consume an inordinate amount of time, the Plan vessel will be equipped to handle small containers via an on-vessel forklift unit. While the use of containers is expected to facilitate expeditious utilization of the cargo deck, a meaningful shortening of loading and discharge times for general cargo can only be accomplished if WSSC devises new methods of receiving and off loading cargoes that are well suited to existing conditions in Samoa. Only through a reduction in cargo handling time can rationalization of services be achieved, making possible increased sailing frequencies and improvements in transport efficiency -- i. e., operating rates -- on the Plan vessel for both passenger and cargo traffic. WSSC, with its keen grasp of local conditions, is obviously in the best position to develop new methods for receiving and discharging cargoes.

At the present time, there are major discrepancies between actual cargo weights and those shown on the cargo manifests. Improving cargo intake methods would facilitate collection of transport charges reflecting true weights, thereby contributing to increased revenues from vessel operations.

(2) Demand Creation:

In order to satisfy the future growth in passenger demand between Apia and Pago Pago, service frequency will eventually have to be increased. However, it is projected that, at relatively low levels of growth in cargo and passenger traffic, the resulting increase in transport revenues from increased sailings would fall short of the increase in operating costs thereby incurred. Looking then at matters from the vantage point of WSSC operations, it has been deemed advantageous, for the time being, to hold frequencies at present levels. On the other hand, given the public service nature of the Plan vessel, it would scarcely be desirable to leave an increasing number of potential passengers behind at each sailing, which, in turn, would suggest the need for increased sailing frequencies. Considering the operating performance on the Pago Pago route in 1991 and 1992, while, admittedly, these were special years in the wake of the cyclone damage inflicted in 1990, these figures would seem to confirm the large latent demand for both passenger and cargo space on the subject route.

Rather than strive simply for a balance between operating revenues and expenditures for the new vessel, based on an operating plan reflecting only a natural growth in passenger demand, it would behoove WSSC to mount a special effort to raise revenues still further by actively creating new cargo and passenger demand for the Plan vessel.

(3)Improvement of route channels and harbor depths:

While there are no particular safety problems associated with Plan vessel arrivals or departures at either Mulifanua or Salelologa, from the standpoint or vessel maintenance, it would be highly desirable to improve water depths and deepen channels at these ports by means of dredging operations. Under existing conditions, owing to insufficient depths, the Lady Samoa churns up bottom sand when entering and departing from these ports. This sand is ingested into the propeller shaft bearing, causing major friction in the propeller shaft and sleeves. Accordingly, an extra supply of both propellers and sleeves will be provided with the new vessel. While early parts replacement will certainly reduce such damage, in order to fundamentally reduce sand ingestion itself, it will be necessary to provide adequate harbor depths at the above ports.