

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)  
AGENCY OF MARINE AND PORTS  
REPUBLIC OF CAPE VERDE

No. 1.

**BASIC DESIGN STUDY REPORT**  
**ON**  
**THE PROJECT FOR CONSTRUCTION**  
**OF**  
**INTER - ISLAND GENERAL CARGO VESSEL**  
**IN**  
**THE REPUBLIC OF CAPE VERDE**

**MAY 1992**

**OVERSEAS SHIPBUILDING COOPERATION CENTRE**

GRS

92-069

BASIC DESIGN STUDY REPORT ON THE PROJECT FOR CONSTRUCTION OF INTER-ISLAND GENERAL CARGO VESSEL IN THE REPUBLIC OF CAPE VERDE

MAY 92

92  
069

92  
069



JICA LIBRARY



1098320(3)

27814



## Preface

In response to a request from the Government of the Republic of Cape Verde, the Government of Japan decided to conduct a basic design study on the Project for Construction of Inter-Island General Cargo Vessel in the Republic of Cape Verde and entrusted the study to the Japan International Cooperation Agency (JICA).

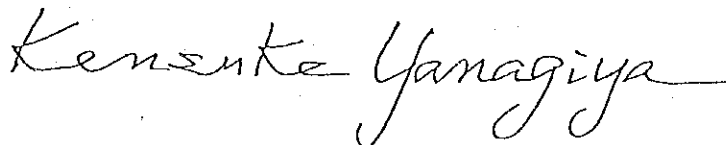
JICA sent to the Republic of Cape Verde a basic design study team headed by Mr. Masahiro Sanuki, Ship Inspector, Maritime Technology and Safety Bureau, Ministry of Transport from November 30 to December 20, 1991.

The team held discussions with the officials concerned of the Government of Cape Verde and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission, headed by Mr. Sadao Akahoshi, Shipbuilding Division, Maritime Technology and Safety Bureau, Ministry of Transport, was sent from March 21 to April 4, 1992 to the Republic of Cape Verde in order to discuss a draft report and the present report was prepared.

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 the Republic of Cape Verde for their close cooperation extended to the teams.

May 1992



Kensuke Yanagiya  
President

Japan International Cooperation Agency



Mr.Kensuke Yanagiya  
President  
Japan International Cooperation Agency  
Tokyo, Japan

Letter of Transmittal

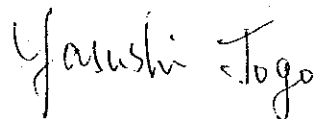
We are pleased to submit here with the basic design study report on the Project for Construction of Inter-Island General Cargo Vessel in the Republic of Cape Verde.

This study has been made by Overseas Shipbuilding Cooperation Centre, based on a contract with JICA, from November 21, 1991 to May 29, 1992 throughout the study. We have taken into full consideration of the present situation in the Republic of Cape Verde, and have planned the most appropriate project in the scheme of Japan's grant aid.

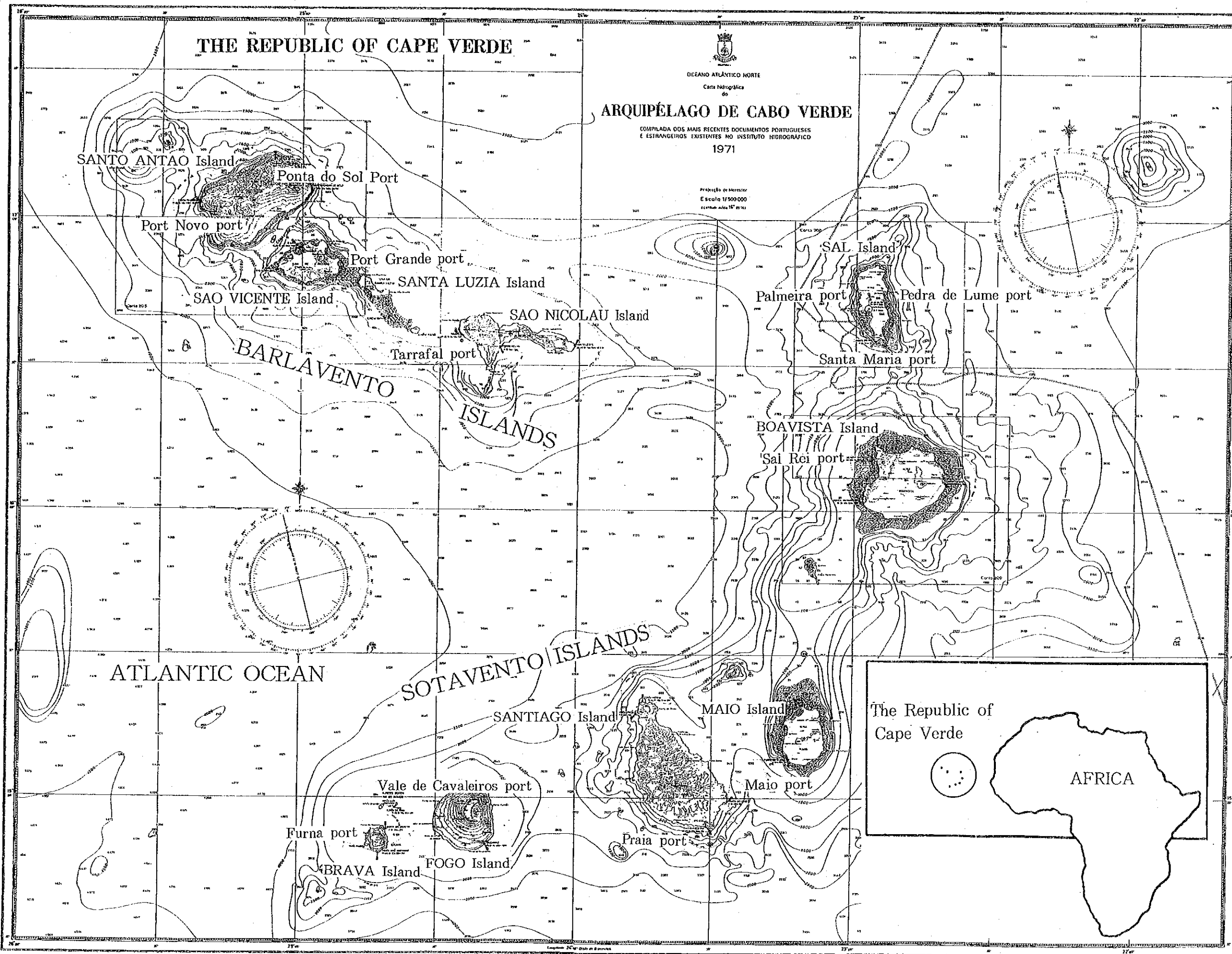
We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs and the Ministry of Transport. We also wish to express our deep gratitude to the officials concerned of Arca Verde National Navigation Company, JICA office in Senegal and the Embassy of Japan in Senegal for their close cooperation and assistance during our study.

At last, we hope that this report will be effectively used for the promotion of the project.

Very truly yours,



Team Leader, Yasushi Jogo  
Basic Design Study Team on  
the Project for Construction of  
Inter-Island General Cargo Vessel  
Overseas Shipbuilding Cooperation Centre



THE REPUBLIC OF CAPE VERDE

OCEANO ATLANTICO NORTE  
Carta Hidrográfica do

ARQUIPÉLAGO DE CABO VERDE

COMPILADA DOS MAIS RECENTES DOCUMENTOS PORTUGUESES  
E ESTRANGEIROS EXISTENTES NO INSTITUTO HIDROGRAFICO  
1971

Projeção de Mercator  
Escala 1:500 000  
Datum: Adm. 1875

ATLANTIC OCEAN

SOTAVENTO ISLANDS

The Republic of  
Cape Verde

AFRICA

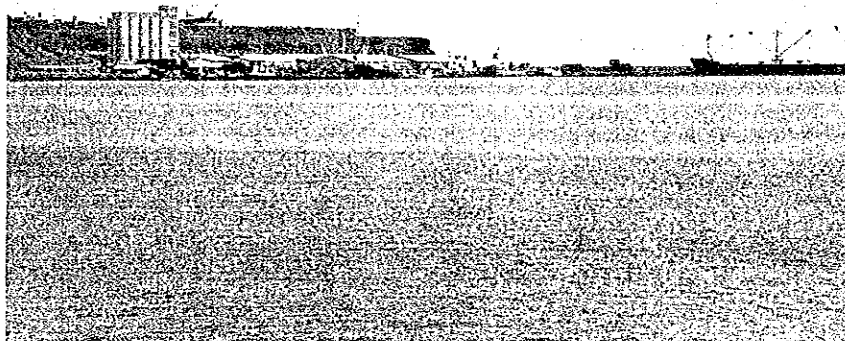




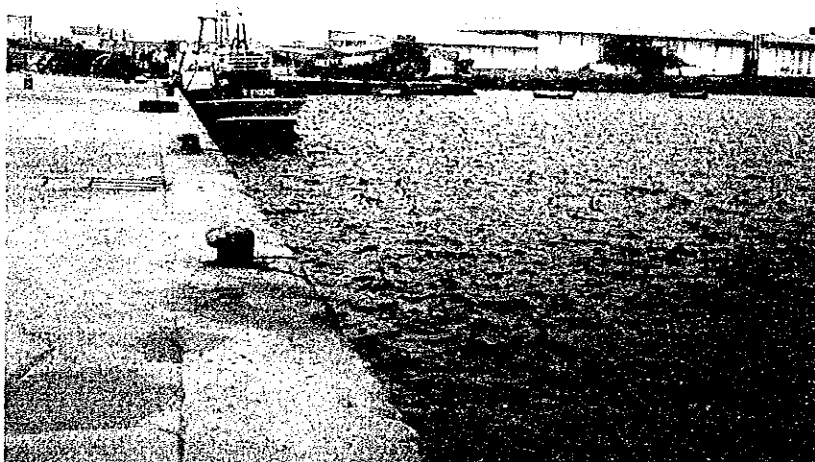
## Photographs



Area around Porto Grande Port  
viewed from sky over Mindelo

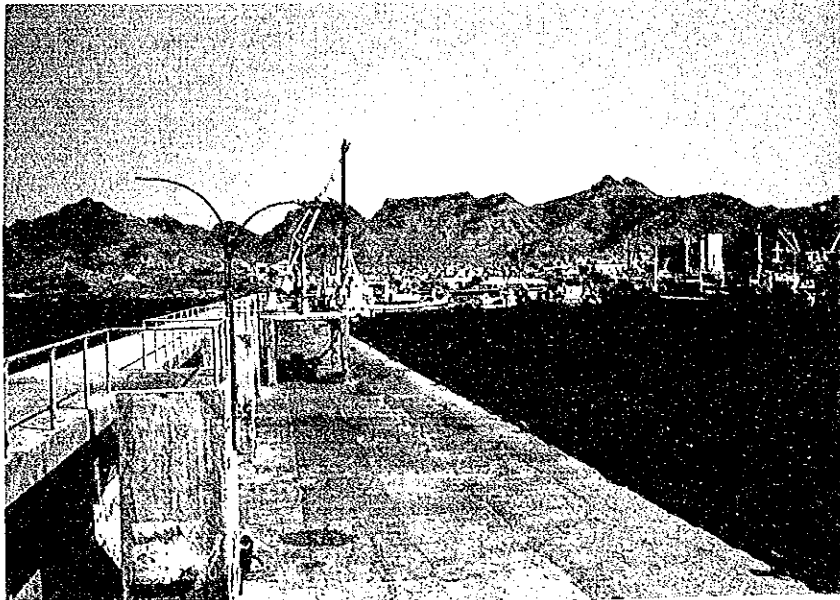


A veiw of Praia Port  
(Santiago Island)



Palmeira Port  
(Sal Island)





Porto Grande Port  
(Mindelo, Sao Vicente)

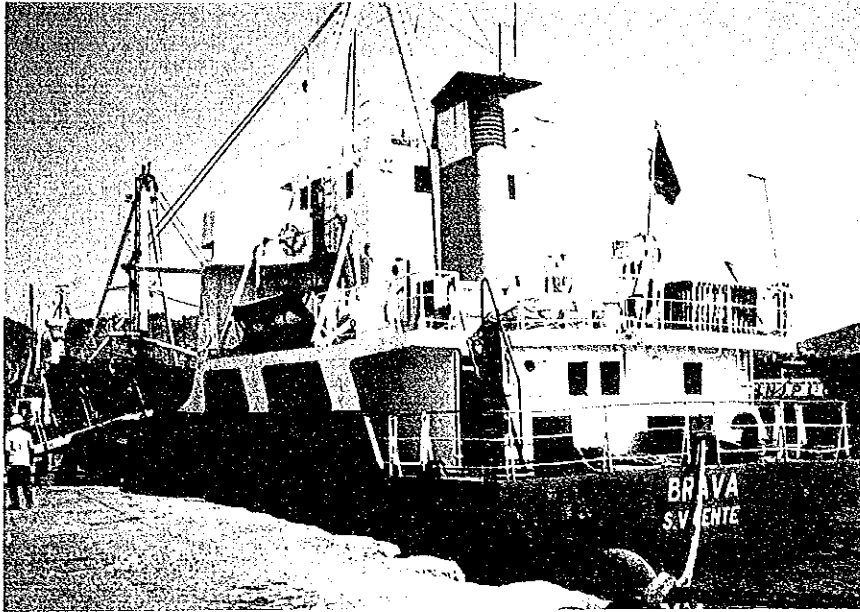


Porto Grande Port  
(Mindelo, Sao Vicente)



The Boa Vista  
(Porto Grande Port)

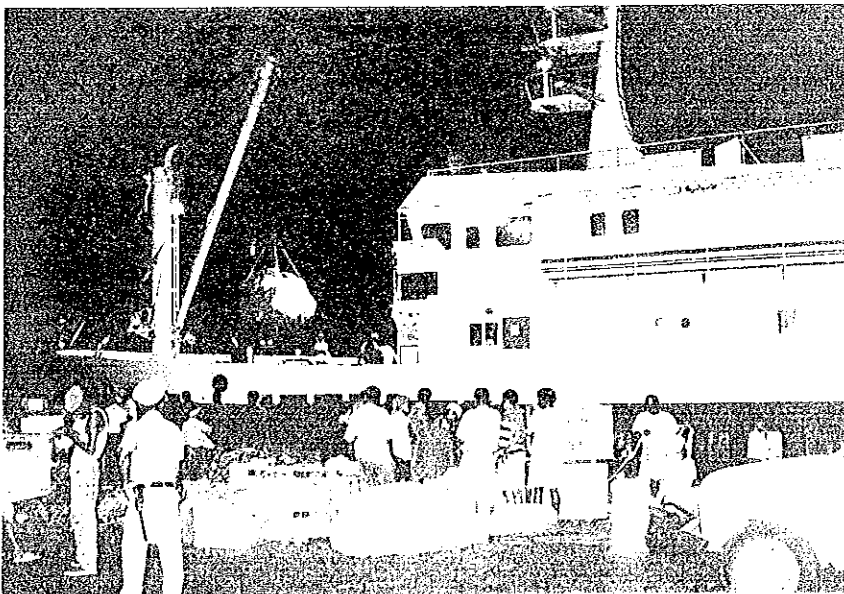




The Brava  
(Porto Grande Port)

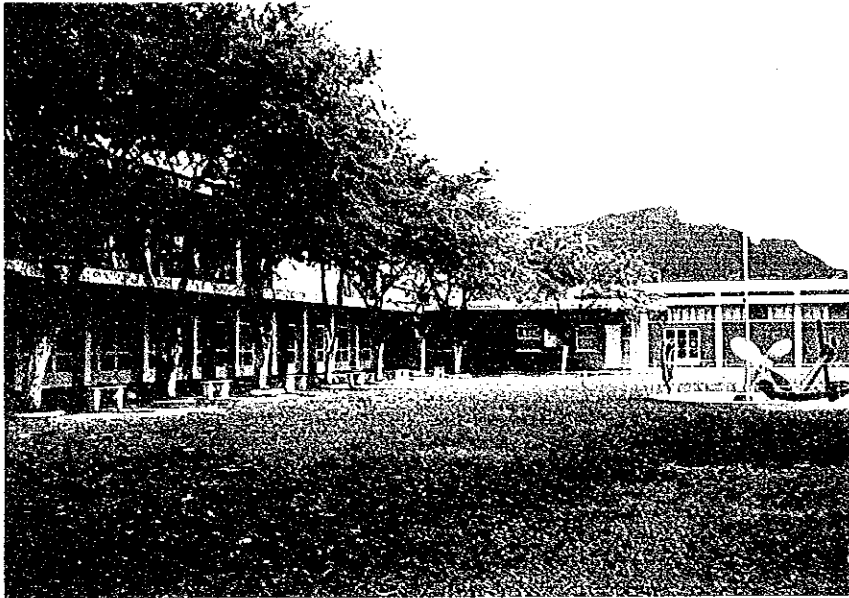


The Sotavento  
(Praia Port)



The Barlavento unloading  
cargo at night  
(Praia Port)





Centro Formacao Nautica (CFN)  
(Mindelo, Sao Vicente)



Arca Verde Manufactory  
(Mindelo, Sao Vicente)



Arca Verde Manufactory  
(Mindelo, Sao Vicente)





## **SUMMARY**



## Summary

The Republic of Cape Verde, situated approximately 600 km west of the Republic of Senegal, is an archipelagic country consisting of 9 major islands scattered in a radius of 150 km centering around a point 16° N, 24° W. It has a population of 337,000 and an area of 4,033km<sup>2</sup>.

Because of its severe climate with floods in the rainy season and frequent attacks of strong winds and dense fog in the dry season, in addition to its geographical factor of being an isolated cluster of islands, the country can barely support its population with its own food products, and depends almost entirely on purchase or assistance of food from other countries. In recent years, in particular, the domestic cargo volume handled in the country has increased drastically at a rate of close to 10 % a year in parallel with the increase of population and the progress of economic development. Most of these imported goods are discharged at two international trading ports in the two inlands of Santiago and San Vicente, and from there to other inlands they are transported by vessels of Arca Verde National Navigation Company employed in inter-island transportation.

The public corporation owns seven vessels including four donated by the then Federal Republic of Germany (West Germany) in the 1980's, and is engaged in the domestic transportation of passengers and cargo. By the donation from West Germany, the demand for the carriage of passengers has come to be fully satisfied. However, the transportation of cargo has fallen into a very difficult situation as regards the securing of regular inter-island transportation of foodstuffs and other commodities for daily life because the country's only long-haul freighter has become outmoded and sustains frequent failures of machinery in addition to the dramatic increase in demand for cargo carriage.

Under these circumstances, the Government of the Republic of Cape Verde requested our country to make a grant aid cooperation for the purchase of a freighter for transportation from international ports to the islands to meet the increased demand domestic carriage.

The government of Japan, in response to the request, decided on the implementation of a preliminary survey. Following this, the Japan International Cooperation Agency (JICA) sent a preliminary survey team to the Republic of Cape Verde in August 1991 in order to check the background and contents of the request and verify the propriety of this request. On the basis of this survey, the Government of Japan decided to carry out a survey to work out the basic design of a vessel. Following this, JICA despatched a full-scale survey team to the country from November 30 to December 20, 1991. The delegation checked the contents of the request by discussing with the Administration of the Republic of Cape Verde and its relevant organizations, and gathered information and data through surveys on site.

After the field survey, the Japanese Government made an analysis of the information and data in Japan and despatched a survey team to the Republic of Cape Verde From March 21 to April 4, 1992 and held a conference in order to explain the draft of a final report to the Cape Verdean government and naviga-

tion corporation and to seek their agreement.

The outline of the survey results concerning a freighter employed in inter-island transportation is as follows:

- (1) The transportation of goods between islands of the Republic of Cape Verde is carried out entirely by vessels employed in domestic trades only and all of them are registered in the same country.
- (2) The total of the vessels engaged in coastal trades is 16 vessels, 4,691 DWT, including cargo-passenger ships, of which approximately 30% in deadweight tonnage is owned by Arca Verde National Navigation Company, with the rest owned by small private shipowners.
- (3) Of the 16 vessels engaged in domestic service, vessels built in and after 1980 are only four, which were donated by West Germany. Most of other vessels are aged, with their operational ratio decreasing every year. Arca Verde National Navigation Company was forced to decommission three old vessels (850 tons in total) in recent years owing to the increase in maintenance and administration cost and deterioration in maneuverability. As a result the transportation capacity of the public corporation has dramatically fallen. Furthermore, it is now in a situation where it has to decommission other aged vessels, including the Santa Luzia.
- (4) Among the nine inhabited islands, six ports of six inlands have port facilities (one of which is under repair). At other islands cargo is handled at anchorage off shore. It follows that a freighter should inevitably be equipped with a cargo handling gear.

Standing on the basis of the actual situation described above, in order to supplement the transportation capacity of the public corporation which is forced to take steps to decommission its superannuated ships, it was decided to supply a newly-built freighter with a deadweight tonnage of approximately 500, which may be capable of coping with the reduction in carrying capacity, for the time being.

The particulars of the new freighter planned on the basis of the survey is as follows:

Length, overall:	approx. 48.5 m
Length between perpendiculars:	approx. 44.0 m
Breadth:	approx. 9.0 m
Depth:	approx. 4.0 m
Draft:	approx. 3.2 m
Gross tonnage:	approx. 480 tons
Deadweight tonnage:	approx. 500 tons
Hold capacity:	approx. 700 m <sup>3</sup>
Service speed:	approx. 10.5 knots
Cargo gear:	3.5 tons (2 units)
Maximum number of persons to be carried	
Crew members:	10 persons
Assistant officer	1 person
Passengers:	8 persons

For the implementation of the scheme, it is expected to take approximately three months for the activities to design the vessel and approximately 12 months for construction (including a cruise of approximately two months to deliver the vessel) after finalizing a building contract.

Arca Verde National Navigation Company, after a substantial merger with Comissao da Gestao dos Transportes Maritimos (Maritime Management Committee) (it has already merged, nominally), is to own four vessels for international trading, including two vessels from the Committee, and six for domestic trading, and is expected to play a major role in the transportation of people and cargo in the Republic of Cape Verde. However, most of their owned vessels are aged ones with low operational ratios, resulting in the lower performance of carriage as compared with their nominal tonnage. The new cargo ship, when put in service, is to increase the transportation capacity of Arca Verde company, thus making great contribution to the constant supply of daily commodities and leading to the improvement of the life of people in the country.

On the other hand, the public corporation already has a sufficient number of experienced seafarers as crew members to operate its vessels, and is capable of recruiting more seafarers, as necessary, through a training school for them. Regarding the maintenance, survey and repair of vessels, the service by CABNAVE dockyard equipped with sufficient facilities and technology, is available on one of the islands and therefore there is no need to sail vessels to foreign countries for repairs.

As a conclusion of the aforementioned, the project is to make a contribution to the improvement and stabilization of the people's life by the stable conveyance of daily commodities to each island, and to the development of the economy of people as well as the nation. Therefore, the implementation of this project by cooperation in the form of grant aid is considered to be well worthwhile.

Proposals have been made regarding the following points for more effective use of the new freighter after it has been decided to put the project into practice.

1. Improvement of port facilities, including wharfs.
2. Improvement of aids to navigation, including buoys.
3. Provision of more precise nautical charts.
4. Securing necessary spares at regular intervals.



## CONTENTS

Preface

Letter of Transmittal

Location Map

Photographs

SUMMARY

CHAPTER 1 INTRODUCTION ..... 1

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1	Outline of the Republic of Cape Verde .....	3
2.1.1	General state of the country .....	3
2.1.2	Population .....	6
2.1.3	Economy, finance .....	8
2.2	Outline of related projects .....	10
2.3	Outline of marine transportation .....	11
2.3.1	Present state of transportation .....	11
2.3.2	Maritime transportation public corporations, shipping companies and related public corporations .....	12
2.3.3	Transportation of cargoes and passengers by international shipping .....	26
2.3.4	Transportation of cargoes and passengers by domestic shipping .....	28
2.4	Outline of ports and harbors .....	31
2.4.1	Present status of ports and harbors .....	31
2.4.2	Harbor development projects .....	38
2.5	Present state of ship repair facilities .....	39
2.6	Outline of crew training facilities .....	42
2.7	Background of the request .....	46
2.7.1	Details of request .....	46
2.7.2	Contents of request .....	46



### CHAPTER 3 CONTENTS OF THE PROJECT

3.1 Objective.....	49
3.2 Study of the request .....	49
3.2.1 Study of the reasonableness and necessity of the project .....	49
3.2.2 Examination of execution and management plans .....	49
3.2.3 Study of contents of the requested vessel.....	53
3.2.4 Need for technological cooperation .....	57
3.2.5 Basic policy on execution of cooperation.....	57
3.3 Outline of the project .....	58
3.3.1 Shipping plan.....	58
3.3.2 Maintenance and administration of a new cargo ship .....	58

### CHAPTER 4 BASIC DESIGN

4.1 Design policy .....	61
4.2 Examination of design conditions.....	61
4.2.1 Weather and sea conditions .....	61
4.2.2 Examination relative to geographical conditions .....	62
4.2.3 Examination relative to ship repair facilities .....	63
4.2.4 Examination of domestic and international laws and regulations .....	63
4.3 Basic Design.....	64
4.3.1 Principal dimensions.....	64
4.3.2 Hull part .....	64
4.3.3 Machinery part .....	67
4.3.4 Electrical part .....	67
4.3.5 General specifications and general arrangement .....	69
4.4 Construction plan .....	79
4.4.1 Construction policy .....	79
4.4.2 Construction management plan .....	79
4.4.3 Other matters .....	79
4.4.4 Construction process plan .....	80

### CHAPTER 5 PROJECT EVALUTATION AND CONCLUSION

5.1 Project evaluation .....	83
5.2 Conclusion.....	84

**APPENDIX**

1. Basic Design Study Team

- (1) Members..... (1)
- (2) Survey schedule..... (2)
- (3) Member of the Cape Verde side, etc..... (4)
- (4) Minutes..... (6)

2. Draft Report Explanation Team

- (1) Members..... (11)
- (2) Survey schedule..... (11)
- (3) Member of the Cape Verde side, etc..... (12)
- (4) Minutes..... (13)

3. List of Data Collected..... (18)

4. Distances Between Ports..... (22)

5. Out-Of-Service Status of Ships Owned by Arca Verde..... (23)

6. Facilities at CABNAVE Shipyard..... (25)



# **CHAPTER 1 INTRODUCTION**



## CHAPTER 1. INTRODUCTION

The Republic of Cape Verde is an archipelagic country comprising 15 islands (of which nine are inhabited) that dot the Atlantic within a radius of about 150 km centering around a point about 600 km west of the coast of Dakar in the Republic of Senegal.

The country imports most of its food, daily necessities, and industrial products. Most of the imported commodities are distributed, from two international ports to the islands by small ships engaged on domestic voyages.

The Republic of Cape Verde's need for inter-island transport using ships engaged on domestic voyages is increasing with its economic development and increase in population. However, the ships engaged on domestic voyages are few in number and are aging rapidly. While a growing number of ships are lying idle because of breakdowns, efforts to increase the number of ships and replace obsolete ones are being delayed. If nothing is done about this situation, transport demand is expected to far exceed transport capacity in the near future.

Under these circumstances, the government of the Republic of Cape Verde has requested the Japanese government for a grant aid cooperation to build a general cargo ship for inter-island transportation.

In response to this request, the Japanese government decided to make preliminary studies. Based on this decision, the Japan International Cooperation Agency (JICA) dispatched a preliminary study team in August 1991 to verify the background and contents of the request and to study the necessity of the project. The team concluded that the project was reasonable.

In accordance with the results of the preliminary study, the Japanese government decided to carry out a basic design study. Accordingly, the Japan International Cooperation Agency dispatched to the Republic of Cape Verde a basic design study team headed by Mr. Masahiro Sanuki, Ship Inspector, Maritime Technology and Safety Bureau, Ministry of Transport, from November 30 to December 20, 1991.

The study team visited Praia, which is Cape Verde's capital on Santiago Island, Mindelo on Sao Vicente Island, and Sal Island. Discussions and other meetings were held with officials of the Ministry of Infrastructure & Transportation, Arca Verde National Navigation Company, and ENAPOR (a public harbor management corporation), etc. Through these meetings, surveys were conducted on the present status of maritime transportation and harbor facilities, the management and navigation abilities of Arca Verde National Navigation Company, the training of crew members, and the status of ship repair facilities in Cape Verde. Minutes of the discussions held during the field surveys, a list

of members of the study team, the survey schedule, etc. are attached to this report as appendices.

## **CHAPTER 2 BACKGROUND OF THE PROJECT**





## CHAPTER 2. BACKGROUND OF THE PROJECT

### 2.1 OUTLINE OF THE REPUBLIC OF CAPE VERDE

#### 2.1.1 General state of the country

##### (1) Geographical conditions

The Republic of Cape Verde measures 4,033 km<sup>2</sup> in land area. It is a country consisting of islands that emerged following volcanic activity. The islands are scattered in an area ranging from 450 km to 750 km west of Dakar, the capital of the Republic of Senegal in West Africa (from longitude 22.5° to 25.5° west) and from 15° to 17° north. The country consists of 10 islands and five islets. Of these, nine islands are inhabited. The archipelago is broken down into two groups. The windward group (Barlavento) comprises Santo Antao Island, Sao Vicente Island, Santa Luzia Island, Sao Nicolau Island, Sal Island, and Boavista Island. The leeward group (Sotavento) comprises Santiago Island, Maio Island, Fogo Island, and Brava Island. Generally, the country is lacking in greenery as the entire land area is characterized by dry weather and volcanic soil.

##### (2) Natural features

Cape Verde has a dry tropical climate with two seasons. The dry season lasts from November to July when there is a persistent trade wind. The rainy season lasts from August to October with irregular rainfall. The average yearly temperature is about 24°C. The yearly temperature difference does not exceed 10°C due to the effects of the ocean. The minimum seawater temperature is 21°C in February and March. The maximum temperature is 25°C in September and October. As the country is located in the Saharian climate zone, it is strongly affected by winds from the African continent. A shortage of rain can continue for several years, while in some years there is heavy rainfall. Average annual rainfall is about 300 mm, with precipitation concentrated in August and September.

##### (3) History

A one-party government under the rule of the Cape Verde Independent African Party (PAICV) had prevailed in the Republic of Cape Verde since its independence. However, in September 1990, a plural-party government system was introduced now that the administrative structure had been properly organized. The first election of members of the National Congress under the plural party system was held in January 1991. A new party, the "Movement for Democracy" Party (MPD), had an overwhelming victory, and a new government was formed.

##### (4) Education system

The school system consists of primary school and secondary school. The primary school, which is compulsory, is made up of a four-year elementary

course which begins at age 6 and a subsequent two-year supplementary course. The secondary school consists of a three-year ordinary course and a subsequent two-year supplementary or technical course.

In the absence of education beyond secondary school, those wishing to obtain advanced learning must study abroad. The Cape Verde government is actively promoting education for the youth who will shoulder the next generation by granting scholarships to students with outstanding academic records who want to go on to higher-level schools.

(5) Political system

The head of state is the president, who is elected by popular vote and serves a five-year term. The National Congress takes the form of a single-house parliament, and consists of 79 seats elected by popular vote. Three of the seats are allocated to expatriate Cape Verdean citizens. The house members serve for five years.

The president appoints the ministers and secretaries of the various government agencies as proposed by the heads of the political parties.

The ministries and agencies of the Cape Verde government are as shown in Fig. 2-1-1. Public corporations related to this project have been included.

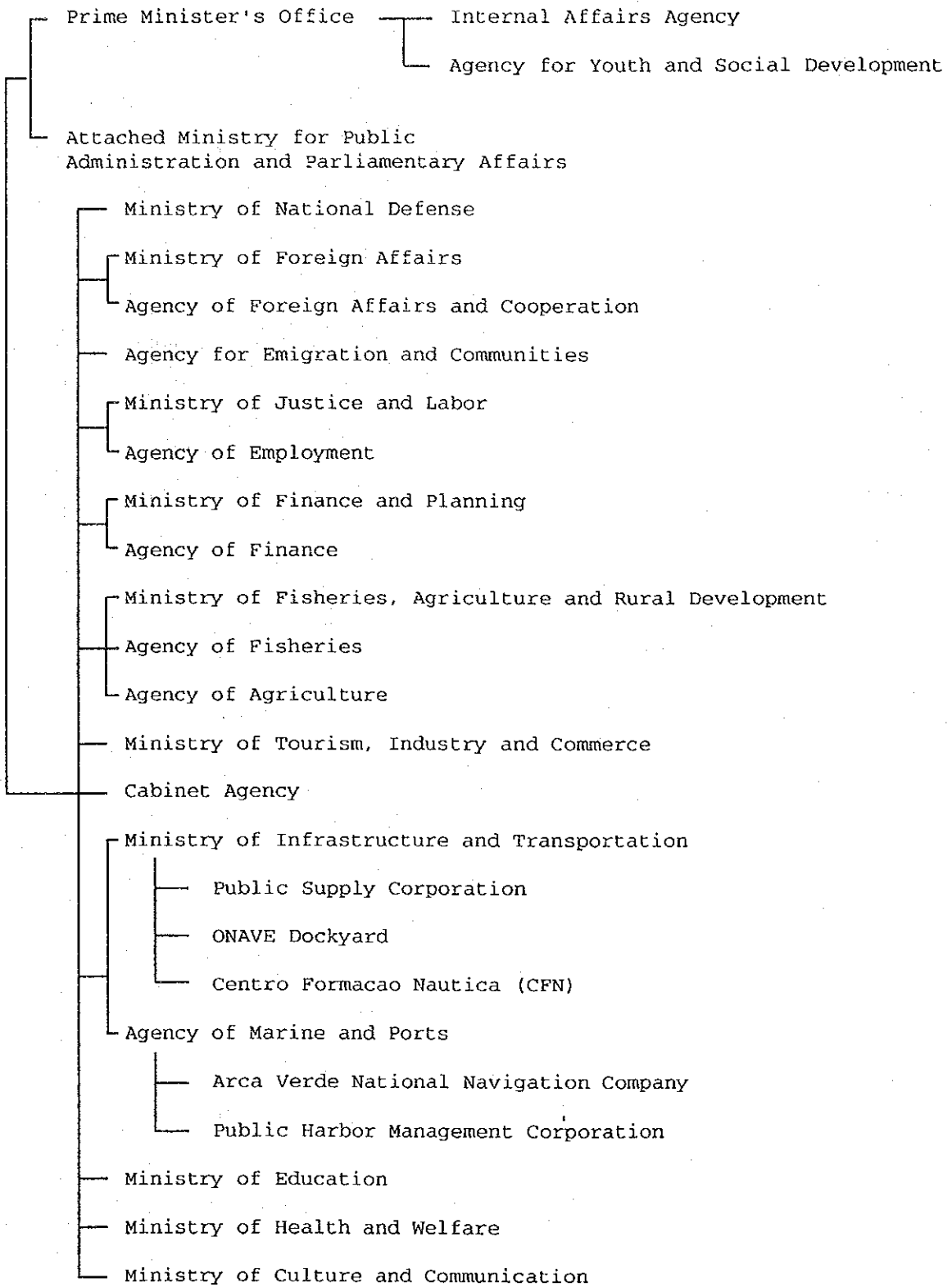


Fig. 2-1-1 Organization chart of the government

### 2.1.2 Population

#### (1) Population

Population by island at 10-year intervals is as shown in Table 2-1-1.

Table 2-1-1 Population

(unit: person)

Name of island	1950	1960	1970	1980	1990
Boavista	2903	3263	3569	3372	3457
Brava	7902	8625	7756	6985	6980
Fogo	17520	25615	29412	30978	33860
Maio	1879	2680	3466	4098	4964
Sal	1813	2608	5505	5826	7998
Santiago	58893	88587	128782	145957	171433
Santo Antão	27947	33953	44623	43321	43272
São Nicolau	10316	13866	16308	13572	13577
São Vicente	19158	20705	31578	41594	51257
TOTAL	148331	199902	270999	295703	336798

(Source: Alguns resultados provisórios do Recenseamento Geral da População e Habitação 1990)

Population trends are shown graphically in Fig. 2-1-2.

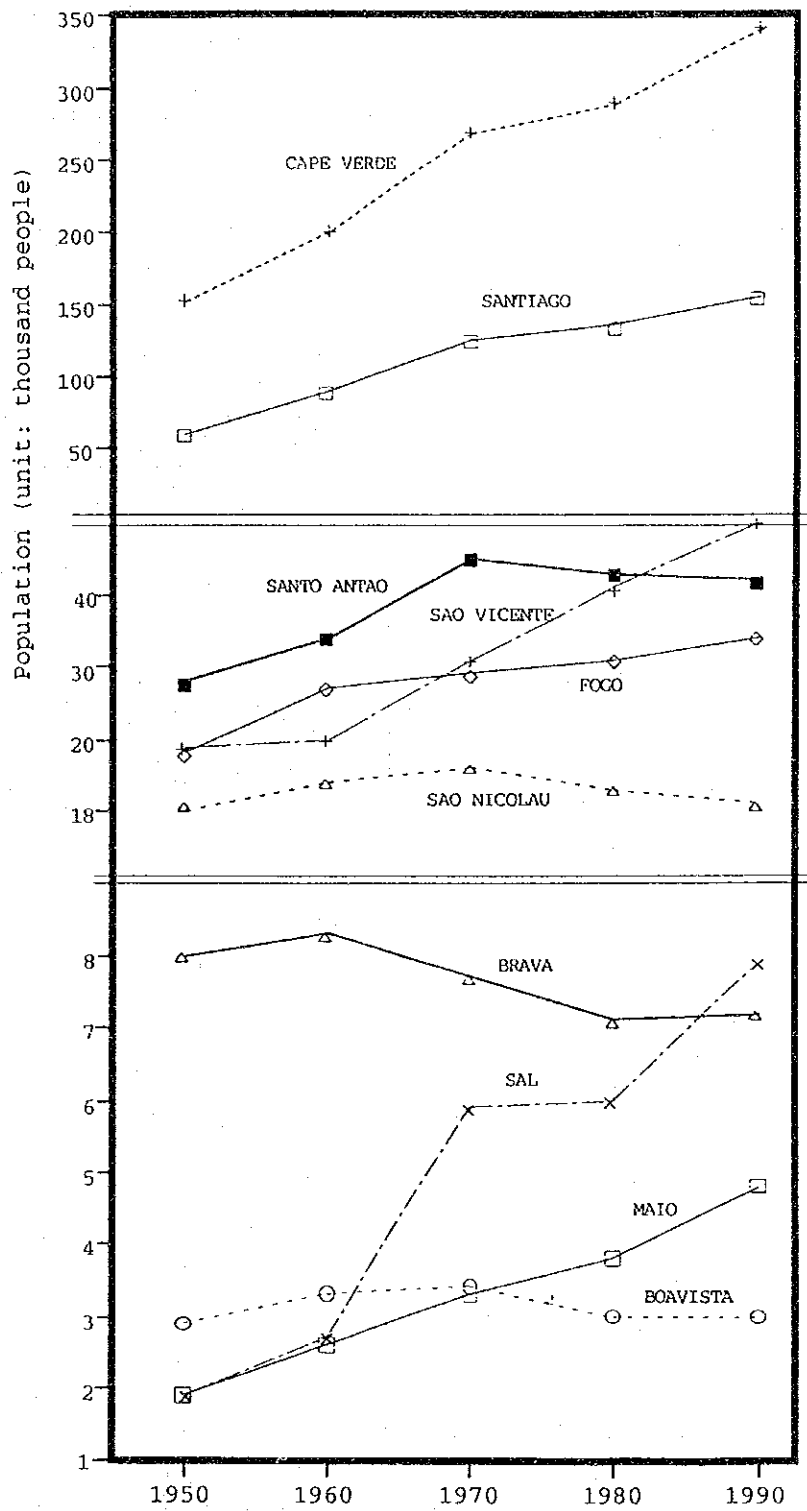


Figure 2-1-2 Trends in population by island

Figure 2-1-2 shows remarkable increases in the populations of Santiago Island, Sao Vicente Island, and Sal Island, and conspicuous decreases for Santo Antao Island, Sao Nicolau Island, and Brave Island.

Incidentally, approx. 600,000 citizens of Cape Verde reside overseas in the United States, Portugal, Angola, Senegal, and other countries.

(2) Rate of population increase

Table 2-1-2 shows the rates of population growth.

Table 2-1-2 Rates of Population Growth

	(unit:%)					
	1983	1984	1985	1986	1987	1988
Birth rate	3.7	3.8	3.8	3.7	3.7	3.6
Death rate	0.8	0.9	0.8	0.9	0.8	0.8
Natural rate of increase	2.9	2.9	3.0	2.8	2.9	2.8
Social rate of increase	-1.1	-0.5	-0.7	-1.0	-0.2	
Rate of increase	1.8	2.4	2.3	1.8	2.7	

(Source: BOLETIM ANUAL DE ESTATISTICA 1989)

2.1.3 Economy, finance

(1) Consumer price indices

The consumer price indices (%) for major consumer goods in Praia are shown in Table 2-1-3.

Table 2-1-3 Trends in consumer price indices

	(unit: %)						
	1983	1984	1985	1986	1987	1988	1989
Foodstuffs	100.0	111.5	110.8	125.2	130.6	134.7	146.9
Clothing	100.0	111.3	119.2	140.2	163.8	182.8	188.9
Water	100.0	112.2	112.2	112.2	112.2	112.2	112.2
Fuel and electricity	100.0	115.5	123.9	130.2	130.5	129.0	
Transportation	100.0	117.6	118.2	145.6	145.6	145.3	171.7
Communication	100.0	134.5	149.0	150.8	176.5	189.3	256.7
Total	100.0	112.1	117.5	129.8	135.7	141.3	152.2
Inflation rate		12.1	4.8	10.5	4.5	4.1	7.7

(Source: BOLETIM ANUAL DE ESTATISTICA 1989, CABO VERDE EM NUMEROS 1990)

(2) Trends in international balance of payments

Table 2-1-4 shows trends in international balance of payments. Imported articles denote purchased items except aid.

Table 2-1-4 International Balance of Payments

(unit: \$ million)

	1983	1984	1985	1986	1987	1988
Exports	1.9	6.9	6.1	5.1	12.2	4.4
Imports	104.5	82.4	92.3	91.5	100.6	104.7
Trade Balance	-102.6	-75.5	-86.2	-86.4	-88.4	-100.3
Exports/Imports	1.8%	8.4%	6.6%	5.6%	12.1%	4.2%
Private transfer Revenue	34.7	21.6	22.2	26.7	34.1	39.5
Government Transfer Revenue	38.8	38.7	37.3	42.2	47.0	41.8

(Source: Country Report 1990-91)

The above trade deficits in Cape Verde are covered by revenues from invisible trade and transfer payments by the private sector and government. Private transfer payments consist of remittances from overseas emigrants while government transfer payments consist of aid from foreign governments.

Major import items are machinery, rice, lumber, corn and clothing.

(3) Economic growth rates, others

Economic growth rates and others are shown in Table 2-1-5.

Table 2-1-5 Economic Growth Rates, Others

	1983	1984	1985	1986	1987	1988	1989
Real GNP Growth Rate (%)	1.3	4.0	9.1	3.8	8.1	4.1	
Real GDP Growth Rate (%)				2.9	7.0	3.2	5.5
GDP per head (1,000CVE)		31.2	35.0	38.6	45.6	49.3	53.8
(US\$)	435	412	424	569	680	747	
Average Exchange Rate (CVE/US\$)	71.69	84.88	91.03	84.01	72.47	77.98	

(Source: Country Report 1990-91)



## 2.2 OUTLINE OF RELATED PROJECTS

Under the basic policy of the Third Five-Year National Development Plan 1991-96, shipping assumes an especially important role in the supply of materials and general transportation in an archipelagic nation such as the Republic of Cape Verde. Shipping aims at building a stabilized state, and improvement of the people's livelihood and welfare.

As a followup to the Second Five-Year National Development Plan, the following items will be carried out by placing importance to promotion of marine transportation in general by:

- (1) Maintaining inter-island maritime transportation capability (transportation of people and goods).
- (2) Promoting the preparation of marine charts and preventing pollution of the marine environment.
- (3) Expanding and reinforcing the seamen's training school at Mindelo on Sao Vicente Island.
- (4) Continuing small-scale harbor construction and facility installation plans on all islands (for 500 tonners).
- (5) Improving the international harbor infrastructure (for 10,000 tonners).
- (6) Reforming navigation regulations and ratifying international conventions on navigation.
- (7) Promoting installation of centers for statistical data on marine activities.
- (8) Setting up a foreign ship registration system, protecting shipowners and expanding labor services, and supply services.

Regarding the state-run transportation company, the government will consider business and financial improvements to promote structural reform and environmental condition. In order to qualitatively reinforce the corporate structure, navigation plans will be re-examined, the management system will be rationalized, and technological innovation promoted.

## 2.3 OUTLINE OF MARINE TRANSPORTATION

### 2.3.1 Present state of transportation

Although marine transportation occupies the most important place as a means of transportation in the Republic of Cape Verde, a brief description of other means of transportation (i.e., land and air transportation) is also given below.

#### (1) Maritime transportation

The Republic of Cape Verde has a low level of self-sufficiency, and the bulk of goods must be imported. Moreover, of the nine inhabited islands, only three have international trade harbors, while the remaining six rely on secondary transportation of imported goods. Therefore, it is primarily domestic shipping that decides the fate of the islanders. Unlike ocean-going shipping which allocates foreign ships to transport goods for importing, domestic trade shipping is managed solely by ships of Cape Verdean nationality. Securing an adequate number of ships and tonnage and efficiently managing these ships is thus extremely important.

Accordingly the government of Cape Verde is working to develop maritime transportation under its Third Five-Year Plan. The government has entrusted private shipping companies with relatively profitable domestic shipping in an effort to achieve stable supply relative to demand. Arca Verde National Navigation Company has been entrusted primarily with low profit and low efficiency cargo handling domestic routes which are shunned by private shipping companies, as well as with inter-island passenger transportation in order to stabilize the national livelihood.

As of December 31, 1990, a total of 39 ships of Cape Verdean nationality had been in operation, but virtually all those owned by both Arca Verde National Navigation Company and the private sector -- except for several vessels -- were about 20 years old and worn out. On top of a drop in the level of capacity utilization due to frequent breakdowns, normal shipping activities have been hindered by delays in cargo handling due to accidents and inadequate harbor facilities.

As for international trade, the requisite transport volume is somehow being maintained through the addition of chartered ships of foreign nationality. As for domestic shipping, however, there is anxiety that there will be a sudden plunge in transportation capacity due to the scrapping of worn-out ships within the next two to three years.

#### (2) Land transportation

Cape Verde's road network is kept in relatively good condition. The goods unloaded from ships can be transported smoothly around the islands. About 80% of the goods transported on the islands are carried by EMPA and private trucks.

(3) Air transportation

International airports are located on Sal Island and at Praia, Santiago Island.

According to flight schedules between October 27, 1991 and March 28, 1992, there are three weekly Praia-Dakar flights, two Sal Island-Lisbon flights and two Sal Island-Dakar flights.

In addition, there are special flights to Paris, Frankfurt, London, New York, Havana, Budapest, Moscow, Luanda, and Johannesburg.

There are one to two domestic flights each day linking Praia, Sal Island, and Mindelo. One daily flight or so links these three airports with other islands.

The number of airline seats offered and the number of passengers are as follows:

Table 2-3-1 State of Use of Airplanes

(unit: 1,000 persons)

		1986	1987	1988
Domestic routes	Number of seats offered	40,925	51,157	49,201
	Number of passengers	23,024	30,853	31,513
	Seat Utilization rate (%)	56	60	64
International routes	Number of seats offered	88,680	172,019	193,666
	Number of passengers	56,091	85,843	91,446
	Seat utilization rate (%)	63	50	47

(Courtesy TACV)

Incidentally, the number of maritime passengers is as shown in Tables 2-3-9 and 2-3-11.

2.3.2 Maritime transportation public corporations, shipping companies, and related public corporations

(1) Maritime transportation public corporations and shipping companies

Maritime transportation in the Republic of Cape Verde consists of maritime transportation public corporations, and private shipping companies. Maritime transportation public corporations comprise Arca Verde National Navigation Company and Comissao da Gestao dos Transportes Maritimos (CGTM). CGTM is a company that specializes in international voyages with two cargo ships of the 3,000DWT class purchased from Denmark. One of these went aground in October 1991 and is now out of service.

CGTM is to be absorbed in January 1992 by Arca Verde National Navigation Company (it has already been dissolved according to the official gazette), and work is under way on the actual transfer. Substantially, therefore, Arca Verde National Navigation Company is the only public shipping company in the country.

The position of a public corporation in shipping, as described above, is designed to meet public interests by contributing to the stabilization of the national livelihood. As such, a public shipping corporation necessarily differs in many ways from private ones which only pursue profits. Accordingly, the public shipping corporation must serve routes marked by low economic efficiency and handle inter-island cargo and passenger transportation as an easy means of transportation for the public.

As of September 26, 1991, a total of 18 private shipping companies were operating in the country. Virtually all companies are minute-scale enterprises possessing only one ship, with only two companies possessing two ships. Most of the ships engaged in domestic trade are old and worn out, having been built more than 20 years ago. The oldest was built in 1924, and the newest in 1971.

Table 2-3-2 shows the ships operated as of September 26, 1991.

(2) Arca Verde National Navigation Company

Arca Verde National Navigation Company (Companhia Nacional de Navegacao Arca Verde E.P.), which is to perform this project, is under the supervision of the Ministry of Infrastructure and Transport and the Agency of Marine and Ports (both established in 1992). The organization of the company and other matters are described in the following.

Table 2-3-2 Ships inDomestic voyage

## Public corporation

Name of ship	Shipowner	Year of construction	Gross tonnage	DWT
BARLAVENTO	Arca Verde Company	1987	499.90	320
SOTAVENTO	Arca Verde Company	1987	499.90	320
FURNA	Arca Verde Company	1972	142.15	60
ILHEU RASO	Arca Verde Company	1988	134.00	70
PORTO NOVO	Arca Verde Company	1980	299.56	100
SANTA LUZIA	Arca Verde Company	1977	272.97	400
TOTAL	6 vessels		1848.48	1,270

## Private shipping companies

Name of ship	Shipowner	Year of construction	Gross tonnage	DWT
ARCA VERDE	ABILIO F. SILVA	1959	278.87	113
AUTA MANUEL	MARIO J. LIMA	1971	489.88	726
ARQUIPELAGO	SODIMAR	1965	489.88	571
BUBISTA	ADRIANO A. LIMA	1924	298.40	36
MAR LIMA	ADRIANO A. LIMA	1971	299.99	720
DJRFOGO	CARGOMAR	1968	199.97	566
GAVIAO	OLAVO N. LOPES	1947	65.91	65
RA DA BARCA	JORGE GOMES	1949	106.57	140
VITORIOSO	ALIRIO B. SILVA	1943	149.94	130
MAR LISO	JOSE A. DUARTE	1927	39.83	30
TOTAL	10 vessels		2,375.36	3,421

		Gross tonnage	DWT
Domestic Voyages	16 vessels	4,223.84	4,691

Service as of Sept. 26, 1991

International voyage

Public Corporation

Name of ship	Shipowner	Year of construction	Gross tonnage	DWT
BRAVA	Arca Verde Company	1972	199.90	600
SANTIAGO	Arca Verde Company	1977	3,259.01	5,500
ILHA DE KOMO	CGTM	1973	1,599.94	3,000
SANTO ANTAO	CGTM	1972	1,599.94	2,900
TOTAL	4 vessels		6,658.79	12,000

Private shipping companies

Name of ship	Shipowner	Year of construction	Gross tonnage	DWT
BOA VISTA	CONCHAVE	1973	197.72	600
CAPE V LINE I	CAPE V. LINE	1965	1,119.09	2,200
ELSIE	TRANSP. C&I	1971	709.55	1,700
VILMA	ALBERTO P. LOPES	1967	299.98	632
INDEPENDENCIA	COMP" ESTRELA	1967	498.68	1,100
MINDELO	COMP" ESTRELA	1976	1,599.94	2,900
JENNY	JOA BF. MEDINA	1968	1,289.92	1,078
MARCO AURELIO	SEALINE	1978	1,249.58	1,930
REVEIRA BRAVA	T. MARITIMOS	1967	390.15	1,010
DILZA	TRANSMAR, LDA	1978	499.93	1,460
TOTAL	10 vessels		7,854.54	14,610

		Gross tonnage	DWT
International voyages	14 vessels	14,513.33	26,610
International and domestic voyages	30 vessels	18,737.17	31,301

1) Organization

At the time of our recent survey (December 1991), the Company was undergoing reorganization in order to merge Comissao da Gestao dos Transportes Maritimos, CGTM but its provisional structure was as shown in Fig. 2-3-1.

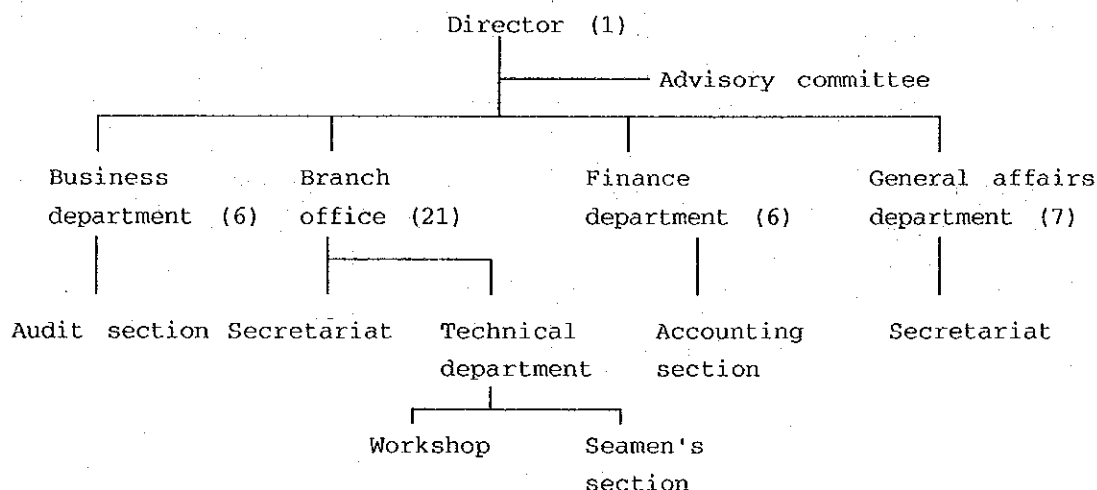


Fig. 2-3-1 Structure of Arca Verde  
(Figures in parentheses indicate number of persons.)

Three departments at the head office -- business, finance and general affairs -- are located in the capital city of Praia, while the branch office is set up at Mindelo on Sao Vicente Island. Under the Director are 41 members (excluding the seamen in the Seamen's section). The number of persons in the Seamen's section totals 103, forming the complement of persons on board the ships of the Company. The operation schedule of the ships is determined by the Business department, which gives instructions to the Technical department concerning ship operations. The advisory committee belongs to the Ministry of Infrastructure & Transport. The four-member committee works out the Company's operation policy. The committee will also map out and decide on plans for the Company's merger with CGTM scheduled for January 1992 along with the new organization structure, business contents, etc.

2) Particulars of ships

The Company owns eight ships totaling about 5,310 gross tons. Two of them with a gross tonnage of about 3,460 tons are registered as ships engaged on international voyages, while six (including four cargo/passenger ships) with a gross tonnage of 1,850 tons serve on domestic voyages. Principal data on ships are given in Table 2-3-3.

Table 2-3-3  
Data of ships owned by  
Arca Verde National Navigation Company

Name of ship	SOTA- VENTO	BARLA- VENTO	P.NOVO	FURNA	SAN- TIAGO	BRAVA	SANTA LUZIA	ILHEU RASO
Type of ship	Cargo passenger				Cargo			
Year built	1987	1987	1980	1972	1977	1972	1977	1988
International or domestic	Domestic				International		Domestic	
Gross tonnage	500	500	300	142	3259	200	273	134
Deadweight tonnage	320	320	100	60	5500	600	400	70
Complement of persons (passengers)	150	150	150	40	-	-	-	-
Speed	10.5	10.5	8.0	9.5	13	10	9.8	9
Output of main engine (PS)	816	816	305X2	400	3180	900	565X2	544X2
Length overall (m)	45.0	45.0	33.6	25.4	96.5	50.0	36.2	28.0
Breadth (m)	9.6	9.6	8.5	7.2	16.0	10.1	7.5	7.0
Depth (m)	4.3	4.3	3.6	3.6	8.8	5.6	4.0	2.5
Draft (m)	3.0	3.0	2.5	2.5	6.8	2.8	3.5	1.5
Volume of fuel oil (m <sup>3</sup> )	38.5	38.5	30.0	14.0	280	55	35	18
Propeller	CPP*	CPP	Twin FPP*	CPP	CPP	CPP	Twin FPP	Twin FPP
Shaft generator	YES	YES	NO	NO	NO	NO	NO	
Port use generator	YES	YES	NO	NO	YES	YES	NO	
Oil purifier	YES	YES	NO	NO	YES	YES	YES	
Sewage-related equipment	YES	YES	YES	NO	YES	NO	NO	
Number of radars	2	2	1	1	2	1	1	

\* CPP: controllable pitch propeller.  
FPP: fixed pitch propeller

Depending on the decision of the Advisory Committee, the SANTIAGO and the SANTA LUZIA are scheduled to be sold or scrapped in 1992 and the FURNA in 1994, because of the mounting costs needed to maintain the ships properly.

### 3) Service routes and state of operation

As described above, the Company transports cargoes and passengers between the islands. Currently, the ships serve the following routes:

#### a) SOTAVENTO and BARLAVENTO (cargo/passenger ships)

Each ship has a complement of 150 passengers. There are virtually no passenger ships operated by the private sector, although there are ships that can carry one or two passengers). Both ships now mostly carry



passengers, and the cargo is limited to passenger baggage or merchandise for storeless retailers.

The shipping schedule is announced a week in advance by the travel agency.

There are two standard courses: One turning clockwise and one turning counterclockwise with Porto Grande port on Sao Vicente Island serving as the base port. In addition, a ship is put into service on the Dakar route about once a month.

A sample shipping schedule is given below:

Ship name	BARLAVENTO	SOTAVENTO
Dec. 14	Praia port	Leaves Dakar Port for Sao Vicente Island.
Dec. 15	Sal Island	
Dec. 16	Sao Nicolau Island Sao Vicente Island	
Dec. 17	Sao Vicente Island	Sao Vicente Island
Dec. 18	Fogo/Brava Islands	Sao Nicolau Island
Dec. 19	Praia Port/Maio Island Praia Port	Sal Island
Dec. 20	Praia Port	Praia Port
	(Counterclockwise)	(Clockwise)

b) FURNA (cargo/passenger ship)

This ship serves the following routes two times a week:

Praia Port <-----> Fogo Island <-----> Brava Island, and  
Praia Port <-----> Brava Island <-----> Fogo Island

c) PORTO NOVO (cargo/passenger ship)

This ship shuttles daily between Sao Vicente and Santo Antao Islands.

d) SANTIAGO (cargo ship)

This ship is now chartered to EMPA for service on international voyages.

e) BRAVA (cargo ship)

This ship had been chartered to EMPA as a ship for international trade use but now it is used as a domestic route ship to carry mostly EMPA cargo.

f) SANTA LUZIA (cargo ship)

This ship is currently out of operation due to a breakdown. It is now moored at a pier.

g) ILHEU RASO (cargo ship)

This landing ship-type cargo ship lands on sandy beaches of Boavista, Fogo, Brava and Maio Islands only, where quays are non-existent, to unload cargo. It is used mostly to transport vehicles. It goes into service two or three times a year.

In the above, we have described the present routes and operations of eight ships owned by Arca Verde National Navigation Company. Only two ships are currently chartered to EMPA -- the SANTIAGO, engaged on international voyages, and the BRAVA, now engaged on domestic voyages (formerly international).

4) Domestic Maritime Cargo

The yearly amount of cargo carried by the Company is shown in Table 2-3-4 and Figs. 2-3-2 to 2-3-4 which show the loading and unloading sites. This data shows the following trends.

a) In 1989 and 1990, 60 to 70 percent of the cargo was shipped from Sao Vicente Island, most of which was unloaded at Santo Antao Island.

b) Shipment from Santiago Island is decreasing.

Table 2-3-5 shows that the share of Arca Verde National Navigation Company in domestic maritime cargo transportation is decreasing due to the disposal of ships by sale, breakdowns arising from the deterioration of ships, and other causes, while the total demand for transportation in the Republic of Cape Verde is increasing year after year.

Table 2-3-5 Tonnage of domestic maritime cargo

(unit: ton)

	Total tonnage of Cape Verde	Tonnage transported by Arca Verde	Share of Arca Verde (%)
1986	90,131	51,742	57.4
1987	106,522	35,917	33.7
1988	103,976	42,528	40.9
1989	120,962	38,437	31.8
1990	135,000	35,407	26.2

(Source: materials of ENAPOR and Arca Verde Co.)

Table 2-3-4 Cargoes Transported between Islands by Ship

(Unit : Tons)

Island where loaded	Island where unloaded											Total
	Santiago	S. Vicente	Fogo	Brava	S. Nicolau	Boa Vista	Sal	S. Antao	Maio	Total		
1	0	4,241	9,791	1,381	229	45	1,366	56	1,153	18,262		
9	5,972	0	1,505	683	5,189	0	935	11,736	330	26,350		
8	3,394	2,775	167	244	140	93	293	24	0	7,130		
6	9,366	7,016	11,463	2,308	5,558	138	2,594	11,816	1,483	51,742		
1	0	829	10,805	2,377	48	1,341	1,929	0	522	17,851		
9	1,693	0	956	114	1,516	57	179	8,489	0	13,004		
8	1,477	1,814	279	322	163	277	591	139	0	5,062		
7	3,170	2,643	12,040	2,813	1,727	1,675	2,699	8,628	522	35,917		
1	0	2,911	5,052	2,528	549	1,126	1,977	3,529	559	18,231		
9	4,572	0	1,901	280	2,093	694	1,954	4,631	610	16,735		
8	2,122	3,656	566	937	125	12	144	0	0	7,562		
8	6,694	6,567	7,519	3,745	2,767	1,832	4,075	8,160	1,169	42,528		
1	0	1,582	4,343	796	263	909	3,557	0	293	11,743		
9	3,925	0	1,268	115	4,653	195	960	11,128	367	22,611		
8	932	2,474	165	121	191	3	197	0	0	4,083		
9	4,857	4,056	5,776	1,032	5,107	1,107	4,714	11,128	660	38,437		
1	0	1,165	2,085	738	247	419	605	0	146	5,405		
9	2,946	0	1,127	356	3,950	250	906	14,962	0	24,497		
9	1,395	3,470	241	62	230	1	106	0	0	5,505		
0	4,341	4,635	3,453	1,156	4,427	670	1,617	14,962	146	35,407		

B9901/CT1289

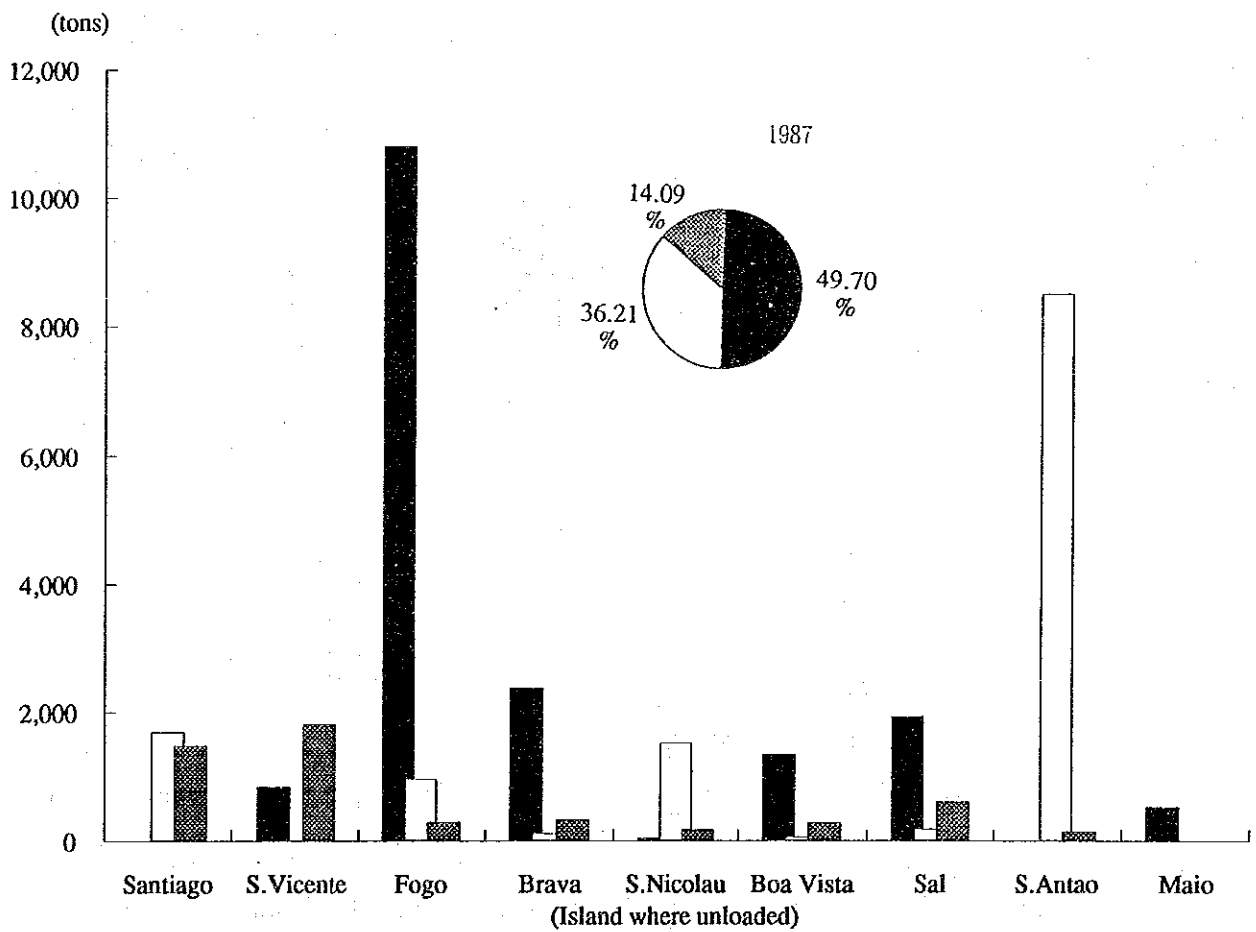
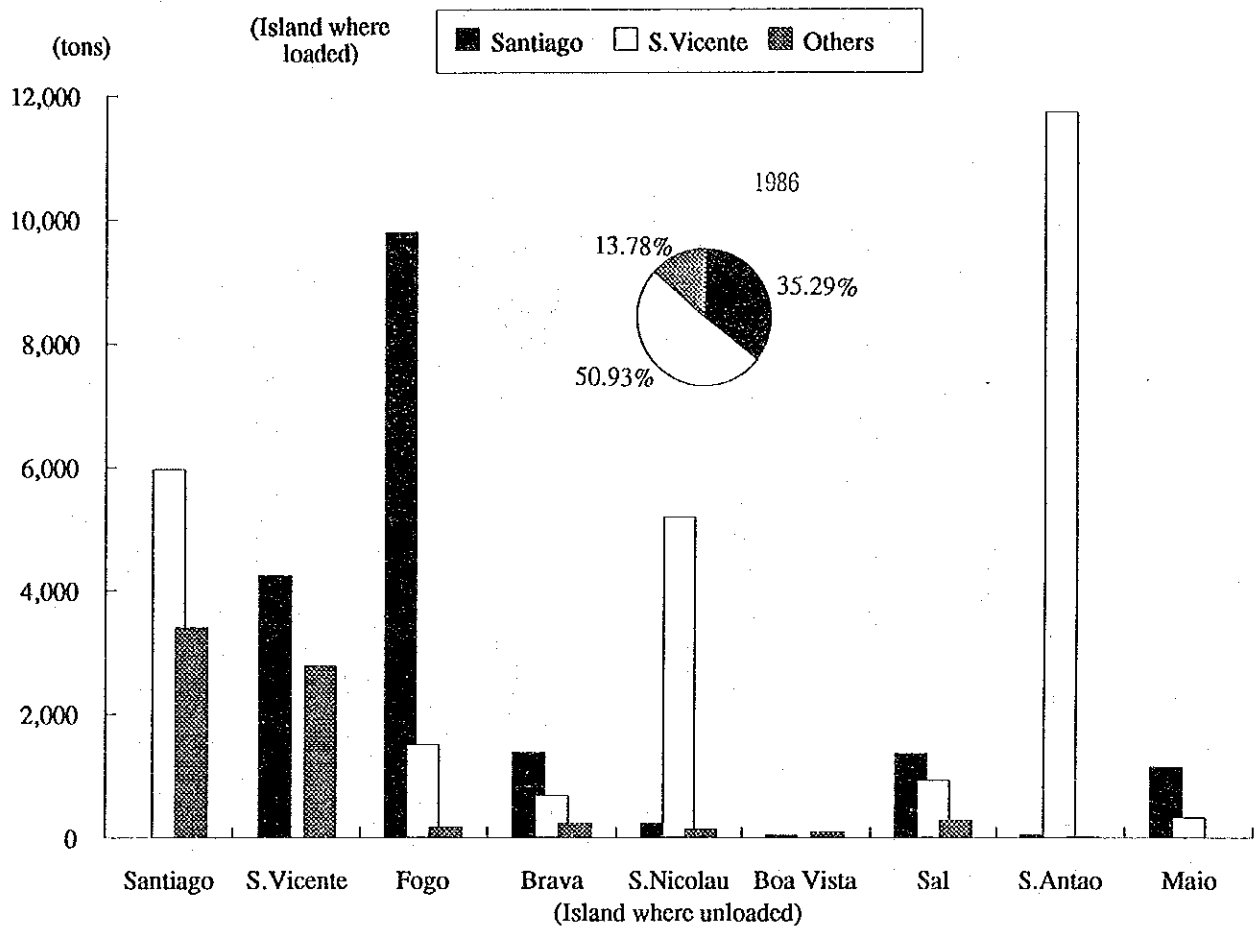


Fig.2-3-2 Cargoes Transported between Islands by Ship 1986, 7

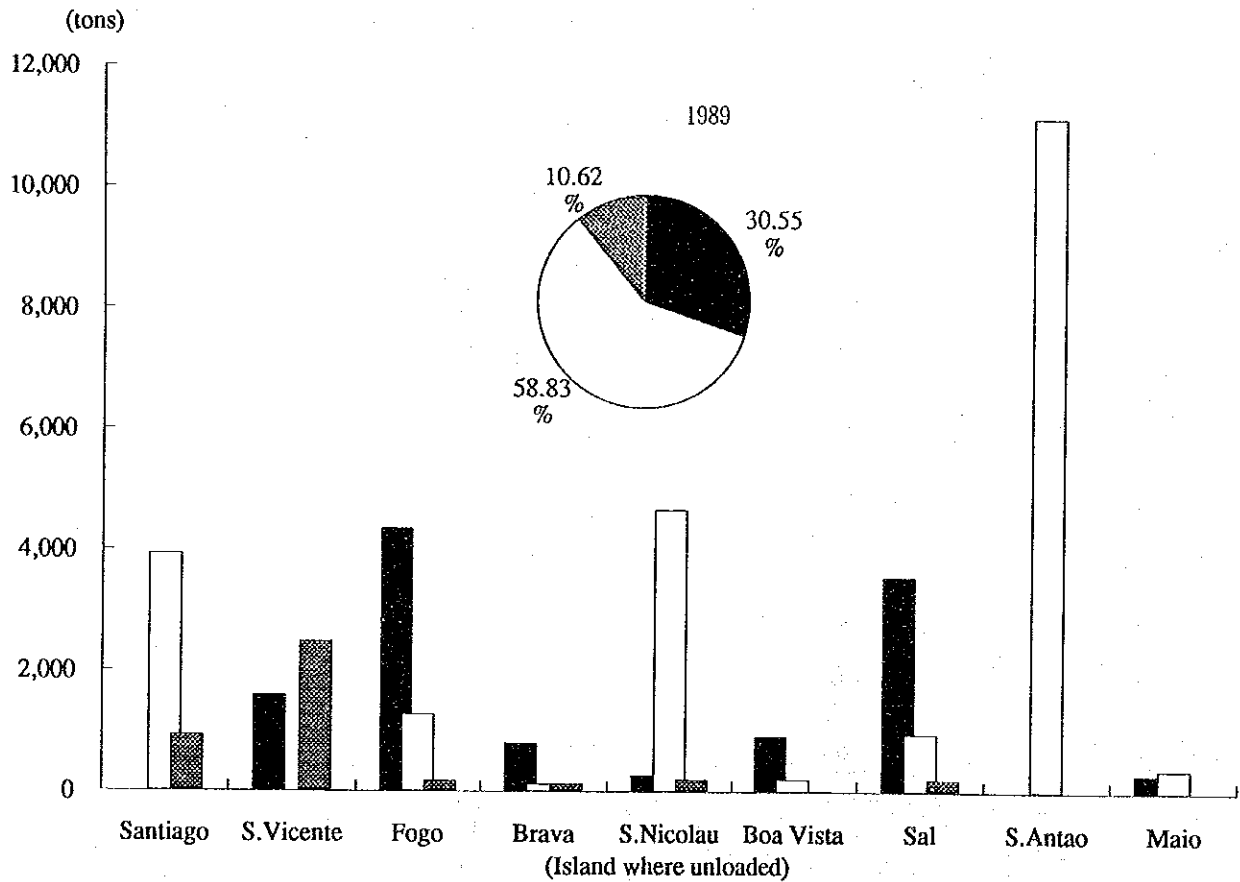
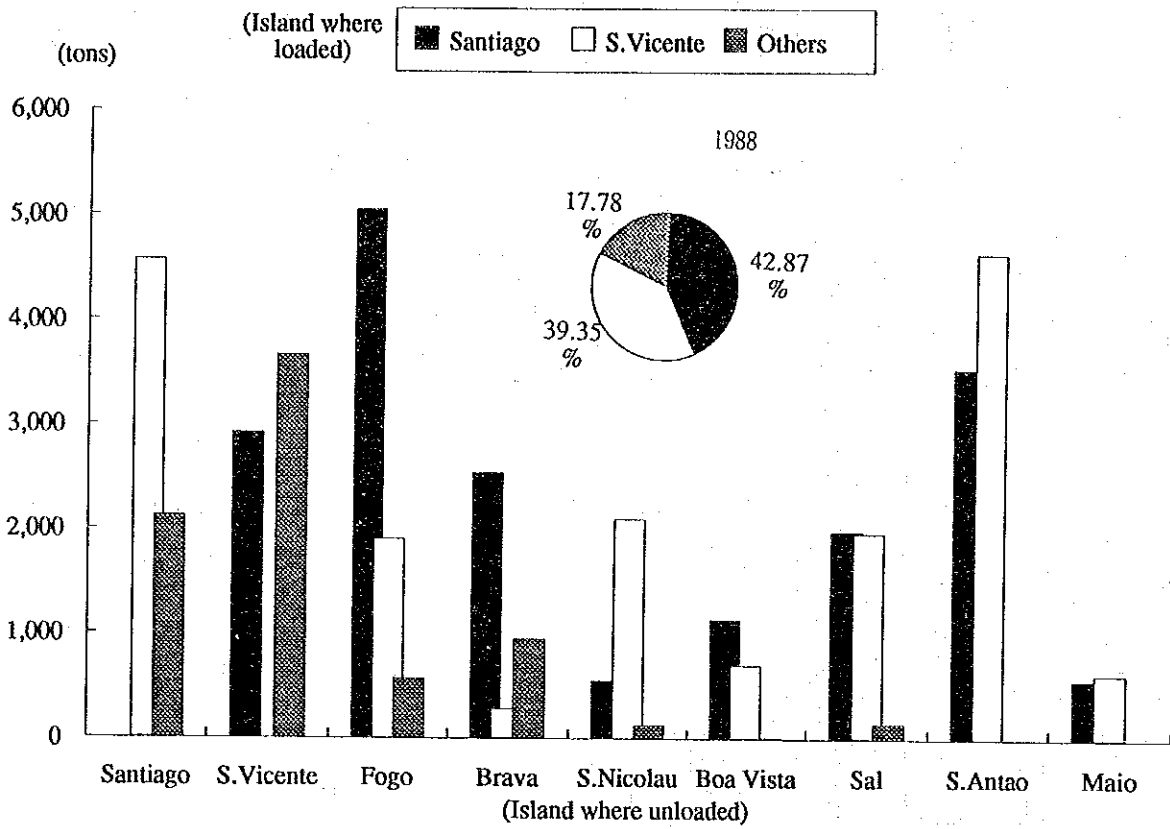


Fig.2-3-3 Cargoes Transported between Islands by Ship 1988, 9

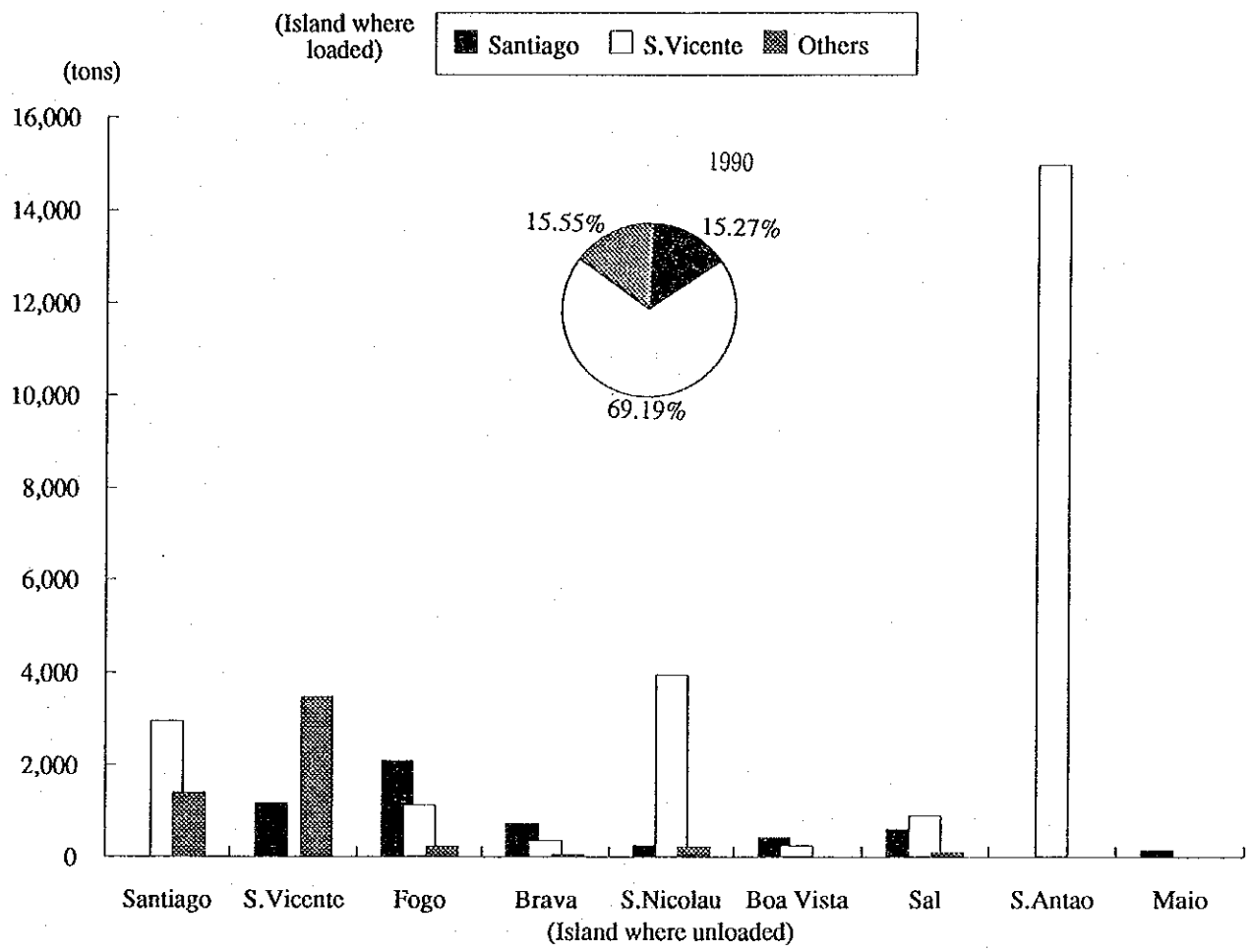


Fig.2-3-4 Cargoes Transported between Islands by Ship 1990

5) Major shippers

The following shows the major shippers who utilize ships owned by Arca Verde National Navigation Company according to the cargo handled.

- a) Empresa Publica de Abastecimento, EMPA: Major foodstuffs, construction materials, etc.
- b) Moagem de Cabo Verde, S.A.R.L., MOAVE: Flour products and raw materials.
- c) CERIS (producer of beer and soft drinks): Beer, soft drinks, and other products and their raw materials
- d) BICAWE (refiller of bottles from wine barrels): Wine
- e) Other general customers

(3) Public supply corporation EMPA (Empresa Publica de Abastecimento)

This public corporation is charged with the import, allocation and distribution of important goods. Its aim is to eliminate the influence of transportation costs on the prices of goods on the islands, ideally enabling the purchase of goods at the same price. Although not a shipowner, this company operates ships chartered from Arca Verde National Navigation Company and others. It also entrusts shipping companies with cargo and distributes goods. The major imported goods handled by the company are corn, rice, cement and sugar (100% in the country), and powdered milk, beans and edible oil (90%). The EMPA's transportation ratio of imports including other materials stands at about 90%.

The major imported necessities (broken down by purchase and aid) by EMPA are shown in Table 2-3-6.

Table 2-3-6 Imports of major necessities

	Purchase	Aid	TOTAL
Corn (tons)	13,121	30,675	43,796
Rice (tons)	6,000	6,900	12,900
Beans (tons)	2,663	-	2,663
Sugar (tons)	11,202	-	11,202
Powdered milk (tons)	1,509	298	1,807
Coffee (tons)	135	-	135
Edible oil (kiloliters)	851	1,051	1,901
Olive oil (kiloliters)	319	-	319
Tallow (tons)	260	6	266
Cement (tons)	83,693	14,765	98,458
Steel (tons)	6,736	750	7,486
Timber (m <sup>3</sup> )	5,812	2,431	8,243

NOTES: Wheat is imported, milled and sold exclusively by MOAVE, a private enterprise.  
Energy (fuel, others) is handled by Shell Cabo Verde, a private company, and ENACOL, a public fuel corporation.

EMPA constantly charters seven to eight ships for international trade and four to five ships for domestic transportation to import goods and distributes them among the islands.

As of December 1991, the company's chartered ships comprised seven ships (7,908.06 gross tons) for international transportation and five ships (1,066.82 gross tons) for domestic transportation.



### 2.3.3 Transportation of cargoes and passengers by international shipping

Table 2-3-7 shows the cargo transportation including export and import over the past five years.

Table 2-3-7. Cargo including exports and imports over the past five years

	Cargo Transported (1,000 tons)	Comparison to previous year (%)	Comparison to 1986 (%)
1986	414.5		
1987	439.7	+ 6.1	+ 6.1
1988	442.5	+ 0.6	+ 6.8
1989	475.1	+ 7.4	+14.6
1990	537.8	+13.2	+29.7

(Source: ENAPOR Statistics)

ENAPOR estimates that the amount of cargo transported in 1991 will increase by 5.8% over the previous year, and a 6.0% increase for 1992, although these figures depend on the nation's purchasing capacity, precipitation, and the progress of the development project.

EMPA also estimates 1992 cargo imports as follows based on past statistics:

Corn	44,000	tons
Rice	18,250	tons
Beans	2,500	tons
Sugar	13,000	tons
Edible oil	3,900	liters
Skimmed milk	2,930	tons
Olive oil	400	k.ltrs.
Cement	110,000	tons
Steel rod	2,000	tons
Timber	4,250	m <sup>3</sup>

The import and export of cargo transported by international trade ships during 1990 was 270,600 tons, of which the imported cargo amounted to 255,700 tons, or 94 percent, as shown in Table 2-3-8. All the cargo thus imported was unloaded at Porto Grande Port and Praia Port.

Table 2-3-8.

Imported cargo unloaded at Port Grande and Praia Ports

(unit: ton)

Ports	Porto Grande	Praia
Food	50,730	60,309
Sanitary goods	853	-
Alcohol	2,580	2,634
Accessories and sports items	261	-
Home appliances	81	147
Heavy oil	442	-
Electrical equipment	1,747	38
Refrigerated fish	4,593	-
Construction materials	33,900	66,223
Soap	-	1,161
Vehicles (including parts)	-	1,271
Fuels, etc.	-	4,826
Others	3,120	15,564
Total	98,311	157,383
Grand Total	255,694	

(Source: ENAPOR Statistics)

Table 2-3-9 shows cargo and passengers on international trade ships handled at each port.

Table 2-3-9. Cargo and passengers of international trade ships handled at ports

Upper line: passengers (persons)

Lower line: cargo (tons)

	1986	1987	1988	1989	1990
PORTO GRANDE	- 104,087	- 95,531	- 104,331	868 87,571	654 102,122
PALMEIRA	- 2,371	- -	- -	- 1,275	- -
PRAIA	29 128,961	219 133,853	2,523 131,812	1,910 147,416	1,703 168,520
Total	29 235,419	219 229,384	2,523 236,143	2,778 236,262	2,357 270,642

(Source: ENAPOR Statistics)

### 2.3.4 Transportation of cargo and passengers by domestic shipping

The cargo volume handled by domestic shipping totaled 270,000 tons in 1990. The operations of ships used for domestic shipping at major harbors, cargo distribution, and passenger transportation are shown in Table 2-3-10.

Table 2-3-10 Activities of ships on domestic routes

Ports	No. of ships entering and leaving harbor	Cargo-handling volume (tons)	No. of passengers boarding and leaving ship
Porto Grande Port (Sao Vicente Island)	973 (243,032 G/T)	91,069	84,201
Sal Rei Port (Boavista Island)	59 (21,300 G/T)	4,897*	585*
Tarrafal Port (Sao Nicolau Island)	204 (45,560 G/T)	13,421	8,095
Furna Port (Brava Island)	203 (52,052 G/T)	5,563	7,051
Maio Port (Maio Island)	121 (13,639 G/T)	5,991	3,453
Palmeira Port (Sal Island)	235 (60,927 G/T)	28,162	7,322
Porto Novo Port (Santo Antao Island)	520 (137,837 G/T)	28,906	74,288
Vale de Cavaleiros Port (Fogo Island)	274 (137,837 G/T)	19,699	19,448
Praia Port (Santiago Island)	432 (115,933 G/T)	72,209	27,424
TOTAL	3,021 (770,669 G/T)	269,917	231,867

(Source: ENAPOR statistical data)

\* denotes fiscal 1989.

Note: The cargo-handling volume and number of passengers is the total of cargo loading and unloading and passengers boarding and leaving a ship at each harbor. Accordingly, overall transport volume is one-half of the total tonnage of freight and number of passengers.

Trends in the domestic shipping cargo volume handled and number of passengers boarding and leaving ships at each harbor are shown in Table 2-3-11.

Table 2-3-11

Trends in cargo volume and number  
of passengers at each harbor for domestic shipping

Upper line: Number of passengers

Lower line: Cargo volume (tons)

Ports	1986	1987	1988	1989	1990
Porto Grande Port	78,303	82,165	88,201	87,305	84,201
	66,445	64,627	57,887	90,197	91,069
Sal Rei Port	285	334	1,660	585	600 *
	3,703	3,226	3,272	4,897	5,000 *
Tarfal Port	2,464	1,961	6,174	7,038	8,095
	6,433	11,637	26,742	15,199	13,421
Furna Port	8,260	7,682	8,336	7,297	7,951
	5,559	6,131	1,290	6,730	5,563
Maio Port	459	-	-	1,892	3,453
	5,229	2,888	4,945	4,994	5,991
Palmeira Port	212	1,206	4,361	5,969	7,322
	13,144	32,684	25,466	21,803	28,162
Porto Novo Port	74,260	75,566	73,292	79,192	74,288
	20,449	23,546	16,690	25,791	28,096
Vale de Cavaleiros Port	9,940	11,904	18,256	19,697	19,448
	17,442	20,904	22,668	18,644	19,699
Praia Port	7,144	9,499	20,198	21,813	27,424
	41,858	47,400	48,991	53,669	72,209
TOTAL	181,327	190,317	220,478	230,788	231,900
	180,262	213,043	207,951	241,924	270,000
Comparison to the previous year (%)		1.05	1.16	1.05	1.00
		1.18	0.98	1.16	1.12

(\* denotes estimate.)

(Source: ENAPOR statistical data)

The domestic cargo transport volume has tended to increase in recent years as indicated in Fig. 2-3-5.

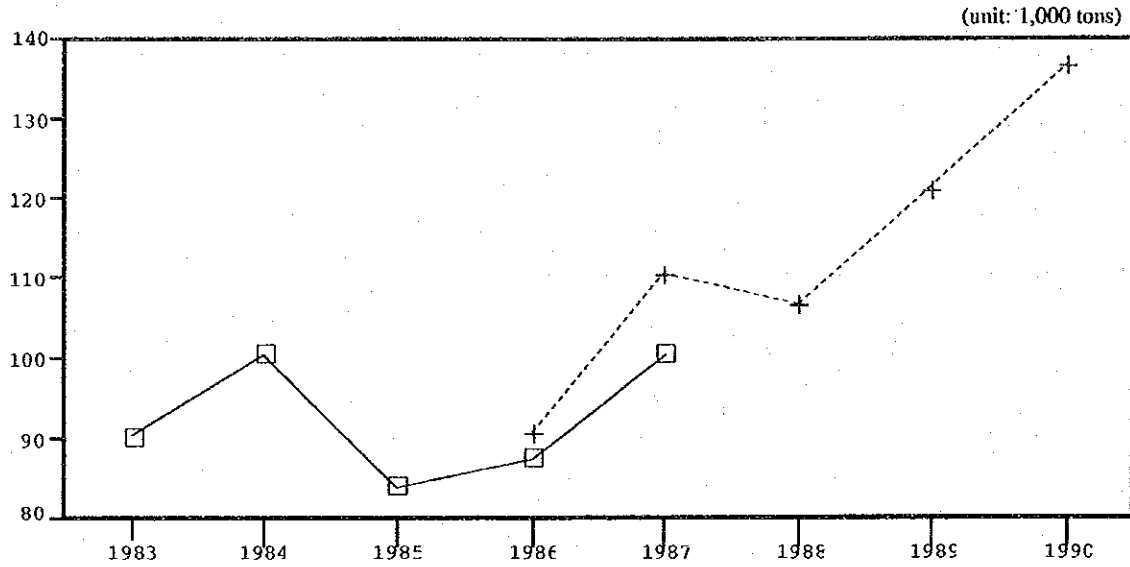


Fig. 2-3-5 Trends in domestic cargo transport volume

(Source: The solid line for 1983-87 is based on BOLETIM ANUAL DE ESTATISTICA 1989; the broken line for 1986-90 is based on data by ENAPOR. (Half the volume of domestic cargo in Table 2-3-11 was assumed.)

## 2.4 OUTLINE OF PORTS AND HARBORS

### 2.4.1 Present Status of Ports and Harbors

#### (1) General description of Ports and Harbors

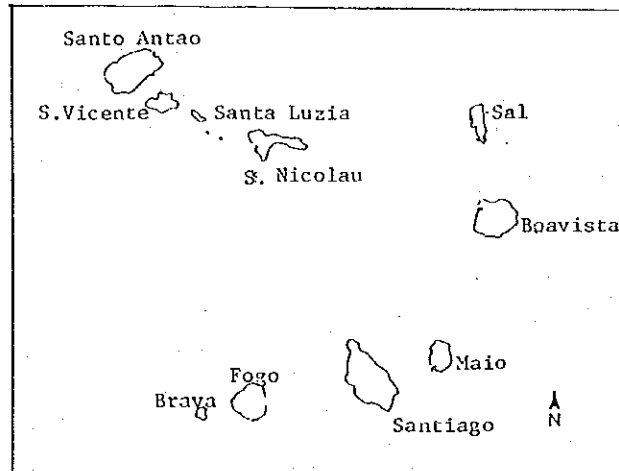


Fig. 2-4-1 Islands

Ten major islands of the Republic of Cape Verde are as shown in Fig. 2-4-1.

#### 1) Sal Island

As this island is apt to get hazy and have poor visibility, sailors must be very careful when they approach it.

##### a) Pedra de Lume Port:

Pedra de Lume Port is a place of anchorage located to the east of the island. Domestic route ships sail in for shipment of salt. At present there are not so many entries due to the rather small scale of this anchorage.

##### b) Palmeira Port:

One of the three international trade ports in the Republic. The port, although open to the southwest, may be a good harbor with its quay which also serves as a breakwater. However, it does not allow the entry of 10,000-ton vessels. Fuel tanks of Shell Cabo Verde are located here. Also, about 2.2 cables to the south of the quay, there is a buoy which can moor tankers up to 175 meters long and up to 18,000 deadweight tons. The tanks and the position of the buoy are connected by an underwater pipeline. (note: 1 cable  $\approx$  185 m)

##### c) Santa Maria Port:

This is a salt-shipping port for domestic route ships. It is located at the southern end of Sal Island adjacent to Santa Maria, the biggest town on the island. There is no quay. A 12.7 m deep anchorage is available

about 4 cables off shore. Unfortunately, the sea-bottom, consisting of coarse sand and shell, is not good for holding an anchor. Therefore, navigators must pay special attention to anchoring when there are southerly surges.

## 2) Boavista Island

As this island is surrounded on all sides by sunken rocks and reefs, navigation around the island can be quite dangerous. In the past, many ships have been driven by the southwest current to the southeast side of the island where they ran aground. At the time of poor visibility careful navigation is required.

### a) Sal Rei Port:

As there are many sunken rocks and reefs, careful attention must be paid when entering this port. Near the shore is a wrecked ship which serves as a good mark for navigation. The anchorage is located 1.4 miles south of the port. It offers sufficient protection against the northeast wind, but is open completely to the south and west, so it is badly affected by surges and winds depending on their direction. There is no quay.

## 3) Sao Nicolau Island

As there are many high mountains (up to 1,304 meters), the island has frequent squalls.

### a) Tarrafal Port:

There is a quay at this port. The harbor offers sufficient protection against the north or northeast wind, waves, and surges, but both quay and anchorage are badly affected by the westerly surges. There are two anchorages, one located about 3 cables to the northwest of the quay and the other (a special anchorage for small ships) located about 2 cables to the north-north-west. The north side of the bay is sometimes met by heavy squalls.

## 4) Sao Vicente Island

### a) Porto Grande Port (Mindelo):

Porto Grande Port is the biggest international port of the Republic. The government is working to position it as the future center of maritime transportation. It is quite an excellent harbor well sheltered from winds, waves and swells in all directions except for the northwest. However, northwesterly wind, waves and swells, are rare, as the island is shielded in this direction by Santo Antao Island.

The port has a 400 m long breakwater to the west, within which there are a couple of quays extending to the southwest. There are 11 berths. Berths No. 1 and No. 2 can receive even 10,000-tonners engaged on international voyages. (Berth No. 1 is sometimes used by passenger boats.)

The length and water depth of each berth are as follows:

Berth No.	Length	Water Depth
1	315.00 m	11.50 m
2	310.05	11.50
3	160.55	9.50
4	160.55	9.50
5	120.05	8.50
6	122.00	6.50
7	60.00	4.50
8	106.75	3.50
9	40.00	3.50
10	100.00	4.50
11	100.00	5.50

Two pilots are ready to navigate ships. Ships engaged on international trade, whether foreign or domestic, are subject to compulsory pilotage.

Oil tanks for Shell Cabo Verde, ENACOL, CABNAVE Dockyard and so on, and appropriate mooring buoys and anchorages are located here. But the water off the quay has many shallows. Just offshore, stranded ships and a desolate and broken quay are left as they are, all of which are hindering the efficient use of the port. The disposal and repair of these ruins, including dredging work, will further improve the utility of this harbor.

Access to the harbor requires careful attention because of the occasional squalls and decreased visibility. Extreme caution must also be exercised when handling a ship in the very swift (2.4 to 3.6 knots) current running southwestward through Canal de Luzia and Canal de Sao Vicente at the east side of the island.

#### 5) Santo Antao Island

This island is separated into two parts, north and south, by a very high mountain range (up to 1,979 meters).

##### a) Porto Novo Port:

As a quay of about 260 meters extends to the south and south-south-west in a way that provides a protection against the strong southwest current, Porto Novo Port is a harbor relatively free of influence by weather and sea states.

The water off the quay is 7.0 meters deep for as far as 133.6 meters from the edge of the far end and occasionally allows vessels engaged on international trade to enter as long as the depth allows for the draught. Beyond this region toward shore, the depth is 2.5 to 4.5 meters for 129.5 meters of the quay and the quay is being used by ferries.



b) Ponta do Sol Port:

This port is at the northernmost point of the island. As there is no quay, freight is unloaded from a ship offshore by stevedores and sent to the town Ponta do Sol. Anchorage is around 3 cables offshore to the west. The port is open to the sea, and the anchorage is quite defenseless to wind and waves except those from the south and easterly directions. Special caution is required for anchoring.

6) Maio Island

As the island is surrounded on all sides by sunken rocks and reefs, sailors must approach it with the greatest possible care.

a) Maio Port:

No quay. Two anchorages are available, one at 2.6 cables from shore with a depth of 23.8 meters and the other at 1.3 cables from shore with a depth of 12.8 meters. As both are only shielded from the northwest wind and waves, the utmost care must be taken when anchoring. Navigation is risky, particularly when winds blow westerly in the rainy season, during which time the skipper must keep his motor on standby continuously.

On a rocky site of the shore there is a crane to unload freight from boat, but it is impossible to work with it when there are swells.

7) Santiago Island

Santiago Island is the Republic's largest island on which the capital Praia has a population of 170,000, or almost a half of all the Republic's inhabitants.

a) Praia Port:

As an international trade port, Praia Port receives many more imported goods than any other port in the Republic. The harbor has one quay which also serves as a breakwater and extends to the southwest with a length of 217 meters and a side water depth of 9.0 meters and another quay which extends, at a right angle to the former, to the northwest with a length of 314 meters and a side water depth of 7.5 meters.

The berth within the breakwater/quay is as deep as 12 meters and is used by large vessels engaged in foreign trade. The mouth of the harbor, which is wide open to the southeast, allows many surges to come into the berths for ships for domestic trade (at the quay extending to the northwest) even when the sea is calm. Therefore, in stormy weather simply leaving the vessel moored alongside the quay would be dangerous, as would be the loading/unloading of cargo.

This is also true for the offshore anchorage (about 2.5 cables to the west of the breakwater/quay). The south wind sometimes becomes stronger in the rainy season, with considerably large surges on the water. At such times, it is not wise to leave ships at anchor. In the dry season (December to June), ships of any size can be anchored with comparative safety.

#### 8) Fogo Island

The archipelago's highest mountain (2,829 meters) is on this island. Local declination of magnetism is reported around this island. The current is strong and sometimes increases its speed, particularly on the north side of the island, when affected by the wind. Navigators must be very careful when they pass by or call at this island.

##### a) Vale de Cavaleiros Port:

There is a 100-meter quay lying along the southern point of the island. Goods are unloaded at this harbor and sent to Sao Filipe, a town about two miles south, which is directly connected by road to the harbor. At present, however, the quay cannot be used due to breakage at its edge, and cargoes must be discharged by stevedores from ships anchored offshore.

The anchorage is located 1.5 cables to the south and has a depth of 18 meters. This location is not adequate for anchorage because of the large waves near the shore, particularly when the wind blows from the west.

Moreover the sea bottom is not good enough to hold an anchor securely. So ships are liable to run with their anchor.

#### 9) Brava Island

##### a) Furna Port

This inlet is an anchorage for smaller vessels, and can only be accessed by navigators who have extensive knowledge of the area and only from November through July. Anchoring is done in a unique manner in which the bow anchor is cast in the sea and the stern and shore are roped for holding the ship.

The inlet does not allow the surf to enter but is occasionally blown by sudden gusts of wind due to the configuration of the land (a 976-meter mountain is at the center of this small isle). Two years ago, Arca Verde's Barlavento was swept by a sudden gust to an uncharted reef area, and stranded at the stern and the propeller shaft was seriously damaged.

On the nine major islands outlined above, there are only three international trade ports, namely Porto Grande Port on Sao Vicente Island, Praia Port on Santiago Island, and Palmeira Port on Sal Island.

There are only two international trade ports capable of receiving 10,000 deadweight-ton class vessels, namely Porto Grande Port and Praia Port.

There are six harbors furnished with mooring quays, namely Porto Grande Port, Palmeira Port, Porto Novo Port, Tarrafal Port, Praia Port, and Vale de Cavaleiros Port (under repair).

From the viewpoint of safety, there are many problems in the harbor situation of this country. Only at Porto Grande Port, Palmeira Port and Porto Novo Port can ships be moored at the quay and cargoes loaded or unloaded from ships quite safely without being affected by the wind, waves and surges even in bad weather.

In order to improve the safety of shipping under such conditions, the government has designated as priority measures the expansion of harbors, precise measurement of sea areas, augmentation of navigational aids, etc., under its Third National Development Plan (Fundamental Policy). Thus, the above situation may be gradually improved.

(2) Harbor Facilities

Table 2-4-1 shows the condition of the six harbors having quays with respect to shed facilities, cargo-handling facilities, number of longshoremen, etc.

(3) Stevedores

At present, ENAPOR has 1,200 stevedores (throughout all the islands) in addition to 480 clerical staff members and handles all stevedore services in the harbors.

Up to 20 persons on smaller islands and more than 20 persons on larger islands are registered as stevedores. Additional workers are temporarily employed from time to time.

Offshore services are carried out from 6:00 am until sunset. In this case, cargoes are carried by 6 to 10-ton barges and occasionally by small chartered fishing boats. But operations greatly depend on the sea conditions and are suspended if there are swells higher than 80 cm or so, sometimes for 24 or more hours running.

Such suspension of stevedore work takes place often on Fogo Island and Boavista Island.

Quay services are performed on a 2- or 3-shift system. Night service is carried out only on Sal Island.

Stevedore wages are 49-200 CVE/hour for clean cargo, an extra 50% for dirty cargo, and an extra 50% for the night shift (19:00-7:00).

Table 2-4-1 Harbor Facilities

	Porto Grande Port Sao Vicente Island	Praia Port Santiago Island	Porto Novo Port Santo Antao Island	Palmeira Port Sal Island	Tarrafal Port Sao Nicolau Island	Vale de Cavaleiros Port Fogo Island
Shed area (sq. meters) Outdoor area (sq. meters)	7,100 33,043	6,150 34,785	4,800	611.5 22,605	450 (under consideration)	325.8 4,500
Number of employees Staff (persons) Longshoremen (persons)	200 240	190 437	5 80	10 32	5 44	14 63
Fuel supply	Quay tank					
Fuel supplier	Barge SHELL ENACOL					
Type of fuel	Diesel oil Gas oil					
Power source	220V, 380V					
Water	Possible					
Tugs	1, 200PS x 1 600PS x 2	600PS x 2				
Launches	150PS x 1	150PS x 1		150PS x 1		4
Floating cranes	60t x 1 25t x 1 8t x 8 3t x 3 4t x 1	25t x 1 5t x 5 3t x 6 2.5t x 3	3t x 1	3t x 1	3t x 1	2.5t x 1
Hoppers	2	2				
Buckets	6	5				
Grain wagon	10t x 3					
Cranes	20t x 1 10t x 1 8t x 1 7t x 1	15t x 2 7.5t x 1 6.3t x 1	7.5t x 1	7.5t x 1	7.5t x 1	12t x 1 3t x 1
Bits	25t x 12 10t x 5	40t x 2 20t x 10 5t x 18	5t x 2 4t x 6 1	20t x 2 5t x 1 1	5t x 1	7.5t x 1 5t x 2 1
Tractors	8					

#### 2.4.2 Harbor Development Projects

ENAPOR is promoting harbor development projects in order to cope with the various problems facing the harbors, and is at the same time developing a long-term plan for the extension and construction of harbor facilities.

At present, ENAPOR is engaged in repair work of the damaged quay on Fogo Island. On Maio Island, construction of a quay for 500-tonners is under consideration. A pier is being built for the small-scale fishing business in Praia.

Other projects already planned include the construction of quays for 600-tonners on Brava Island and Boavista Island, and the construction of two more harbors on Santo Antao Island.

In addition, more harbors that can receive at least 600 deadweight-ton cargo boats will be built on all the islands over the next 10 to 15 years.

In parallel with the construction of these harbors and as part of the Third Five-Year plan, the development of the following basic industries will be incorporated into the plan such that each harbor can serve as a door to such industries as tourism for Sal Island and Boavista Island, agriculture for Santo Antao Island and Fogo Island, and salt and cement production for Maio Island.

## 2.5 PRESENT STATE OF SHIP REPAIR FACILITIES

Ship repair facilities in the Republic of Cape Verde are concentrated in Mindelo (Sao Vicente Island) which boasts the country's foremost harbor facilities and where many ocean-going and domestic ships converge. CABNAVE shipyard is capable of undertaking full-scale repairs on foreign ships and large ships, ONAVE shipyard repairs mostly fishing boats, and the workshop of Arca Verde National Navigation Company handles small-scale repairs. An outline of each shipyard is given below:

### (1) CABNAVE shipyard

With technical backing from the Lisnave dockyard (Portugal), this dockyard was established in 1985 as the CABMAR public corporation by the Cape Verdean government, the Lisnave dockyard, and Deval (the Netherlands), plus a stake by the private sector of the Republic of Cape Verde. Actual operations got under way in 1983 with the undertaking of repair work. As a semi-governmental private enterprise, CABNAVE is currently managed under a 15-year lease contract with CABMAR. The company is 87% owned by the Cape Verdean government, 12.5% by Deval, and 0.5% by individuals.

As for its scale as a dockyard, CABNAVE can undertake slip-way lifting of ships up to 110 m long, 18 m wide, and with hull weight of 2,800 tons. It is equipped with a slipway system and six dry ship-parking work areas where dry ships undergo repair work. To carry out rubber docking repairs or prepare for hoisting by the slipway (draft and trim adjusting, etc.), CABNAVE has a wharf measuring 130 m long and 8 m deep. Plants include an iron works, a mechanical workshop, an electrical workshop, a pipe works, and a paint works. In addition, there is a warehouse, a technical training center, mobile cranes and gas, electricity and water facilities.

A layout of the dockyard is given in Fig 2-5-1 and the facilities are shown on pages (24) to (27) of the Annex.

With technical support from the Lisnave dockyard, this dockyard has many years of experience and is capable of handling any kind of work such as engine-related work, electrical work, and hull and painting work.

As for the upkeep of machinery and electrical parts, spare parts kept by the ship or owner-supplied articles are used. In many cases, paints kept by the shipowner are used. General steel materials and tubing along with materials for general use (such as paint) are purchased from Europe every three months based on past records and work estimates and are kept by the company in stock. Small cast metal articles (excluding steel castings) are procured from the ONAVE dockyard. Even parts requiring special machining can be processed so long as the necessary materials and drawings are provided.

As for heuristic work or work on seriously damaged items, it is often impossible to make arrangements to secure new replacement parts, and such parts must be ordered from overseas. As a result, work can be suspended for as long as three months or more. Concerning repair work, various non-destructive tests, dynamic balance adjustments of rotating objects and repair work on propeller blades are undertaken as well as machinery overhauling and inspection, facing-up and cleaning, and motor rewinding.

This dockyard employs 210 workers, but about 400 workers are mobilized during busy seasons. A look at its repair results for 1990 shows that the operation rate of the ship-parking work section stood at about 60%. In that year, 130 ships were repaired, including many foreign ships from the Republic of Korea, the Netherlands, Mauritania and elsewhere. The largest per-ship sale reached \$1 million, which included repair work on the main engine, hatch cover, and mooring equipment. In 1991, the dockyard's capacity utilization dropped to about 50%.

The dockyard also handles large-scale work for ships owned by Arca Verde National Navigation Company, not to mention the work on the dry vessel parking section.

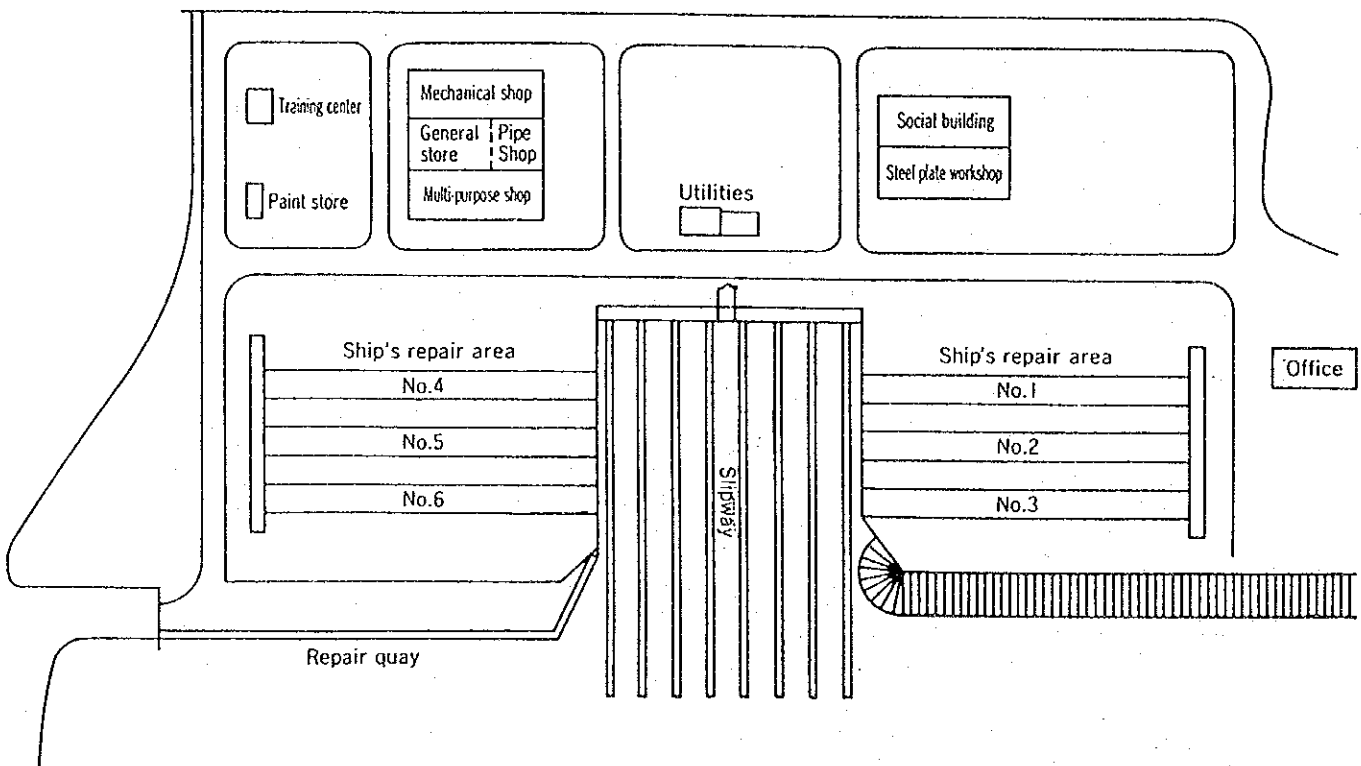


Fig. 2-5-1 CABNAVE Dockyard site layout plan

(2) Oficinas Navais do Cabo Verde (ONAVE dockyard)

This dockyard was established as a private British company called Wilson & Son in 1906, after which it was owned by the Portuguese government. With the birth of the Republic of Cape Verde in 1975, it was placed under the direct control of the Ministry of Infrastructure and Transport. It is a repair dockyard whose main job is repairing fishing boats (made of wood or FRP) and the manager is on loan from the CABNAVE dockyard.

The dockyard is equipped with two slipways. At the time of our survey, four fishing boats had been docked in the slipways. In addition, the dockyard supplies the CABNAVE dockyard with cast metal articles excluding steel castings such as bronze, cast iron, aluminum and zinc castings. Parts scrapped during repairs and parts of scrapped ships are recycled to serve as raw materials for these cast iron products.

In addition to the above facilities, there is a workshop for woodworking and machining and a set of winch equipment for the slipway handling.

A 32-member work force repairs 15-20 ships a year.

(3) Workshop of Arca Verde National Navigation Company

Belonging to the technical department of Arca Verde National Navigation Company, this workshop is managed and operated by two inspection engineers, one in charge of the hull and the other in charge of machinery. There are 13 other workers.

This workshop undertakes small-scale work such as overhauling, inspection and repair of small engines of the Company, rewinding of motors, and repairs on cargo-handling hardware. Maintenance and management of ships owned by Arca Verde National Navigation Company and the upkeep of parts in storage for the ships of the Company are also undertaken. The workshop also entrusts the CABNAVE dockyard with full-scale work such as bottom cleaning and painting, hull plate repairs and propulsion overhauls requiring dry docking, as well as with the management of ship parts.



## 2.6 OUTLINE OF CREW TRAINING FACILITIES

Centro de Formacao Nautica (Nautical Training Center) is an educational organization comparable to the Mercantile Marine College in Japan. This school was established in 1984 with the aid of the Norwegian government and to date has trained many key ship personnel to handle marine transportation in the Republic of Cape Verde.

### (1) Organization (See Organization Chart Fig. 2-6-1.)

This center belongs to the Ministry of Infrastructure and Transport. There are three departments for training ship personnel, viz., the Nautical Department, the Marine Engineering Department, and the Radio/Electronics Department. The Academic Department and the Fisheries Department under a separate system.

At the time of our survey (December 1991), a five-year plan was under way with the aim of expanding the center using aid from the Norwegian government.

If this project was implemented fully, the center is to set up a department for training all ship personnel and shipping and harbor-related technical personnel, set up a new research organization, establish another Radio/Electronics Department (for a total of two departments) and also inaugurate a research consultant course for shipowners. New students will be invited not only from the Republic of Cape Verde but also from neighboring countries whose official language is Portuguese.

Unfortunately, the Norwegian government has drastically cut down on aid for this project, necessitating a squeezing of the plan from five to 1.5 years. A big leap forward cannot be expected from the present organization.

### (2) Educational system

Any high school graduate (science course) (primary school starts at age 6 for a four-year program, followed by a seven-year high school course) can apply to enter the center. A four-year program is offered, with the first academic year starting in September and ending in July of the next year. The fixed number of students for the four-year program is 120. Students do not enroll regularly each year, but are enrolled depending on the employment situation of the shipping industry. At present, the school is attended by 57 freshmen in the Nautical Department and Marine Engineering Department and 17 in the Radio/Electronics Department, while 15 seniors are studying in the Marine Engineering Department.

The total number of students is 89.

Deck officers and radio operators will not be trained until the present freshmen graduate. Tuition is funded by scholarship.

To date, the graduates can be broken down as shown in Table 2-6-1.

Table 2-6-1. Graduates of departments.

	DECK	ENG	RADIO	TOTAL	COASTAL SKIPPER	FISHER SKIPPER	MOTOR MAN	TOTAL
1988	26	16	8	50	-	-	-	-
1989	16	13	-	29	-	-	-	-
1990	-	-	-	-	22	36	20	78
1991	18	-	13	31	-	21	-	21
1992 (estimate)	-	13	-	13	-	25	15	40
TOTAL	60	42	21	123	22	82	35	139

(3) Curriculum

First year (common to all departments)

Mathematics, safety, physical training, technical English, first aid, fire fighting, survival, pollution prevention, nautical science, engine, electrical equipment

Second year

Nautical Department: Hull, weather, cargo work, drafting, electronics, computers, nautical science

Marine Engineering Department:

Internal combustion engines, auxiliary machines, mechanical design, automatic operations, welding, electrical equipment

Radio/Electronics Department:

Electronics, computers, microprocessors, radio engineering.

Third year

Nautical department: Economics, maritime laws, shipbuilding engineering, oceanic science, automatic control, nautical science

Marine Engineering Department:

Data processing, shipbuilding, external combustion engines, refrigerating equipment, applied chemistry, thermodynamics, hydraulics

Radio/Electronics Department:

Communications techniques, microprocessors, wireless, nautical antenna instruments

Fourth year: Practical corporate training

(Note: In the absence of a training ship, one year of practical training is given aboard company ships. Shipping companies are obligated to have trainees on board with the expenses to be borne by the companies.)

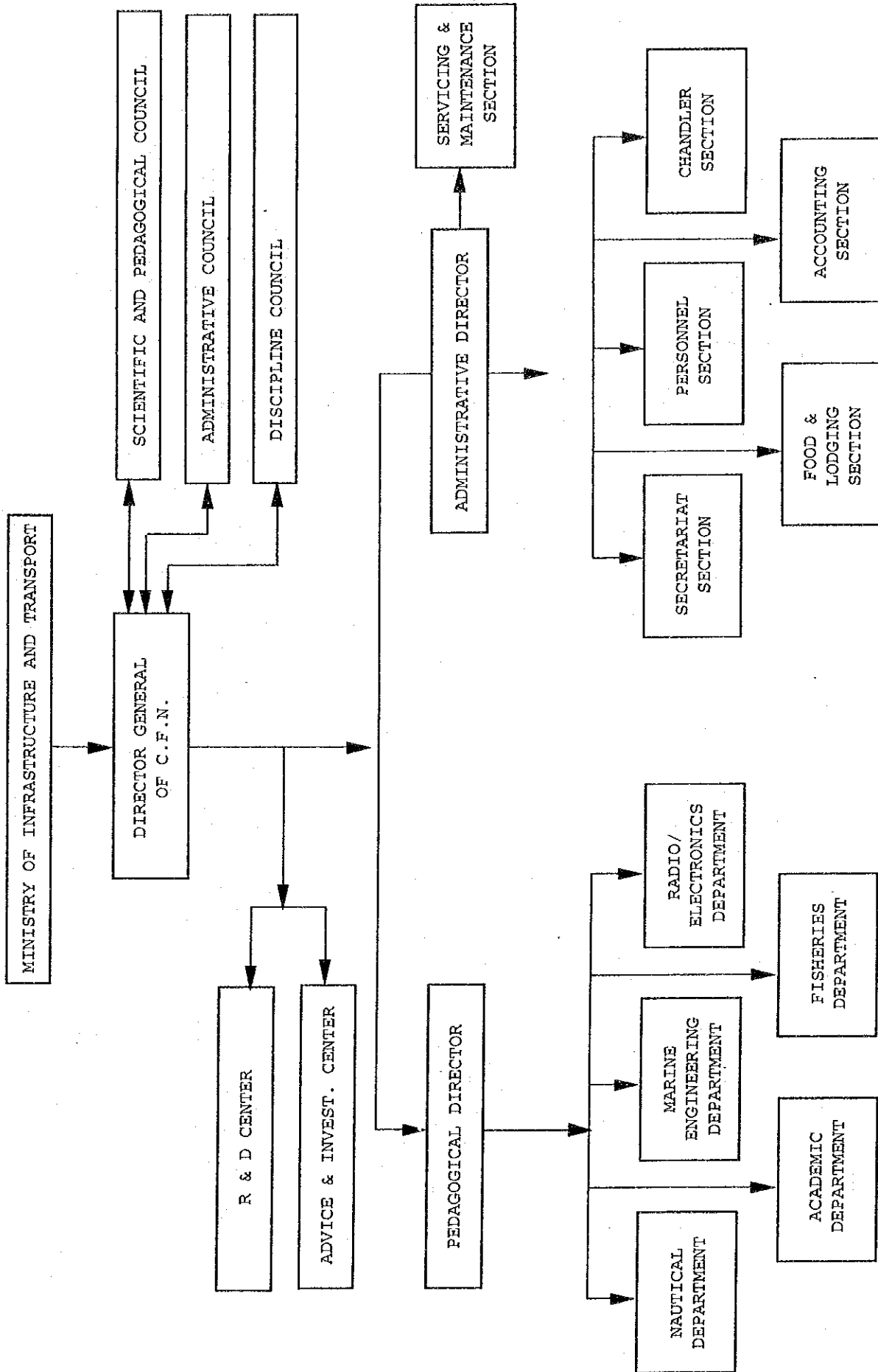


Fig. 2-6-1 Organization of Nautical Training Center

## 2.7 BACKGROUND OF REQUEST

### 2.7.1 Details of request

The Republic of Cape Verde is an archipelagic country comprising 10 major islands that dot the Atlantic within a radius of 150 km centering around a point about 600 km west of Dakar, the Republic of Senegal, in the western Africa. The archipelago has limited arable land because of its volcanic soil and dry weather. Cape Verde's agricultural self-sufficiency is low, while various industries are in the process of development. Consequently, virtually all food and other daily necessities and industrial products must be imported. Imports are distributed to the islands primarily through two international harbors.

Accordingly, the government of Cape Verde is pursuing a policy to reinforce its shipping capacity in order to maintain a stable supply of goods under its Third Five-Year National Development Plan, thereby contributing to the stabilization of the nation's livelihood.

Demand for inter-island transportation by domestic trade ships is growing to keep pace with economic development and an increase in population. But ships serving domestic routes are not only limited in quantity but are also becoming too old for use. On top of a growing number of inoperative ships due to breakdowns, reinforcement of shipping capacity and replacement of worn-out ships have been lagging behind. Should things be left as they are, the demand for transportation is expected to surpass transportation capacity by a wide margin.

Under these circumstances, the government of Cape Verde has requested Japan to provide a grant aid cooperation to enable the construction of a cargo ship for inter-island transportation.

### 2.7.2 Contents of request

The ship thus requested will transport cargo between the islands of Cape Verde, and its specifications shall be as follows:

(1) Number of ships	:	1
(2) Principal particulars		
Deadweight		About 500 metric tons
Cargo hold capacity		About 700-750 cubic meters
Length overall		About 45 meters
Service speed		About 10-12 knots
Cargo gear		3-5 tons 2 sets
Cargo hold	:	1
Cargo hold hatch cover	:	1 (single-pull type)

Complement of persons

Crew members 10 persons

single rooms 3

double rooms 4

Passengers 6-8 persons (1 room)

Fuel tank capacity

About 30 tons



## **CHAPTER 3 CONTENTS OF THE PROJECT**





## CHAPTER 3 CONTENTS OF THE PROJECT

### 3.1 OBJECTIVE

In contrast to the demand for inter-island cargo transportation which has been growing each year, the transportation capacity of domestic trade ships has been declining due to the deterioration of ships. To make up for this, this project is designed to build a general cargo ship for carrying daily goods such as food and sundries and construction materials, including cement.

### 3.2 STUDY OF THE REQUEST

#### 3.2.1 Study of the Reasonableness and Necessity of the project

In the Republic of Cape Verde, the demand for the cargo volume of inter-island transportation has been increasing at about 10% each year, but many of the purpose-built cargo ships belonging to public and private shipping companies have become too old for use, resulting in a low frequency of operation which in turn is limiting transportation capacity. If things are left as they are, serious impediments to the inter-island transportation of goods will develop. Hence, a new and powerful cargo ship must be put in service in this country.

Construction of the ship will help to realize systematic operations of ships and will contribute greatly toward smoother inter-island transportation of goods, the higher efficiency of cargo transportation, and the stabilization of the national livelihood. Wasteful outlays due to repairs, for example, can be prevented and the new ship will boost the rate of ship operations, and encourage sound management of the Company. The above considerations naturally show that a grant aid cooperation to support the project would be appropriate.

#### 3.2.2 Examination of execution and management plans

As for the cargo ship for inter-island transportation that is the subject of this project, Arca Verde National Navigation Company, which is under the supervision of the Agency of Marine and Ports, will serve as shipowner and undertake management activities such as navigation and maintenance. Here, we will examine the operation, maintenance and management of ships, the collection of cargo, and overall management and operation on the assumption that Arca Verde National Navigation Company will engage in shipping on its own.

##### (1) Operation of ships

The technical department of Arca Verde National Navigation Company is in charge of 103 crew members and eight ships. If a vacancy arises due to a long vacation, disease, etc., of a crew member, the company hires auxiliary members (occasionally on a short-term basis) listed on the crew register.

Therefore, there will be no problems at all with crew members. At present, 22 officer-class seamen, who finished the seamen's training school in 1990, as well as other ordinary crew members, are all awaiting a chance to go on board domestic trade ships and foreign trade ships. As for Arca Verde National Navigation Company itself, the SANTA LUZIA (a 9-member crew) which it owns, has also been laid up for a long time, with recent talk of selling or scrapping it. It is possible for its crew to be asked to board a new cargo ship (a 10-member crew). As described under the Third Five-year National Development Plan, the number of ship-related personnel is expected to increase in the future through the expansion of the seamen's training school, and technically no trouble is foreseen in ship operations.

(2) Maintenance and management of ships

The technical department of Arca Verde National Navigation Company has on its staff technical specialists on both the hull and engine sections who oversee ship maintenance, management, and inspection. The company's workshop is manned by 13 operators and equipped with facilities for performing minor repairs. Located near Porto Grande Port is the CABNAVE dockyard, which can undertake large-scale repairs and slipway lifting. Judging from its scale of facilities, this dockyard can handle a good many repairs. Therefore no problem is seen with regard to ship maintenance or management.

(3) Collection of cargo

In 1992, domestic cargo transport is expected to rise by 10% over the 1991 level. Taking into account the 2% yearly increase in population, such a trend is expected to continue into the future. Given the continued deterioration of private ships, the new cargo ship will also become important for EMPA, a major shipper, and there should be no problem related to the loading of cargo aboard the new cargo ship.

(4) Administration of Arca Verde National Navigation Company

Inter-island cargo transportation is at the center of the Republic's livelihood. As far as the operation, maintenance, and management of ships and cargo collection are concerned, there is nothing to worry about for the reasons cited above.

On the other hand, because this ship will be used for relatively low-profit operations, certain difficulties in management will be unavoidable.

Now, we will outline the present business situation of the company as follows.

The annual profit/loss status of all Arca Verde over the past four years in terms of its head office and branches, and ships is shown by Table 3-2-1.

Table 3-2-1. Profit/loss for head office, branches and ships of Arca Verde

(unit: thousand CVE)

	1987	1988	1989	1990
Head office	△ 12,891,520.20	△ 13,633,442.40	△ 17,268,566.20	△ 16,165,060.00
Branches	△ 7,218,259.20	△ 11,050,263.00	△ 11,724,184.00	△ 11,103,337.20
Subtotal	△ 20,109,779.40	△ 24,683,705.40	△ 28,992,750.20	△ 27,268,397.20
Vessels:				
Arca Verde I	△ 38,831.30	△ 1,203,876.30	△ 5,256,074.00	△ 2,919,935.60
Arca Verde III	△ 530,861.10	△ 813,428.60	△ 966,889.20	459,295.00
Bôa Vista	20,585,584.30	-	-	-
Brava	3,764,708.10	△ 5,332,970.90	3,455,454.30	△ 2,025,848.60
Primos	△ 496,436.50	△ 587,825.10	1,554,017.60	-
Santiago	△ 8,103,922.40	△ 14,122,298.90	△ 22,519,186.30	△ 31,753,773.90
Porto Novo	9,327,030.30	5,755,902.50	8,118,275.40	5,047,255.50
Furna	△ 5,699,827.00	△ 6,330,045.70	△ 8,064,583.30	△ 9,229,525.70
Santa Luzia	△ 2,038,433.80	△ 4,114,299.00	△ 8,181,472.80	△ 5,809,835.80
Barlavento	△ 10,901,917.70	△ 29,853,517.10	△ 30,467,128.00	△ 35,751,327.40
Sotavento	△ 5,064,383.80	△ 27,406,965.60	△ 31,191,762.40	△ 23,822,819.90
Ilhéu Raso			△ 593,633.80	28,299.00
Subtotal	△ 32,874,613.60 33,677,322.70	△ 89,765,227.20 5,755,902.50	△ 107,240,759.80 13,127,747.30	△ 111,314,066.90 5,534,849.50
Total	△ 19,307,070.30	△ 108,693,030.10	△ 123,105,762.70	△ 133,046,614.60
Income Tax	700,000.00	700,000.00	700,000.00	65,000.00
Net Profit/Loss	△ 20,007,070.30	△ 109,393,030.10	△ 123,805,762.70	△ 133,111,614.60

Operating losses, which has been sharply increasing since 1988, are attributable to the selling off of the profitable Bôa Vista vessel, the drop in profit of the Porto Novo, and the increasing losses caused by unprofitable vessels such as the Sotavento, Santa Luzia, Santiago, and Furna.

For reference, a breakdown of main expenses incurred by inter-island vesels from 1987 through 1989 is shown in table 3-2-2.

Table 3-2-2 Breakdown of Inter-island Shipping Service Expenses

(unit: Thousand CVE)

	1987	1988	1989 (JAN.-NOV.)
Fuel	8,847	19,862	21,755
Labor Cost	15,724	23,742	29,058
Repair	6,055	12,368	9,441
Harbor Facilities	3,206	6,578	9,184
Insurance	4,578	9,325	9,325
Depreciation*	33,489	77,494	83,879
Loading/Unloading	11,084	20,782	21,727
Others	3,301	5,109	5,669

\* The depreciation figures include the corresponding amounts for the Sotavento and the Barlavento donated by West Germany (16,571,000 CVE in 1987, 58,848,000 CVE in 1988 and 58,630,000 in 1989). These amounts have been reserved in the form of a depreciation fund, and so do not constitute actual losses. Arca Verde has been using this fund as working capital to cover fuel and labor costs.

Tariff rates fixed by the government (as revised in April 1991) are shown in Table 3-2-3.

Table 3-2-3 Tariffs

(unit:CVE)

Distance (nautical miles)	Cargo (per freight ton)	Passenger (per person)	
		Barlavento Sotavento	Other Ships
Up to 50	840	600	450
50 - 90	950	1,050	750
Over 90	1,250	1,500	1,050
Berth	-	750	750

Tariffs for domestic route transportation are set by the government and cannot be changed by individual companies.

Given the above circumstances, the business situation of Arca Verde Company can be summarized as follows.

- 1) Depreciation is not a substantial expense. So if an equivalent amount is subtracted from the liabilities in Table 3-2-1, then the deficits will be reduced greatly, namely: 13,500,000 CVE for 1987, -32,000,000 CVE for 1988, and -40,000,000 CVE for 1989.
- 2) Declining operation efficiency, increase in repair outlays and decreasing fuel efficiency is contributing to the deficit.
- 3) Adding to the fleet a new cargo ship will make it possible to reduce expenses for repairs and to increase ship operability, thus upgrading the overall profitability.
- 4) The government subsidizes some official transportation organizations for the deficits incurred by the tariff and non-profitable route services.
- 5) Arca Verde Co. is planning to sustain itself by shifting the business of collecting cargoes and passengers from national agents to the company itself in order to reduce expenses, by promoting profitability through sorting out superannuated non-profitable ships, and so on.
- 6) The major shipper EMPA and others will continue to favor the reliable Arca Verde Company in the future, which will be good for balance.

The yearly costs necessary for the new cargo ship are estimated roughly as follows:

Fuel:	11,000	thousand CVE
Labor Cost:	8,000	thousand CVE
Repair:	1,500	thousand CVE
Insurance:	1,350	thousand CVE

As compared with other ships, the new cargo ship will economize 3,000,000 CVE in repairs, and have a higher operation rate, leading to a 23,000,000 CVE increase in sales.

### 3.2.3 Study of contents of the requested vessel

Among the items concerning the requested vessel, the deadweight tonnage was studied as follows:

#### (1) Demand for cargo transportation

The movement of total cargo volume handled in recent years in the Republic of Cape Verde can be summarized in Table 3-2-4 when Table 2-3-11 'Trends in cargo volume and number of passengers at each harbor for domestic shipping' in 2,3,4 is used.

Table 3-2-4

Aggregate of domestic cargo volume handled at each port

(tons)

	1986	1987	1988	1989	1990
Cargo volume	180,262	213,043	207,951	241,924	270,000
Comparison to the previous year		1.18	0.98	1.16	1.12

The above table shows an increase in domestic cargo volume of 10% a year on the average during five years from 1986 to 1990. The cargo volume of the above table represents the sum total of cargo both at loading and discharging places. The actual cargo volume is half the amount shown in the above table, on the order of 135,000 tons in 1990.

## (2) Capacity to transport cargo

The transportation capacity of Arca Verde National Navigation Company has changed as follows:

Table 3-2-5

Transportation capacity of freighters owned by Arca Verde National Navigation Company

(DWT)

ship f.year	Brave	Santa Luzia	Arca Verde I	Arca Verde III	Total
to '87	In foreign trade	400	180	400	980
'88 to '89	In foreign trade	400	180	400	980
'90 to '92	600	400	decommis- sioned	decommis- sioned	1,000
'92 to	600	To be decommis- sioned			600

Although Arca Verde National Navigation Company maintained a constant transportation capacity of 1,000 DWT in the past, it was forced to decommission vessels owing to the increase in the expenditure on maintenance and

administration in association with the aging of vessels, and the Santa Luzia is to be decommissioned in the fiscal year 1992. As a result the company's capacity is to drop to 600 DWT, represented by the Brava only.

On the other hand, the mean age of vessels owned by private companies is approximately 40 years as shown in Table 2-3-2 found in 2.3.2 "Maritime transportation public corporations, shipping companies, and related public corporations" in Chapter 2, and all of them are over 20 years. As a result, the actually available transportation capacity is approximately 60 % of the nominal capacity. From Table 2.3.2, therefore, the total transportation capacity offered by private companies is judged to be:

$$3,421 \text{ DWT} \times 0.6 = 2,053 \text{ DWT.}$$

Arca Verde National Navigation Company mainly operates the ships to be engaged on voyages from the principal two ports to each island (branch route service) and on voyages between two principal ports. So it is assumed that the vessels provide a twice a week service between Porto Grande port and Praia port and a fortnightly service to other islands. This makes the number of voyages to 2.5 per week.

It follows that:

$$\text{Number of voyages a year} = 52 \text{ weeks} \times 0.9 \text{ (operational ratio)} \times 2.5 = 117 \text{ times/year}$$

In the case of private shipping companies, the state of maintenance of their vessels is expected to deteriorate owing to the aging. The operational ratio in a year is estimated to be not more than 80% and their service routes are relatively long. So the number of voyages is supposed to be twice per week.

It follows that:

$$\text{Number of voyages a year} = 52 \text{ weeks} \times 0.8 \text{ (operational ratio)} \times 2 = 83 \text{ times/year.}$$

When the actual record of transportation in 1990 is studied, the yearly total of domestic trade cargo volume is 135,000 tons and the state of transportation provided by Arca Verde National Navigation Company and the private shipping companies is shown in Table 3-2-6.

Table 3-2-6

Analysis of state of domestic cargo Transportation in 1990

	Cargo capacity in DWT A	Cargo loading ratio* B	No. of voyages per year C	Estimated annual transportation capacity AxBxC tons	Transportation ratio
Arca Verde	1,000	0.6	117	70,200	135,000/ 172,439 =0.783
Private companies	2,053	0.6	83	102,239	
Total	3,053			172,439	



N.B. The cargo loading ratio is supposed to be 60%.

From the above table, the actual operational ratio can be said to have been 78% against the transportation capacity. This figure, however, does not mean extra capacity against the demand for transportation.

(3) Comparison of the demand and capacity of cargo transportation .

The future capacity of transportation provided by vessels and demand for transportation are studied by using the capacity in 1990 as a reference. The Santa Luzia of Arca Verde National Navigation Company is to be decommissioned in 1992 or later leaving only the Brava as an available vessel for the public corporation. The vessel, however, considering her age of 20 years, will, of course continue to decrease in efficiency.

Furthermore, as the average age of the vessels owned by the private companies is greater as compared with those of the public corporation, their capacity of transportation too is expected to be reduced gradually. Although the propulsion efficiency is said to decrease by 1% a year owing to the reduction of engine output and increase in hull resistance, the capacity of transportation is estimated to be reduced by 3% a year considering the decrease in the number of operable days owing to the increase in the need for maintenance attributable to a ship's old age.

Although Table 3-2-4 "Aggregate of domestic cargo volume handled at each port" shows an average annual increase in demand for cargo transport of approximately 10% from 1986 to 1990, the cargo volume is considered to be proportionate to the imported cargo quantity, as the Republic of Cape Verde depends for almost all commodities on imports. From the statistics of handled international cargo volume shown in Table 2-3-9 found in 2-3-3

"Transportation of cargoes and passengers by international shipping", Chapter 2, the annual movement of handled cargo volume can be summarized as follows. It shows an average annual growth of 3.5 % during the period from 1986 to 1990.

Table 3-2-7

Total international trade cargo handled at each port

	(tons)				
	1986	1987	1988	1989	1990
Cargo volume	235,419	229,384	236,143	236,262	270,642
Ratio to previous year		0.97	1.03	1.00	1.14

It is difficult to estimate the growth rate of demand for cargo transportation in the future by using such data, but it is apparently on the increase. If the demand for transportation five years after 1992 is calculated on the basis of a 3.5% annual growth:

$$135,000 \times (1 + 0.03)^5 = 160,000 \text{ tons.}$$

Assuming that the Santa Luzia (400 DWT) is decommissioned in 1992, the

transportation capacity, when calculated in the same manner as in Table 3-2-6, is reduced by as much as:

$$400 \times 0.6 \times 117 = 28,000 \text{ tons,}$$

and in addition, if assumption is made that the transportation capacity decreases at an annual rate of 3% as mentioned above:

$$(172,439 - 28,000) \times (1-0.03)^5 \approx 124,000 \text{ tons.}$$

Therefore, if we study a vessel with a capacity to satisfy demand five years later from present 1992, a shortage in transportation capacity of approximately 36,000 tons is derived in 19897.

When a new freighter is put into service in order to strike a balance between the capacity and demand for transportation and to compensate the shortage brought about by scrapping the Santa Luzia, if an assumption is made that a new freighter is to perform three voyages a week by utilizing its high mobility as it is a newly built one, we must calculate as follows:  
Number of annual voyages = 52 weeks  $\times$  0.9 (operational ratio)  $\times$  3 =140 times/year

Thus the required cargo capacity of the vessel is:

$$36,000 \text{ tons} / 0.6 \text{ (occupancy rate)} \times 140 = 428 \text{ tons}$$

On the basis of this figure, the new freighter, if it has a deadweight tonnage of 500 tons, may be able to meet the demand for transportation for the time being, and we have accordingly, come to decide on a 500 DWT-size vessel.

However, if demand for transportation continues to grow, for the purpose of coping with such increase in demand, it will be necessary to improve the operational ratio, and regularly increase the tonnage.

#### 3.2.4 Need for technological cooperation

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

#### 3.2.5 Basic policy on execution of cooperation

Based on an examination of the above matters, we conclude that the construction of a cargo ship will help to stabilize the supply of daily goods in the republic, thus greatly helping the republic to achieve economic development and improved national welfare. We are assured that the country has the ability to maintain, operate, and repair ships. Judging from the various circumstances mentioned above, the construction of a cargo ship exactly coincides with the purpose of grant aid cooperation, and we believe that the cooperation of Japan would be appropriate and effective. Therefore on condition that a grant aid should be awarded, a general plan will be prepared and the basic design developed.

Incidentally the cooperation as referred to above complies with the concept of ensuring inter-island transportation capacity, which has been pointed out in the basic policy of Cape Verde's Third National Development Plan.

### 3.3 OUTLINE OF THE PROJECT

#### 3.3.1 Shipping plan

Although detailed shipping plans have yet to be determined, the new cargo ship is expected to be engaged in distributing goods principally between the Porto Grande and Praia ports or from Porto Grande or Praia port to other islands as with other domestic route ships, whether the ship is operated by Arca Verde Co. or chartered by EMPA.

The new ship will be put into service on a flexible schedule to meet the demand for transportation, but it is likely to serve the following routes:

- 1) A route originating in Porto Grande port with visits to Sao Nicolau Island, Sal Island and Boavista Island and returning to Porto Grande port
- 2) A route originating in Praia port with visits to Fogo Island, Brava Island or Maio Island and returning to Praia port
- 3) A route linking Porto Grande port and Praia port

In case a ship is put into service with two trips per week between Porto Grande port and Praia port, the ship will be required to leave one port at 15:00 and arrive at the other port by 06:00 in order to complete cargo handling during the daytime. For this purpose, the ship has to be capable of completing a oneway trip within 15 hours, which naturally places a speed requirement on the ship's design.

#### 3.3.2 Maintenance and administration program

Arca Verde National Navigation Company, responsible for the implementation of the plan, has to give full consideration to the maintenance and administration of the vessel in order to operate the new freighter effectively. The public corporation has sufficient capability to inspect and operate the vessel and to secure crew members. Regarding repairs, in the case of minor repairs, its own workshop has such capacity and in the case of major repairs and bottom-washing in drydock, the capability of CABNAVE dockyard in Mindelo is available. Concerning routine maintenance, crewmembers are capable of such operations as chipping and scaling hulls, replacing packings, supplying consumable stores, overhauling and inspecting crank pin metals, replacing piston rings, and cleaning and adjusting fuel injection valves. Thus any problem with maintenance and administration, is unlikely to occur.

Besides the above, a public corporation should bear the following points in mind for the effective operation of the vessel.

- (1) To ensure the compliance with regular inspections in accordance with the classification society the vessel is classed to.

The actual situation is that each classification society in the world adopts almost the same frequency and manner for regular inspections, etc. and such inspections are almost always in accordance with the manner as specified in the SOLAS Convention. Take the example of Nippon Kaiji Kyokai, which has been appointed to classify the vessel in question. It makes surveys once every year, including intermediate surveys and special surveys, and surveys in drydock twice every five years.

- (2) It should have the vessel covered by marine insurance.  
It is a prerequisite to have a vessel insured for its operation, thus it is understood that marine insurance will be absolutely necessary for the new freighter.

- (3) It should avoid a situation in which the vessel is put out of service because of a shortage of spare parts by properly securing, supplying, and maintaining them.

The country has no agencies which deal with marine equipment and there may be cases which require delivery of parts from remote places. Regarding the parts for the new freighter, the public corporation, therefore, has to ascertain the required period to obtain each part, and establish the quantity to keep on hand and the method, including the channel to obtain them.

- (4) It should secure a fund to cover the estimated annual cost of maintenance and administration.
- (5) It should carry out oiling and replacement of lubricating oil in order to extend the useful life and avoid failures of equipment. The frequency and manner of oiling or replacement of lubricating oil should basically be in accordance with the instructions manual of the maker of each piece of equipment. Such a manual specifies the manner and the frequency of replacement of the oil depending on the kind of oil, type of machinery, temperature at which it is used, lubricating surface speed, and the size of the machinery.



## **CHAPTER 4 BASIC DESIGN**



## CHAPTER 4 BASIC DESIGN

### 4.1 DESIGN POLICY

The basic policy of preparing the basic design of the cargo ship is to give due consideration to the service sea area, the type of loaded cargo, and cargo transport volume, and to conduct a field survey on the ship's operation environment relative to the weather, sea conditions, the state of harbors and other facilities, etc. In addition, attention must be given to the following points in view of Cape Verde's unique features:

- (1) Durable and trouble-free machinery and tools must be used to ensure that the ship will not go out of operation due to mechanical trouble or a shortage of parts. High-tech equipment considered difficult to repair and procure parts for will be avoided as much as possible. Spare parts which are considered necessary will be supplied superflously.
- (2) Machinery and tools that are easy for the crew members to operate will be provided aboard the ship.
- (3) Consideration will be given to ensuring safety. In other words, in consideration of the marine and land climate specific to the area where the ship is expected to sail, the ship will be fully equipped with instruments necessary for safe navigation, such as those for communication, measurement of sea depth and the position of the ship, and detection of obstacles.
- (4) The ship engaged in inter-island transportation of Cape Verde will have an empty cargo hold on its return voyage. Even when the ship hold is empty and the draft is very shallow, however, the ship should have a sufficient quantity of ballast to maintain the draft and keep its propeller in the water.
- (5) Efforts will be made to cut down on fuel consumption.
- (6) To prevent corrosion, the appropriate paint, zinc plate, selection of materials, pipe thicknesses, etc., should be considered.

### 4.2 EXAMINATION OF DESIGN CONDITIONS

As to the ship's design conditions, the following examination was made:

#### 4.2.1 Weather and sea conditions

- (1) Meteorology and sea state

As the ship's service area is located in a northeasterly trade wind zone, a strong northeasterly wind prevails throughout the year. Generally, wind



velocity is 4 (5.5-8.0 m/s) or less on the Beaufort wind scale but on about 1% of the days of a year, the wind velocity can rise to 7 (13.9-17.2 m/s). Therefore, the ship should be possessed of sufficient stability even at a wind velocity of up to 7.

(2) Visibility

Visibility frequently drops to below 5 miles due to what is known as "dust haze." In some sea areas, "haze" occurs on more than 20% of all days except in October and November. This "haze" originates in Africa's inland area. "Dust haze" reduces visibility to 2.5-6 miles but it is not rare for visibility to drop to 0.6 miles. Accordingly, nautical instruments will be designed taking into consideration such limited visibility.

(3) Tides and currents

Cape Verde is situated at the southern rim of the region at which the Canary Current turns from its southwestward direction to its westward direction to change into the North Tropical Current. Thus, a southwestward to south south westward current prevails.

A high tide moves in the northwestward direction and an ebb tide in the southeastward direction. Both high and ebb tides can be coped with adequately if the maneuverability of the ship is designed in such a way as to satisfy the conditions for ordinary ships.

(4) Atmospheric temperature, sea-water temperature, etc.

In designing air conditioning equipment, heat exchangers, etc., the maximum temperature of 32°C and the maximum sea-water temperature of 30°C are applied.

#### 4.2.2 Examination relative to geographical conditions

Of the nine inhabited islands which will be served by the new cargo ship, three have no piers. Therefore, at anchorage, cargo must be loaded and unloaded with the help of barges. Some islands have piers which are not kept in good conditions. Only a limited number of islands permit refueling. To cope with these geographical conditions, an examination was made concerning the following points:

(1) Loading/unloading equipment

Loading/unloading equipment is inadequate both at piers and in anchored areas as well. Thus, the new cargo ship will be equipped with cargo gears.

(2) Refueling

Only two ports have refueling facilities--Porto Grande port on Sao Vicente Island and Praia port on Santiago Island. Refueling is less expensive at Porto Grande port than at Praia port. Accordingly, a fuel tank will be fitted that dispenses with the need for refueling until completing 160 miles

(Porto Grande port-Praia port) in the course of two round-trip cruises lasting three weeks.

(3) Principal dimensions

Ships larger than the new cargo ship are currently in service in the area the ship will navigate. Therefore, there are no restrictions on principal dimensions and drafts in relation to the depths at service routes, and harbors, the length of piers, etc. As a result, it is possible to use the ship's optimum dimensions and draft needed to satisfy the requisite conditions.

4.2.3 Examination relative to ship repair facilities

As explained above, the CABNAVE dockyard in Cape Verde can undertake docking and parking of ships weighing up to 2,800 DWT and up to 110 meters in length on the slipway and repair parking area. When docking and parking, the new ship will weigh 400 tons at the most and will be less than 50 meters in length. Therefore, there should be no problem at all as far as docking at the slipway and parking area is concerned.

The CABNAVE dockyard has complete repair capabilities in terms of both technique and equipment. Simple repairs on mechanical and electrical parts can also be undertaken at the workshop of Arca Verde National Navigation Company. Hence, there should be no problem concerning ship repair facilities. Parts procurement, however, will take time, and a shortage of parts could cause suspension of operations in the worst case. Special attention will be paid to the durability of machinery and the supply of spare parts.

4.2.4 Examination of domestic and international laws and regulations

Domestic laws have been prepared to some extent to regulate the qualifications and number of crew for different categories of ships, i.e., for passenger, cargo and fishery ships, and also for different tonnages and engine outputs in different areas for domestic and international navigation.

Most international laws have been ratified (with some exceptions).

Therefore, both domestic and international laws, in accordance with their application, will be applied to the cargo ship depending on its areas of navigation (Cape Verdean inter-island), ship categories (cargo ship), gross tonnage (approximately 480 tons), and engine output (approximately 1,000 PS).

### 4.3 BASIC DESIGN

Upon examining the contents of the request and the design conditions, the basic plan was worked out as follows:

#### 4.3.1 Principal dimensions

In determining principal dimensions, the deadweight, cargo hold capacity, stability, propulsive performance, resistance, hull steel weight, etc., were taken into consideration in an integrated manner. In other words, the length was determined in such a way as not to impair propulsion, resistance and maneuvering performance in order to maintain the requisite speed and also to minimize hull steel weight.

The ship's breadth was also set at the maximum permissible level in terms of propulsion, resistance and maneuvering performance in order to improve its stability performance. The ship, which will have comparatively large cargo gears, was designed well within the range of not impairing stability in order to maintain its cargo hold capacity.

#### 4.3.2 Hull part

##### (1) Type of ship

This will be a well decker with a stern featuring a durable poop arranged with a living area, a steering gear room, etc., and a bow featuring a forecastle which is advantageous in maintaining seaworthiness and arranged with a store.

##### (2) General arrangement

The cargo hold is arranged at midship to ensure convenient cargo handling. As a result, the engine room, the bridge and the living quarters are arranged to the aft. The bridge is located to the aft but is located on the third tier of the upper deck, permitting full visibility ahead.

##### (3) Speed

Speed is a design factor as important as the deadweight tonnage in determining the ship type, engine output, construction costs, etc. Speed is therefore determined through deliberate consideration of the navigational plan.

Although the navigation plan for the ship has not yet been established, it is most likely that the ship will be put in service between Port Grande Porto, Sao Vicente Island, and Praia Port, Santiago Island. This means that the ship must cover a distance of 160 sea-miles in 15 hours (e.g. leaving at 15:00 and arriving at 6:00, enabling cargo handling during the daytime when labor costs are low) at a navigation speed of 10.5 knots.

Since it is normally the case that a ship designed to have a nominal speed of 10.5 knots can often sail at only 8 to 9 knots, the ship under consideration has been requested to have a nominal speed of 12 knots. However, the speed of 10.5 knots planned for the ship in this case is the value when the ship is fully loaded with 85% of engine output and includes a 15% sea margin for speed decrease in stormy weather. This means that the ship can sail faster than 10.5 knots under normal conditions.

(4) Deadweight tonnage

The deadweight tonnage for this ship is approximately 500 tons. (The reason for selecting this deadweight tonnage is given in the Appendix.) The net cargo weight becomes approximately 440 tons, as the deadweight tonnage includes shipboard fuel, water, food, stored goods, crew members, etc.

(5) Cargo hold capacity

The volume of the cargoes that can be accommodated varies to a large extent depending on their categories. The ship under study is planned to transport rice, beans, sugar, powdered milk and sundries. Though it depends on the ratios of the cargoes, therefore, the loading capacity of the ship can be based on the volume of 1.6 m<sup>3</sup> per ton (for corn packed in a sack, as the principal cargo). The net weight of the cargo to be loaded on this ship becomes about 440 tons after 60 tons, the approximate weight of water, oil and food included, is deducted from the nominal dead-weight of 500 tons. When 440 tons is multiplied by 1.6 cubic meter/ton, the loading space capacity becomes about 700 cubic meters.

(6) Fuel tank capacity

Fuel tank capacity of about 40 cubic meters will be provided to facilitate navigation without the need for refueling and to ensure that the ship will be able to cover 160 miles in two round trips a week over a period of three weeks (e.g., a cruising distance of about 2,200 miles).

(7) Hull construction

The hull will be of the all welded construction type based on the transverse framing system which is advantageous to small ships. A double bottom will be installed beneath the cargo hold and the part of the engine room for providing fuel, fresh water and ballast water tanks. Steel materials authorized by the classification society will be used as structural steel materials. Hull vibration and stress concentration will be given full consideration.

(8) Hull outfitting

1) Living quarters

In addition to rooms for the crew, a passenger room equipped with seats for eight passengers will be set up to cope with emergencies.

2) Ventilation

In order to enhance ventilation of the cargo hold, supply ventilating fans will be installed at the front of the hold on both sides of the ship.

3) Life rafts

In accordance with regulations, two sets of life rafts will be provided. These rafts will be of the Viking type to facilitate maintenance and yearly annual inspection criteria.

4) Deck machinery

Deck machinery such as the winch, windlass, and hatch closing assembly will be of the electro-hydraulic type to ensure smooth operation and easy handling with a minimum of trouble. Only the stern capstan will be of the electric motor type. Otherwise, a hydraulic system has to be applied with long hydraulic piping.

5) Cargo gear

The higher the capacity of the cargo handling gear, the shorter the loading or unloading time becomes. For the ships of this size, the capacity of 3.5 tons is in the upper range from the standpoint of safety. Therefore, the cargo handling capacity is set at 3.5 tons, for which the outreach (the distance of the cargo boom swung out from the ship side) should be 3.5 m in order to enable direct cargo transfer to and from trucks, providing that when the cargo hold is half full or less, the double-bottom ballast water tank should be filled with water in order to keep the hull inclination within 3° for the sake of safety.

6) Cargo hold

In order to protect cargo such as sundries, a bottom ceiling and side sparring will be fitted in the cargo hold.

7) Hatch cover

The hatch cover will be of the steel single-pull type. It will be outfitted with a hydraulic opening/closing device to enable easy opening and closing. Clamping, however, will be performed by hand. The cover will be durable enough to withstand four 20-foot containers placed on it and will also be fitted with metal pieces for container fitting.

8) Hawsers

To prevent hawsers being broken off by a gust of wind, they will be made of polypropylene measuring 50 mm in diameter (which is thicker than the requirement). Mooring metal mountings will be in proportion to the size of the hawsers.

9) Paint

For the bottom, boot-topping, and ship sides, which come into continuous

contact with sea water, chlorinated rubber-based paint which is in common use and known for good painting efficiency will be used. The exposed deck and the exterior of the deck house will be coated with oil paint.

For the ballast tank, tar epoxy paints will be used, while pure epoxy paints will be used to coat the fresh water tank.

#### 4.3.3 Machinery part

##### (1) Main engine

The main engine will be a vertical-type, single-acting 4-stroke marine diesel engine, whereby power is transmitted to a propeller through a reduction gear. Control over the main engine speed and the propeller blade angle is operated remotely from the bridge. Starting and stopping of the engine will be performed at the engine. Diesel oil or gas oil, which are readily available in Cape Verde, will be used as fuel.

##### (2) Shafting system

Taking into account relevant factors, the propeller will be of a controllable pitch type. As explained above, power from the main engine is transmitted to the controllable pitch propeller through a reduction gear.

##### (3) Generators

As an electro-hydraulic system is to be adopted for deck machinery, the electric motor that drives the hydraulic pump must be large, necessitating the mounting of a couple of relatively large main generators. This system requires fewer diesel engines than the system under which the hydraulic pump is driven by an independent diesel engine, resulting in easy maintenance. As a small-capacity port-use generator is needed for providing electric power when the ship drops anchor, however, one such unit will be installed in the steering gear room.

##### (4) Fuel oil, lubricating oil purifiers

A purifier for fuel oil will be installed to prolong the life of the fuel nozzle of the main and auxiliary engines. Another purifier will be installed for lubricating oil in order to extend the life of the lubricating oil, thus reducing operating expenses.

#### 4.3.4 Electrical part

##### (1) Generators

Refer to machinery part under 4.3.3.

##### (2) Nautical instruments

Nautical instruments are extremely important, as the service routes of the new cargo ship are often marked by poor visibility due to "dust haze" and fog. Accordingly, two radar units, a wireless direction finder, and a GPS

navigation instrument will be installed.

(3) Shore connection

There are many cases in which shore electric power is used. To this end, an 80 ampere shore connection will be installed.