

Japan International Cooperation Agency (JICA)

Ministry of Communication, Works and Energy,
Government of the Republic of the Fiji Islands

PREPARATION OF NAUTICAL CHARTS
IN
THE NORTHERN LAU ISLANDS REGION
IN
THE REPUBLIC OF THE FIJI ISLANDS

Main Report - Volume I

Recommendations for the Improvement of
Operation and Management System of
Hydrographic Surveying and Nautical Charting
in Fiji

March 1999

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List of Reports

MAIN REPORT

VOLUME I : Recommendations for the Improvement of Operation and Management System of Hydrographic Surveying and Nautical Charting in Fiji

VOLUME I SUMMARY : Recommendations for the Improvement of Operation and Management System of Hydrographic Surveying and Nautical Charting in Fiji

VOLUME II : Study Progress Report

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PREFACE

In response to a request from the Government of the Republic of the Fiji Islands, the Government of Japan decided to conduct a study on the preparation of nautical charts in the Northern Lau Islands region and entrusted to the study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yasuhiro OYAMADA, Aero Asahi Corporation (and consist of Asia Air Survey Co., Ltd.) to Fiji, six times between January 1995 and November 1998.

The team held discussions with the officials concerned of the Government of Fiji, and conducted hydrographic surveys at the study area, and prepared three nautical charts with the cooperation of the Hydrographic Department of Japan Maritime Safety Agency. The team also drafted recommendations for improvement of the operation and management system of hydrographic surveying and nautical charting in Fiji. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report and the nautical charts will contribute to the promotion of navigational safety in the study area as well as the improvement of hydrographic activities in Fiji and to the enhancement of friendly relationship between our two countries.

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

March 1999



Kimio FUJITA

President

Japan International Cooperation Agency

March 1999

Mr. Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr. Fujita,

Letter of Transmittal

We have the pleasure of submitting herewith the Final Report of the Study on the Preparation of Nautical Charts in the Northern Lau Islands Region in the Republic of the Fiji Islands. The Study was conducted for a total period of 52 months from December 1994 to March 1999, by the joint venture of Aero Asahi Corporation and Asia Air Survey Co., Ltd. under the contract with your Agency.

Despite that there exist several major shipping routes in the Northern Lau Islands region, the nautical charts covering these waters show only outdated hydrographic data of late 19th to early 20th centuries. Aiming at improving them for safer and more economical navigation, the Government of Fiji requested the Government of Japan for technical cooperation in preparing updated nautical charts as well as in recommending improved operation and management system of hydrographic surveying and nautical charting in Fiji.

We believe that the three nautical charts successfully resulted from the Study will serve for vessels' safer navigation, and the recommendations, drawn up from a practical point of view, will be useful to improving the hydrographic activities in Fiji. This will certainly be enhanced by the modern technology transferred to the Fiji counterpart personnel throughout the Study.

We wish to take this opportunity to express our deep gratitude to your Agency, the Ministry of Foreign Affairs, the Ministry of Transport and the Maritime Safety Agency of Japan for their continued support during the Study. Our sincere appreciation is also due to the Ministry of Communication, Works and Energy of the Government of the Republic of the Fiji Islands, for their close cooperation and assistance extended to the Study team.

Very truly yours,


Yasuhiro Oyamada

Team Leader

Study on the Preparation of Nautical Charts in the Northern Lau Islands Region in Fiji

**Preparation of Nautical Charts in the Northern Lau Islands Region
in the Republic of the Fiji Islands**

MAIN REPORT : VOLUME I

**Recommendations for Improvement of the Operation and Management System
of Hydrographic Surveying and Nautical Charting in Fiji**

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Figure 1 : Domestic Shipping Routes in Fiji

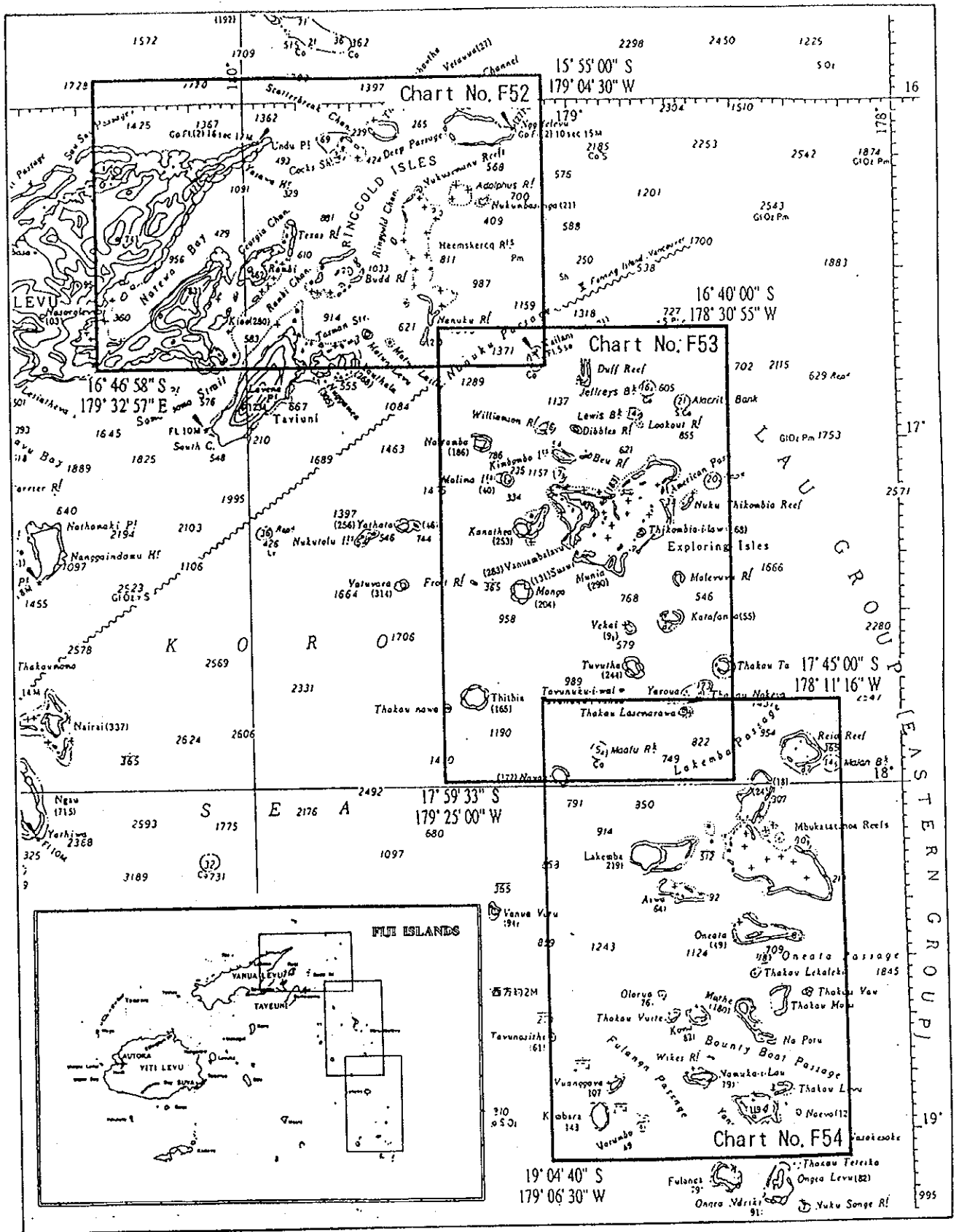
Figure 2 : Charts for Short-Term Needs

Appendix I : Job Description and Qualification of the Post at FHS

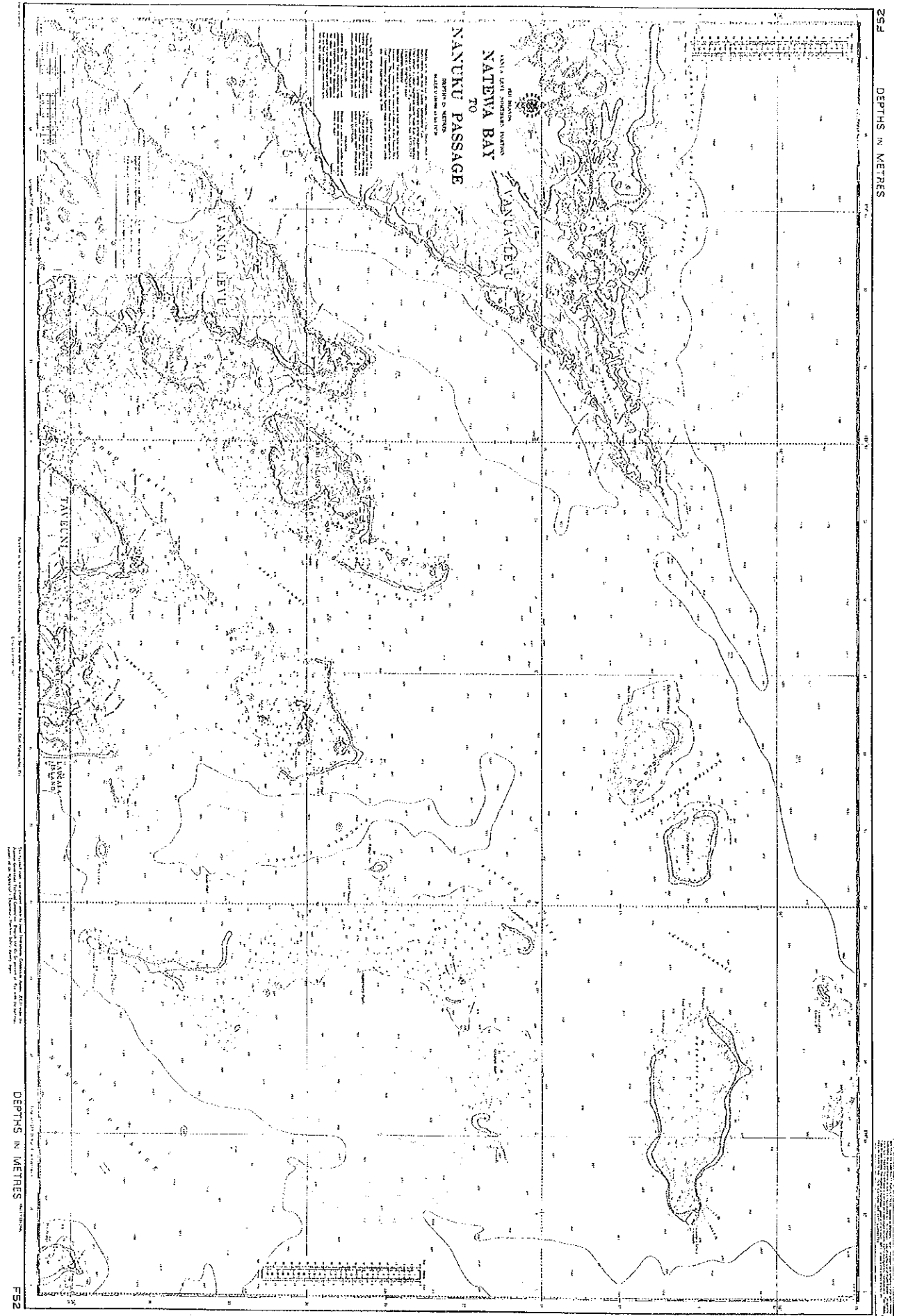
Appendix II : List of Principal Survey Equipment and Instruments

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Study Area and Chart Coverage



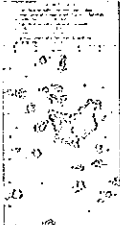
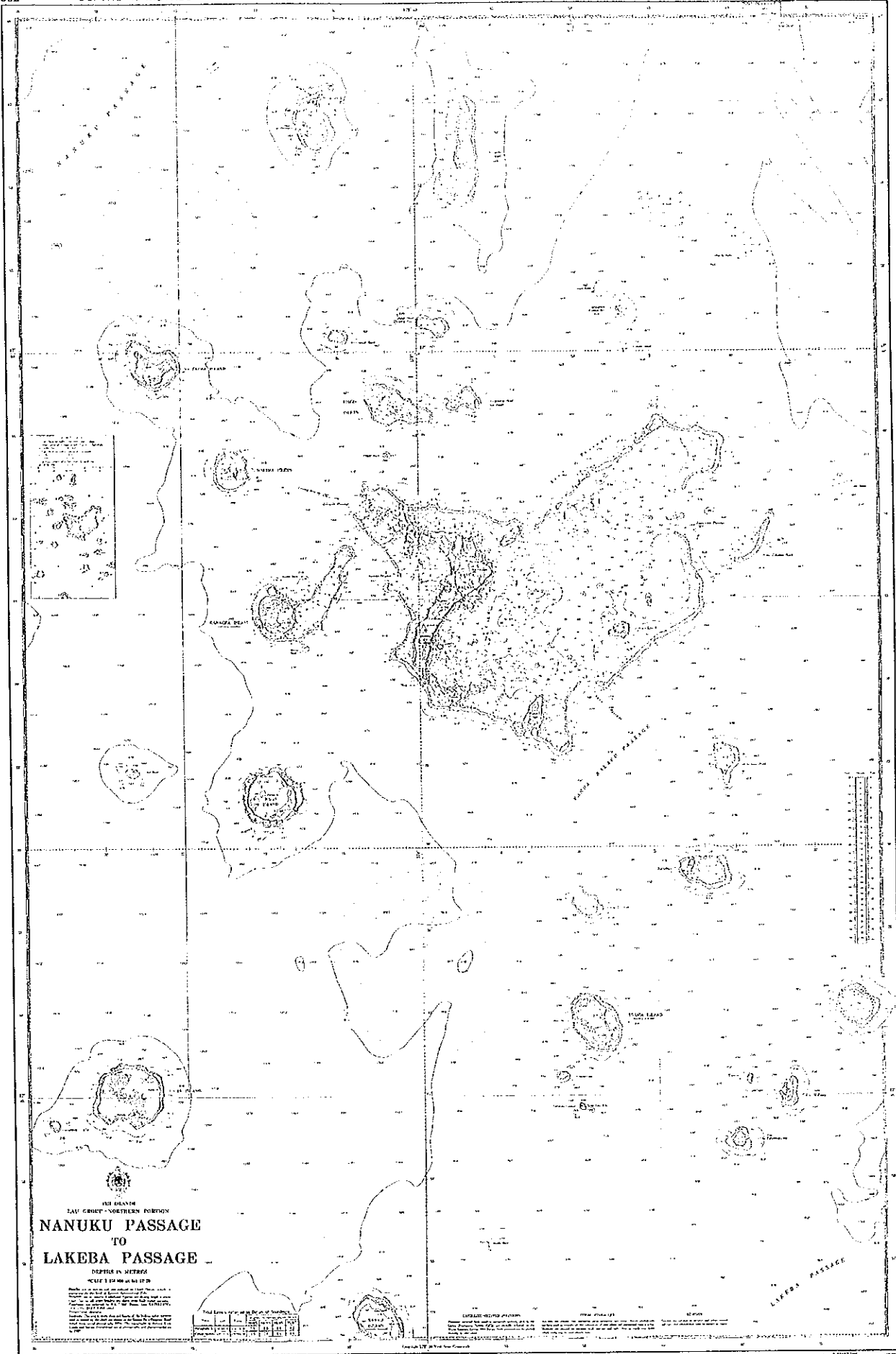
254 DEPTHS IN METRES

DEPTHS IN METRES F52

Fiji Chart No. F52

Scale of Soundings
1:100,000
1:200,000
1:300,000
1:400,000
1:500,000
1:600,000
1:700,000
1:800,000
1:900,000
1:1,000,000

Scale of Soundings
1:100,000
1:200,000
1:300,000
1:400,000
1:500,000
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1:900,000
1:1,000,000



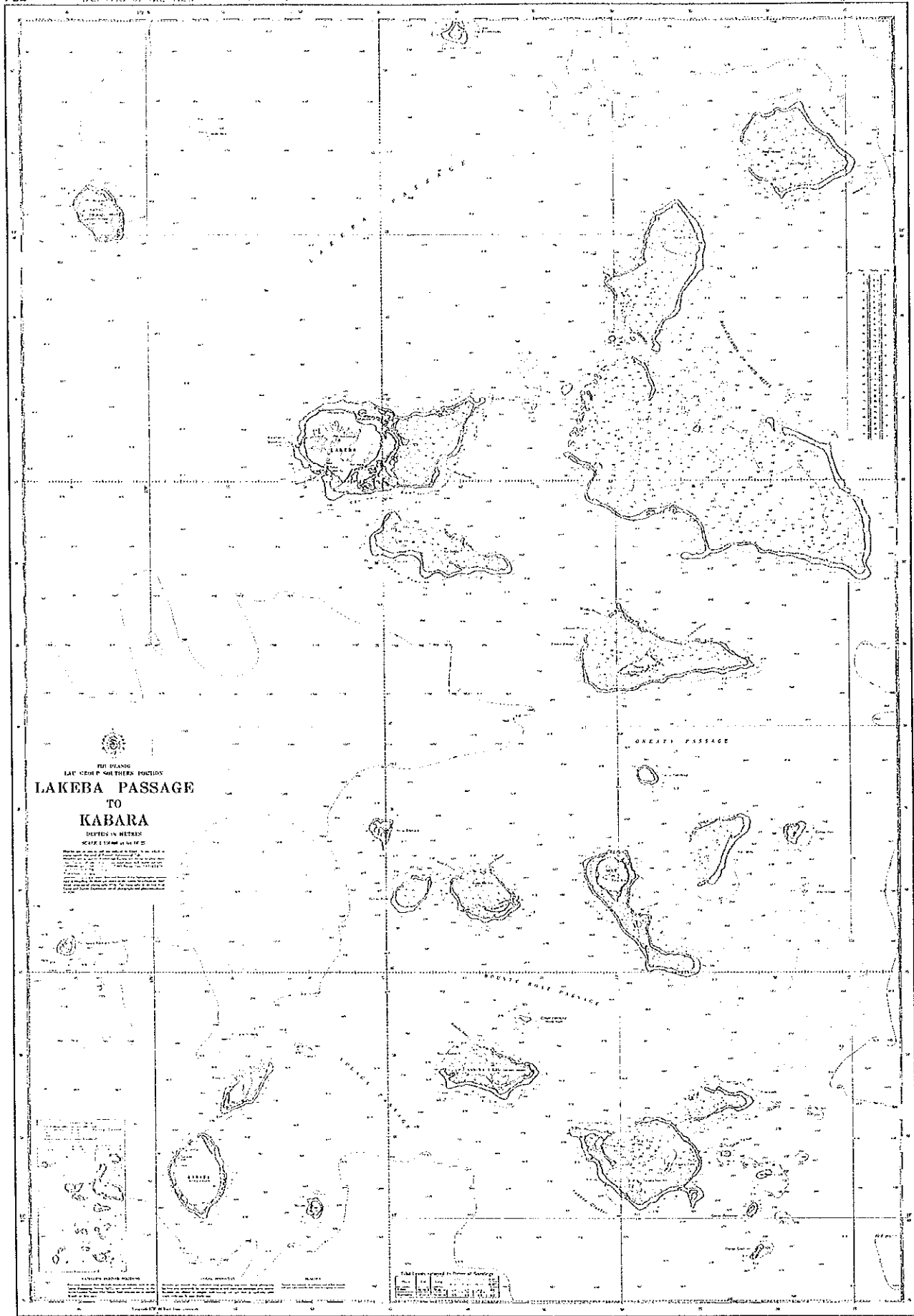
THE SOUVENIR
LAU GROUP - NORTHERN DIVISION
**NANUKU PASSAGE
TO
LAKEBA PASSAGE**
DEPTHS IN METRES
SCALE 1:100,000 at 60° 17' 20"

Published by the Hydrographic Office, London, under the authority of the Admiralty, and by the Hydrographic Office, Washington, D.C., under the authority of the United States Navy Department.
Copyright 1953 by the Hydrographic Office, London, and the Hydrographic Office, Washington, D.C.

Tidal Levels at 15° 00' N, 178° 00' W	
Time	Depth in Metres
High Water	10.0
Low Water	4.0
Mean High Water	7.0
Mean Low Water	5.0

Published by the Hydrographic Office, London, under the authority of the Admiralty, and by the Hydrographic Office, Washington, D.C., under the authority of the United States Navy Department.
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Fiji Chart No. F53



Fiji Chart No. F54

1. INTRODUCTION

Maritime traffic in Fiji is playing an important role in social and economical development of the nation. Namely, sea transportation of passengers and cargo related to not only shipping but other activities such as fishing, exploitation of marine resources, yachting and other marine sports, are given a vital importance in the social and industrial activities of Fiji which is a maritime nation consisting of more than 300 islands and atolls. The Northern Lau Islands region is situated at a place of strategic importance for maritime traffic in the South Pacific Ocean. In addition, some of the islands surrounded by coral reefs also provide lucrative places for possible tourism development.

For all such activities, updated bathymetric data are required for safe navigation of cruise vessels and yachts. Hence, requirement for provision of modern nautical charts covering this region is vital for safety of navigation. However, current nautical charts covering this region are mostly based on the old hydrographic surveys in the latter part of 19th century, which lacks reliability and accuracy for modern navigation. The Fiji Government, although noticing the importance of revising those nautical charts, had only limited personnel and budgetary provisions to renew those charts.

Under such circumstances, the Fiji Government requested the Government of Japan for technical cooperation in "The Study of the Preparation of Nautical Charts in the Northern Lau Islands Region in the Republic of Fiji" (hereinafter referred to as "the Study").

In response to the request, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of the technical cooperation programmes of the Government of Japan, dispatched a Preparatory Study Team to Fiji from 15 February to 15 March 1994, and the Scope of Work (hereinafter referred to as "S/W") was agreed between JICA and the Ministry of Infrastructure, Public Works and Transport (renamed as the Ministry of Communication, Works and Energy as of August 1997) on 15 March 1994.

According to S/W, the objectives of the Study were:

- (1) To prepare three Fiji nautical charts, Nos. F52, F53 and F54, each on the scale of 1/150,000, covering the Northern Lau Islands region;
- (2) To report the recommendation for improvement of operation and management system of hydrographic surveying and nautical charting in Fiji; and
- (3) To promote technology transfer through the implementation of the Study with a view to enabling the Fiji counterpart personnel to improve their technique in hydrographic surveying and nautical charting.

This report is prepared under (2) of the objectives above.

2. GENERAL ASPECTS OF THE REPUBLIC OF THE FIJI ISLANDS

2-1. Social and economic facts

The official name of the country of Fiji is the Republic of the Fiji Islands, and the country became independent on 10 October 1970.

The population is 781,400 (1997), of which Fijian 51.1%, Indian 43.6%, others 5.3% (1996).

The languages spoken are English (official language), Fijian and Hindi.

As for the religion, Christian are 52.9% of the total population, followed by Hindu 38.2% and Moslem 7.8% (1986).

The head of the state is President Ratu Sir Kamisese Mara since January 1994.

The cabinet is headed by Prime Minister Sitiveni Rabuka since June 1992. There are 18 Ministers in the cabinet (1998).

The Gross Domestic Product (GDP) is US\$1,868.5M (1997), and GDP per capita is US\$2,391 (1997)

The growth ratio of Gross National Product (GNP) is 3.6% (1996).

The commodity price rises at a rate of 2.2% annually (1996).

As regards international trade, the amount of export is F\$870M while that of import is F\$1,220M in 1996. Principal export goods estimated in 1995 are Sugar (31.9%), gold (9.6%), fish (7.4%), lumber (6.0%), apparel (3.0%); and principal import goods are industrial products (32.2%), mechanical/transport equipment (28.2%), foods (16.7%), petroleum (14.3%), chemical products (8.6%).

Goods are exported to those countries of Australia (26.0%), U.K. (22.9%), U.S.A. (13.0%), Japan (6.6%), New Zealand (5.3%), Canada (3.6%) (1995).

The countries from which goods are imported are Australia (38.8%), New Zealand (15.9%), Japan (7.2%), U.S.A. (7.1%), Singapore (7.1%) (1995).

The currency used in the country is Fijian dollar (F\$), and 100 cents (c) constitute F\$1. The exchange rate as of January 1998 was F\$1 = US\$0.53.

2-2. Geographical fact

The 320 islands, of which at least 100 are inhabited, comprising Fiji are spread over an area of 709,700 km² - 97 per cent of it is ocean - between latitudes of 12.5 and 22 degrees south of equator, and lying on either side of the 180th meridian, between 177 degrees W and 174 degrees East. The actual land area, however, is about 18,376 km². The largest island, Viti Levu, is 10,429 km² in area, where the nation's capital Suva is situated. Vanua Levu is next with 5,538 km², followed by Taveuni, 435 km², Kadavu, 409, Gau, 140, Ovalau, Koro,

Rabi, Rotuma, and Beqa.

These and other islands of the Fiji group are high islands, volcanic in origin, though no longer active, and rising to heights of over 1,000m in the case of the three main islands. Rock structures of volcanic origin, however, combine on the large islands with those of sedimentary formation, a clear indication that the processes of land building took place both above and below the surface of the ocean.

The group is positioned in the southern tropics, and the southeast trade winds prevail for most of the year. Due to this effect, the rainfall in the eastern part of Viti Levu reaches about 3,000mm a year, while the western part is rather dry, the precipitation is 1,900mm a year. During the rainy season from November to April, the group is sometimes visited by cyclones causing more rain and violent damages.

2-2-1. General aspects of geographical features of the Study Area

The Lau Group consists of about 80 islands and atolls extending between Lat. 17° to 19° S and Long. 179° 30' to 178° W. Those islands are made of volcanic rocks but there is no volcanic activities. Most of the islands are not steep but their coasts are mostly steep without flat areas. Coral reefs are developing on the basis of those volcanic rocks in the forms of fringing reef, barrier reef and atoll. There are several huge atolls ranging 50km in diameter.

Within this area pass important shipping routes between North America/Hawaii and Australia/New Zealand, and between South America and Southeast Asia, and also between Fiji and Samoa/Tonga. Those passages frequented by large-sized vessels are Nanuku Passage, Lakeba Passage, Oneata Passage, Bounty Boat Passage and Fulaga Passage. These passages have been used by navigators since ancient times, and this locality is known as "Crossroad of the South Pacific".

The Exploring Isles situated in the middle of the area consists of 7 islands and a number of islets and coral reefs, forming a vast lagoon covering an area of about 518km² with circumference of about 130km. The largest island is Vanua Balavu with an area of 52km² located at the western end of the lagoon. Lomaloma village is located on this island and is the second largest island of the Lau Group with population of about 1,400, and is a core of the economic activities in the Lau Group.

The lagoon of Exploring Isles has been used as maritime traffic and fishing grounds since early times, and has recently becoming the object of tourism development for marine resort and yacht havens.

The largest island in the area is Lakeba in the south of Exploring Isles with an area of 54km² and population of about 2,400. This island plays an important role in social and economic ties between Fiji and Tonga.

An airport is located each at Vanua Balavu, Lakeba and Cicia in the Lau Group, and air traffic is available between Suva and these islands. For other islands, maritime transportation is the only means of travel.

3. BRIEF HISTORY OF HYDROGRAPHIC SURVEYING AND NAUTICAL CHARTING IN FIJI

The earliest systematic hydrographic surveys of Fijian waters were undertaken by the British Navy in 1838. Later in 1840, US Exploring Expedition produced the first chart that adequately depicted the whole of the Fiji Group. In 1854-57, many large scale surveys were conducted by British Navy. When Fiji became a British colony in 1874, the British Hydrographic Department assumed responsibility for the provision of nautical charts covering Fijian waters, and by 1900, twenty-three British Admiralty (BA) charts were published.

During the first half of the 20th century, further work was carried out by British and Australian hydrographic surveyors, resulting in revision to those charts. After World War II Fiji was designated within New Zealand's administrative area for general naval purposes, although the United Kingdom was still responsible for surveying and charting.

By this time the needs of modern shipping prompted the requirement to review the existing charting scheme which was based on 19th century requirements, and the UK Hydrographic Office (UKHO) consulted the Fiji Marine Department for local advice, and in 1952, a Fiji Government committee acknowledged that, due to increases in ship size and changes in traffic patterns, the existing charts of the group were becoming obsolete.

Updating charts commenced only when hydrographic surveys were conducted between 1957-66 by two British survey ships with modern echo-sounders. At the same time the Fiji Marine Department assisted UKHO in maintaining the BA charts by supplying information for inclusion in Notices to Mariners and other important information necessary for safe navigation. During this period four new charts and a number of revisions of existing BA charts were published.

In 1966, the United Nations (UN) initiated a hydrographic study as part of a survey for the development of Fijian maritime traffic. In 1968 the "Fiji UN Transport Survey Project" was commenced. This was the foundation of a hydrographic unit in the government. The Assistant Project Manager of the Survey was an expatriate hydrographer who, during 1967-69, carried out a number of large scale port surveys.

In 1969, the Fiji Government, recognizing the value of an inshore survey capability, requested UN to continue its hydrographic assistance. This resulted in personnel and equipment being placed in the Fiji Marine Department forming the Fiji Hydrographic Unit (FHU).

Fiji became independent in 1970, but this did not affect the close ties with UKHO and UN. The UN Development Plan (UNDP) recruited a further expatriate assistant surveyor in January 1971. A second UN project was approved for the period 1972-75, with the objectives of operating and directing FHU, including the execution of those hydrographic surveys required for development projects and for the modernization of charts, and training of local personnel with the ultimate aim of full localization.

A new Fiji chart scheme was agreed within the Marine Department in 1973, confirming the Fiji Government's commitment to developing the maritime industry. The progress of developing the FHU was, however, less successful both technically and personnel wise due to unavailability of effective training, equipment including a survey ship, and recruitment of personnel.

During this period UKHO began conversion and modernization of all BA charts to metric. This required identification of areas to be surveyed for the new metric charts in Fijian waters. To carry out surveying British survey ship engaged in survey work during 1974-75 of major commercial shipping routes. At the same time FHU was completing large scale surveys of wharves and jetties.

In 1970 FHU was transferred to the Royal Fiji Military Forces (RFMF) Naval Division, with the hope that FHU's militarization would allow the training of personnel and the acquisition of equipment to be pursued within the terms of Fiji's existing bilateral military aid programmes with Australia and New Zealand.

After the UN expert left Fiji with expiry of UNDP Project in 1975, requests were made for the loan of a naval hydrographer from Australia, New Zealand or UK. Finally a Royal Navy Charge Hydrographic Surveyor was appointed to head FHU in August 1979. Specialist and military training of recruits was accomplished both in Fiji and overseas, with military assistance from Australia and New Zealand.

In 1982, Fiji became a member of the International Hydrographic Organization (IHO), thus formally cementing FHU's growing ties with the international hydrographic community in general, and in particular, with the naval hydrographic services of UK, Australia and New Zealand.

In 1981, FHU published its first four colour metric chart, an achievement followed in the period to 1988 by the production of two further new charts and one new edition, all to full international standards; three INT charts were also adopted and printed locally in 1987-88.

In January 1987, with full funding provided through Australia's Defence Cooperation Programme (DCP), the purchase of an Australian geological survey ship (later named RV TOVUTO) was approved by the Cabinet; the intention was then that the DCP would fund the ship's outfitting for hydrographic survey work after her arrival in Fiji.

Unfortunately, just 3 days after the ship's first arrival in Suva in May 1987, a military coup led to the immediate termination by both Australia and New Zealand of all forms of military assistance. As a result, the vessel could only be utilised as a "mother ship" for survey operations, because it had not been fitted out properly for surveying.

Since FHU was almost totally dependent on Australia and New Zealand Navy sponsored assistance for its continued development and well-being, urgent action was taken to obtain other source of assistance. In November 1988, Cabinet approved the transfer of FHU back to the Marine Department to become Fiji Hydrographic Service (FHS), making it eligible to receive civil aid.

The period in RFMF was one in which FHU made enormous progress towards the goal of full localization. This was partly due to the on-going support of UNDP until 1985 and the vital contribution of both the Australia and New Zealand Hydrographic Services from 1979 onwards, and the main key unifying element of the continuity of professional direction afforded by the consecutive appointment of three British Navy hydrographic surveying officers to head the Unit between 1979-88.

Taking advantage of a new civil status, FHS aimed for 1989-90 at initiating bilateral training and equipment programmes in order to develop FHS into an organisation with a balance of professional skills and adequate modern equipment required to fulfil its national responsibility for hydrographic surveying and nautical charting.

In December 1990, the Fiji's first local Chief Hydrographer was appointed bringing to reality the UNDP's original plans of full localization. This encouraging state of affairs could not have come about without the considerable personal interest shown by Fiji's Minister for Infrastructure and Public Utilities in the activities of FHS.

As for equipment and survey instruments, FHS was empowered with provision of an aluminium survey catamaran SMB BABALE to be carried aboard R/V TOVUTO and dual channel echo-sounder by British aid in 1989.

In 1993, the Fiji Government requested the Government of Japan for a technical cooperation on the Study of Nautical Charting in the Northern Lau Islands Region for preparation of three 1/150,000 nautical charts covering the region, using modern hydrographic survey technique and equipment.

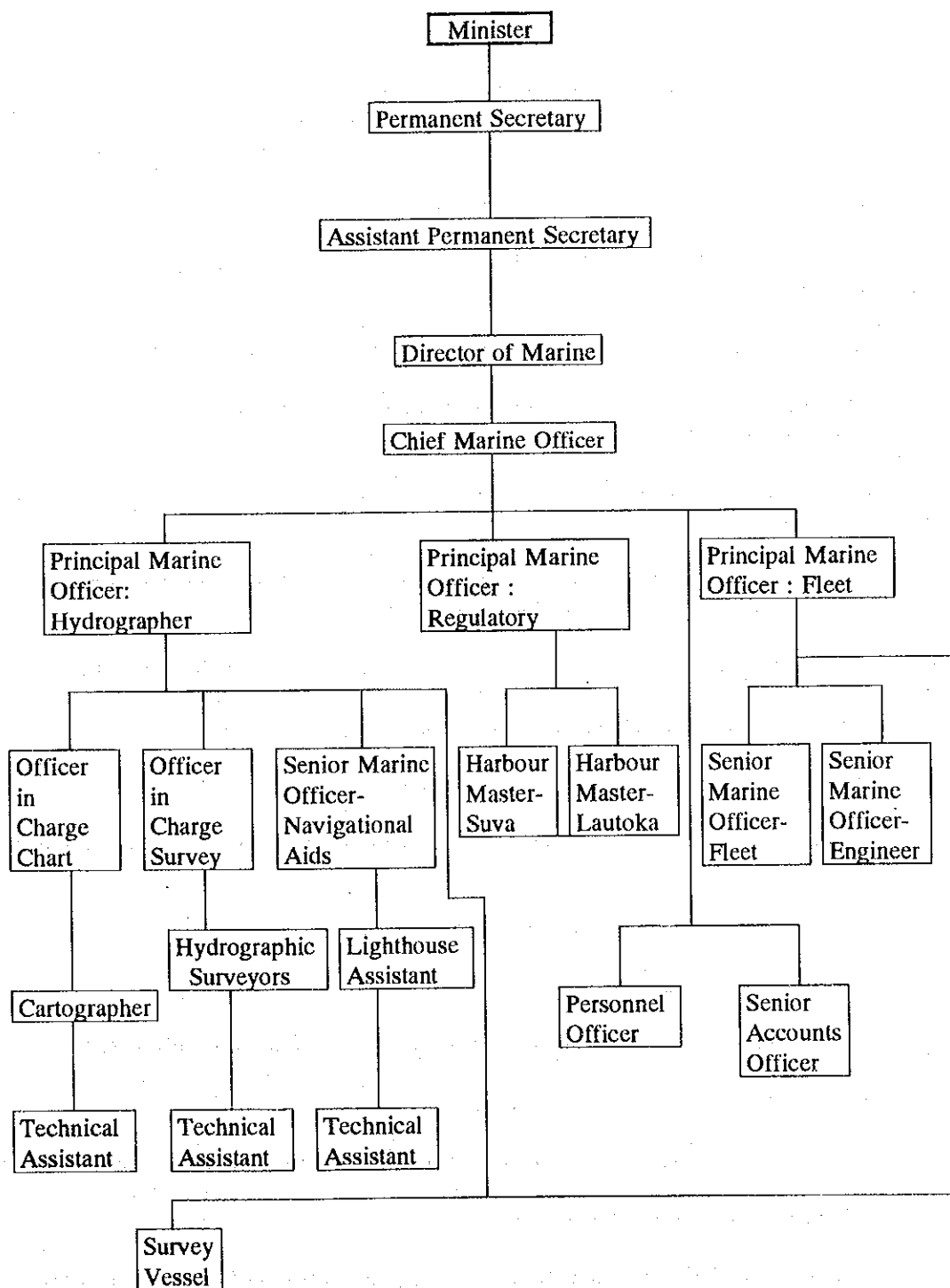
For effective implementation of the Study, Japan International Cooperation Agency (JICA) provided modern survey and navigational equipment, such as a dual channel echo-sounder, GPS receiver and auto-pilot/gyrocompass, which enabled R/V TOVUTO to conduct hydrographic surveys herself. Also provided were a plotter and computers which made data processing of survey results faster and more accurate.

This was a five-year project starting from 1994, resulting in three nautical charts being prepared and published. Also prepared during the Study were recommendations on the improvement of operation and management system of hydrographic surveying and nautical charting in Fiji.

4. EXISTING STATUS OF FIJI HYDROGRAPHIC SERVICE

4-1. Organisation and functions

4-1-1. Organisation chart of the Marine Department



4-1-2. Functions of the Marine Department

To operate safely and efficiently, the maritime community required a uniform set of minimum standards that apply equally to all participants.

The role of the Marine Department is to provide those standards, monitor and promote compliance within them and, where necessary, take action against those that fail to meet the standards.

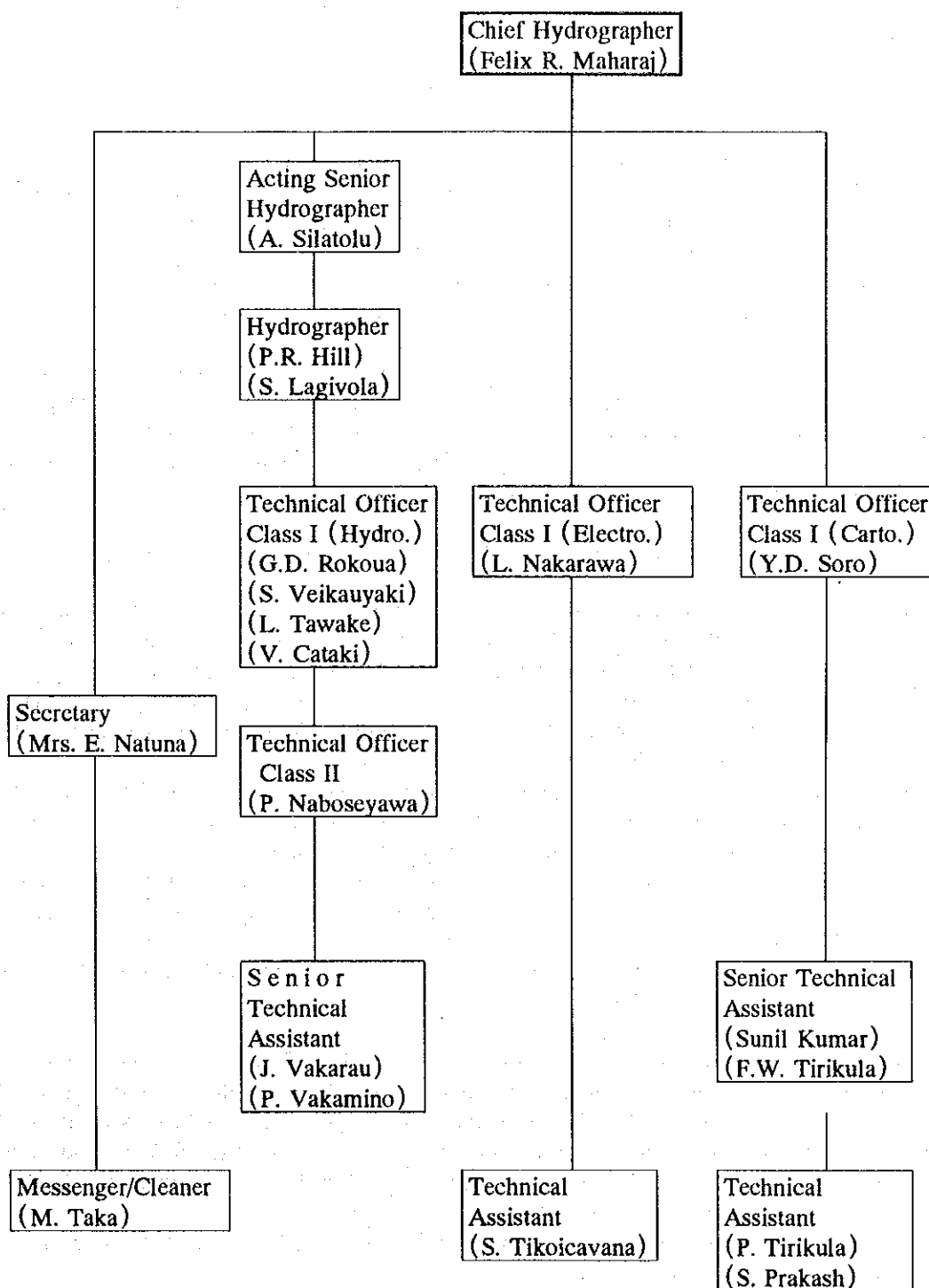
The Department is also responsible for ensuring that the maritime community has access to marine safety support services in the form of navigational aids, distress and safety radio system and marine search and rescue, and is provided with an effective oil spill response capability.

In summary, the Marine Department's functions are as follows:

- (1) to establish safety standards relating to entry into the maritime transport system, which promote safe shipping;
- (2) to monitor adherence to the safety standards within the maritime transport system;
- (3) to ensure regular reviews of the maritime transport system to promote the improvement and development of its safety;
- (4) to promote compliance with safety and marine pollution prevention standards in the maritime transport system;
- (5) to ensure the provision of appropriate distress and safety radio communication systems, marine navigational aids and hydrographic services;
- (6) to ensure Fiji's preparedness for, and ability to respond to marine oil pollution spills;
- (7) to licence vessels, their operation, and their crews;
- (8) to ensure the occupational health and safety of seafarers;
- (9) to promote safety in the maritime transport system by providing marine safety information and advice;
- (10) to investigate and review maritime accidents and incidents;
- (11) to maintain the Fiji Register of ships;
- (12) to maintain and preserve records and documents relating to the department's functions;
- (13) to advise the Minister on technical maritime safety policy;
- (14) to perform such other functions as are conferred on it by the Marine Act or any other Act;
- (15) providing technical advice and expertise.

The total number of officers and employees working in the Marine Department in 1997 was 557. The annual budget for 1997 was about F\$8,064,000.

4-1-3. Organisation chart of FHS



4-1-4. Functions of FHS

The detailed functions of FHS according to the posts of technical staff are as follows (cf. Appendix I):

(1) Post : Chief Hydrographer (Grade : TG01)

Duties of the Post : Responsible for National Hydrographic Policy.

Providing Technical Advice to the Government of Fiji on hydrographic matters.
Formulation and execution of the National Nautical Charting programme.

Departmental and inter-departmental liaison on hydrographic matters, exchange and dissemination of hydrographic data both nationally and internationally.

Professional efficiency and standards of the Fiji Hydrographic Service.

Typical Tasks Performed : Daily correspondence with overseas Hydrographic Offices and International Hydrographic Bureau (IHB). Assisting in queries from the general public and private sector. Checking of final submissions of survey reports and drawings.

Advising Senior Hydrographer on surveying operations. Drawing up survey programmes and costing these General office administration.

(2) Post : Senior Hydrographer (Grade : TG02)

Duties of the Post : To conduct and carry out hydrographic surveys from start to completion stage according to the standards of the International Hydrographic Organization, using General Instructions for Hydrographic Surveyors (GHS RP135) as guideline. The person will be required to efficiently plan and programme the surveying tasks well in advance utilizing personnel and equipment efficiently to accomplish the survey tasks as dictated by the Chief Hydrographer in the time specified.

The person will be responsible for utilising all the equipment available achieve the above and for training personnel to the necessary standards in order to obtain the necessary competence in field work that is required to carry out surveying.

In addition to the above, the officer is to be capable of carrying out the duties of the Surveying ship Master when called upon for such a task, utilizing the qualification of Grade 3 Master.

On occasion the officer will be required to attend meetings and conferences and will be required to present papers relating to his work.

Typical Tasks Performed : Organizing and overseeing work of field survey teams including checking and approving data gathered on a daily basis. Ensuring the safety of personnel and equipment by daily checks to the sounding boat, engines, fuel and safety appliances. Briefing field teams on their return from field work on quality of data and their performance. Discussing field surveying problems and making suggestions to Chief Hydrographer on how to rectify the same.

Offering advice on the general day to day operation of the hydrographic section and ideas on improving the production on level

(3) Post : Hydrographer (Grade : TG03)

Duties of the Post : Carry out the duties as officer in charge of boat sounding team, ensuring that the boat operation is carried out efficiently and data collected to the specifications laid down in GHS NP135. The officer will be required to assist junior officers in gaining

the necessary levels of competence required for their respective grades and for advancement. The person is required to carry out all tasks required for setting up survey geodetic stations ashore and for calibration of all equipment used in the survey. He is required to be able to manipulate surveying calculations using manual methods and also computer assisted methods. On completion of day's field work he is to put all the data onto the working drawing correcting any data that is not up to standard and produce the same data to the Senior Hydrographer for checking.

On occasions the officer will be required to undertake small uncomplicated hydrographic surveys on his own from start to finish stage.

Typical Tasks Performed : Daily briefing and supervision of boat crew. Putting down all collected data on drawing sheets and checking discrepancies. Assisting in computations using computer programmes. Ensuring all equipment used during his days work are properly secured and maintained. Reporting to the senior hydrographer on the day work. Carrying out any other duties detailed to him by the senior surveyor e.g. checking field data, taking on the responsibility of tidal officer or geodetic officer, and teaching junior officers on the use of field observation instruments, etc.

(4) Post : Technical Officer Class I (Hydrography) (Grade : TG04)

Duties of the Post : To assist the Hydrographer in boat sounding and field observations for geodetic control. The officer is required to record field data, establish and level tide poles, draw up plans and describe survey geodetic control stations accurately. On return from field observations the officer will extract data and record the observations on the appropriate manner ready for checking by the Hydrographer.

Typical Tasks Performed : Recording theodolite observations, carrying out levelling between tide pole and benchmarks, correcting echo sounder graphs for tides, recording observations whilst boat sounding, describing geodetic stations ashore and representing these accurately on station description forms, performing the duties of boat coxswain (steering the boat along lines of sounding).

Ensuring the sounding boat is fuelled and all equipment ready at the start of the day's work.

Ensuring the safety of surveying equipment in the boat whilst sounding.

Carrying out observations ashore using theodolites, levels and electronic distant measuring equipment. Drawing fair sheets of completed surveys in accordance with GHS NP 135.

(5) Post : Technical Officer Class II (Hydrography) (Grade : TG05)

Duties of the Post : To record data correctly in the field, erect tide poles, set up field observing equipment, inking in of soundings on completion of day's work, reduction of tides on soundings, compilation of station descriptions, steer lines of soundings in sounding boat and onboard ship, carry out levelling from tide pole to benchmarks, observe simple traverses for geodetic control. Drawing fair sheets and fair tracings.

Typical Tasks Performed : Carrying out the task of survey boat coxswain. Observing angles using a theodolite. Levelling for sounding datum. Describing geodetic control stations. Inking soundings on to collector accurately.

(6) Post : Senior Technical Assistant (Hydrography) (Grade : TG06)

Duties of the Post : To correctly record data obtained from echo-sounders, Trisponders, theodolites and levels. To be able to erect tide poles, set up survey marks ashore and correct up electrical survey equipment used in field surveying. The person is to carry out the work of tide watcher, echo-sounder operator, reduce tides on echo sounding rolls and draw up tide graphs. To assist the boat coxswain when lowering and hoisting boats and when bringing the boat alongside the survey ship and wharves. Cleaning survey equipment and surveying boats. Charging batteries for field use.

Typical Tasks Performed : Reducing echo sounder charts. Drawing up tidal graphs. General cleaning and storage of survey equipment. Carry out reconnaissance of geodetic survey stations. Carry out maintenance on survey motor launches. Carry out the duties of tide watchman. Assist in setting-up stations ashore. Reading tide poles. Drawing small motor boats. Assist in setting up field stations. Taking a general interest in survey work and learning by on the job training.

(7) Post : Technical Assistant (Hydrography) (Grade : TG07)

Duties of the Post : To assist in field work such as clearing of surveying marks ashore, establishing tide stations, driving small motor boats, recording data on appropriate forms, keeping watch on equipment that is gathering data, drawing simple diagrams such as graphs and station descriptions.

Typical Tasks Performed :

Assist in setting-up stations ashore. Reading tide poles. Drawing small motor boats. Assist in setting up field stations. Taking a general interest in survey work and learning by on the job training.

(8) Post : Technical Officer I (Cartography) (Grade : NS03)

Duties of the Post : Responsible to the Chief Hydrographer for the control, supervision and administration of the Nautical Charting section; chart scheming and specifications; programming and updating of nautical charts; arrange training programme for cartographic staff; co-ordinate with cartographic organizations locally and overseas for nautical charting and carry out such other duties delegated by management.

Typical Tasks Performed :

Carrying out research into source material and writing specifications for the compilation of New Charts/New Editions by junior staff. Carrying out first edit of compilations to ensure source data has been correctly used, accuracy standards achieved and specifications followed. Checking reproduction material before preparation of negatives to ensure compilations have been correctly interpreted and accuracy standards maintained. Monitoring progress of each job and supervise chart printing. Providing day to day guidance to junior staff in compilation and reproduction processes. Acting as First Reporting Officer for all cartographic staff.

(9) Post : Technical Officer II (Cartography) (Grade : NS05)

Duties of the Post : Responsible to the Technical Officer I (Cartography) for the compilation of nautical charts, updating of chart stocks, chart sales, publication of Notices

to Mariners, chart cataloguing and archiving.

Typical Tasks Performed :

Compilation of New Charts/New Editions. Co-ordinating production and publication of Notices to Mariners. Supervising the hand correction of chart stocks. Providing chart sales service and maintaining records of Sales figures. Maintenance of Fiji Chart Catalogue and FHS Archives.

(10) Post : Senior Technical Assistant (Cartography) (Grade : NS06)

Duties of the Post : Responsible to the Technical Officer II (Cartography) for the preparation of nautical charts reproduction materials and Notices to Mariners.

Typical Tasks Performed :

Carrying out reproduction work such as compilation scribing, patching-on of information onto positive of scribe and spotting of negatives prior to colour proofing. Assist in the production of Notices to Mariners.

(11) Post : Technical Assistant (Cartography) (Grade : NS07)

Duties of the Post : Responsible to the Technical Officer II (Cartography) for the correction of navigational charts and archiving.

Typical Tasks Performed :

Under the supervision of Technical Officer II (Cartography), hand correcting of chart stocks. Assist in the maintenance of FHS Archives. On the job training in Nautical Cartography and the Study for the New Zealand

(12) Post : Technical Officer Higher Grade (Electronics) (Grade : RE04)

Duties of the Post : To take overall charge of all electronic surveying equipment instruments and tools. The person is required to maintain all effective planned maintenance scheme for all the above ensuring a high state of serviceability of the equipment, batteries and accessories both at sea and ashore. It is this persons responsibility to have defective equipment repaired in the minimum amount of time and be available at all times during field surveying.

Typical Tasks Performed : Maintenance of electronic equipment.

Maintaining a supply of serviceable spares. Training junior officers in the field. Installation of equipment in boats, on survey ship and ashore.

(13) Post : Technical Officer (Electronics) (Grade : RE06)

Duties of the Post : To carry out basic electronic maintenance on surveying equipment.

Maintenance of batteries. Assist the Technical Officer Higher Grade on major maintenance projects and on installation of equipment. To be available at survey sites at all times and available to rectify minor electronic problems.

Typical Tasks Performed : Surviving batteries. Preventative maintenance on electric gear.

Basic fault finding on electronic components and rectifying these. Servicing the power source and wiring in the survey motor boat.

(14) Post : Technician (Electronics) (Grade : RE08)

Duties of the Post : To assist higher level technical officers with maintenance and servicing of electronic equipment. Changing of batteries and installation of electronic surveying equipment ready for surveying.

Carry out theoretical studies and practical work to qualify for a Trade Certificate.

Typical Tasks Performed : Assisting the higher level technicians on maintenance projects. Keeping electronic workshop tidy and ensuring proper storage of test equipment. Being available to assist survey teams in transporting survey equipment to wherever needed.

4-2. Staff and employees

4-2-1. List of staff and employees and their qualifications

The staff and employees of FHS and their qualifications at present are as follows:

No	Name	Post	Qualification
1	Felix R. Maharaj	Chief Hydrographer	Cat.A(UK)B(A), G3(Mate)
2	Aca Silatolu	Acting Senior Hydrographer	Cat.B(J), G3 (Mate)
3	Philip R. Hill	Hydrographer	Cat. A(UK)B(A), G2(Mate)
4	Seci Lagivola	Hydrographer	Cat. B(J)
5	Gerard D. Rokoua	Tech. Officer I (Hydro.)	Cat.B(UK), DLS(A), G4 (Mate)
6	Soko Veikauyaki	Tech. Officer I (Hydro.)	Cat.B(J), G4(Mate)
7	Lui Tawake	Tech. Officer I (Hydro.)	Cat.B(J), IMSC(A)
8	Viliame Cataki	Tech. Officer I (Hydro.)	Cat.B(J), G5(Mate)
9	Pio Naboseyawa	Tech. Officer II (Hydro.)	Cat.B(J), G5(Mate)
10	Joeli Vakarau	Sr. Tech. Assist. (Hydro.)	BSC(A), G5(Mate)
11	Panapasa Vakamino	Sr. Tech. Assist. (Hydro.)	BSTC(A), G5(Mate)
12	Lenaitasi Nakarawa	Tech. Officer I (Electro.)	ETC(F)
13	Saromi Tikoicavana	Tech. Assist. (Electro.)	Under training (Electro.)
14	Yauka D. Soro	Tech. Officer I (Carto.)	HDPMC(UK), CSD(NZ), DLS (NZ)
15	Sunil Kumar	Sr. Tech. Assist. (Carto.)	HDPMC(UK), GTC(J)
16	Filimoni W. Tirikula	Sr. Tech. Assist. (Carto.)	GTC(J)
17	Peni Tirikula	Tech. Assist. (Carto.)	GTC(J)
18	Sanjay Prakash	Tech. Assist. (Carto.)	GTC(J)
19	Manoa Taka	Messenger/Cleaner	
20	Mrs. Esita Natuna	Secretary	

Abbreviations:

Assist. : Assistant

BSTC : Basic Survey Technician Certificate

Carto. : Cartography

Cat.A or B : International Hydrographic Surveyor Category A or B (FIG/IHO)

CSD : Certificate in Survey Draughting

DLS : Diploma Land Survey

Electro. : Electronics

FIG : Federation International des Geometres

IMSC : Intermediate Marine Science Certificate

HDPMC : Hydrographic Data Processing and Marine Cartography
G : Grade of Certificates of Seafarers under the STCW Convention
GTC : JICA Group Training Course in Nautical Charting
Sr. : Senior
Tech. : Technical
TCE : Trade Certificate (Electronics)

(A): Australia (F): Fiji (J): Japan (NZ): New Zealand (UK): United Kingdom

All staff qualify under the job descriptions and qualifications of posts described in the Duty Statement Form prescribed by the Public Service Commission, Office of Prime Minister, as of 3 August 1993, which appears in Appendix I. This is a comprehensive document giving detailed items of work to be done currently at FHS. If there is any new job to be carried out by a member of FHS, it should be added to the job description.

4-2-2. Recruitment and training of staff

For the recruitment of staff of FHS, firstly the vacant post is advertised in a daily news paper. This is done by the Public Service Commission, Prime Minister's Office. To be selected, applicants should fulfil the minimum qualifications to the post advertised. A list of applicants who appropriately fulfil the qualifications is prepared, and those applicants are then interviewed by a panel consisting of the officers of FHS and the Personnel Division of the Marine Department. After the interview, discussions are held by the panel members to decide the final selection of applicants.

The performance of the newly recruited staff is reviewed after the probation period of one year. If it is satisfactory, he will be officially assigned to the post. At this stage, he will be able to be sent abroad to participate in a training course, if necessary. This is because such training is unavailable locally. At FHS, on-the-job training can be made available to him, which consolidates his formal training abroad.

The overseas training courses which the FHS staff members attended to date are as follows:

1. UK Hydrographic Office (HMS Drake) : FIG/IHO Competence of Hydrographic Surveyor Category A and Category B Courses; Hydrographic Data Processing and Marine Cartography Course
2. Australian Hydrographic Office : FIG/IHO Category B Course; Basic, Intermediate and Advanced Marine Science Courses; Basic Survey Technician Course (re-classified to Basic Marine Science Course)
3. New Zealand Hydrographic Office : Basic Survey Draughtsman Course
4. Japan Hydrographic Department : JICA Group Training Course in Hydrographic Survey (FIG/IHO Category B Course); JICA Group Training Course in Nautical Charting

It is expected that the staff of FHS will continue to be sent abroad to attend both advanced and basic training courses in the future. This is because such training in Fiji cannot be justified due to budgetary constraints and limited demand.

4-3. Current activities of FHS and achievements

4-3-1. Hydrographic surveying

The budgets allotted to Chief Hydrographer for day-to-day operations of FHS including the survey motor boat in the recent years were as follows (in F\$):

Item	1993	1994	1995	1996
1. Travel and Communications	280	1,300	300	1,100
2. Maintenance and Operations	83,600	34,800	48,000	63,200
3. Purchase of Goods and Services	16,620	7,500	15,200	13,100
Total	100,500	43,600	63,500	77,400

Note : Maintenance of R/V TOVUTO and personal emoluments are funded from the central pool of the Marine Department.

Hydrographic surveying by FHS has been conducted according to requests of various organisations including governmental organisations and private enterprises, such as Marine Department, Maritime and Ports Authority of Fiji and private shipping companies. Since, however, almost a fixed amount is allotted to the operation and management of FHS in the annual budget each year, the annual survey plan should be designed within such an amount, taking into account the priority needs.

The Chief Hydrographer is responsible for identifying and planning the activities to be carried out by FHS in the year. This usually includes one or two survey programmes in harbours or coastal waters. There is no established coordination body for the needs of hydrographic surveying and nautical charting in Fijian waters, and any long-term planning, such as a 5-year plan, for surveying and charting is not practised due to existing circumstances.

The survey vessel R/V TOVUTO belongs to the Marine Department. She was originally purchased for the purpose of hydrographic survey, but has not been fully utilized as such. Due to lack of government's shipping services and numerous demands by government ministries, TOVUTO has been used to provide passenger and cargo transportation to outer islands, thus surveying operations are not always carried out as planned.

Other factors that hinder surveying operations are the high maintenance and operation costs of TOVUTO, which was constructed 27 years ago and has already reached its useful life and now requires a bulk of the maintenance and operation funds to keep it serviceable. With limited funding in the Marine Department's fleet maintenance and operation pool, TOVUTO's use for hydrographic surveying is usually avoided, thus causing difficulty in implementing any survey plan.

Surveying operations at present are usually kept to the coastal, harbour and unsurveyed areas urgently required to be navigated because of the limited funding available to operate the large survey vessel TOVUTO. In these instances TOVUTO is used only as a support vessel and the small survey motor boat BABALE becomes the main surveying platform.

A survey team usually consists of eight to ten members, one of them works as leader of the team, and assisted by hydrographic surveyors and technicians including an electronic specialist.

After the field work, a smooth sheet of survey or a sounding sheet is prepared by the survey team members and cartographers using personal computers. Preparation of the smooth sheet or sounding sheet has been manually done in the past. At the present, however, the plotter provided by JICA in 1997 helps surveyors to plot the sheet faster and more accurately.

The results of a survey are usually submitted to the client and copies of them stored in FHS archives for use by anyone upon request. Results of surveys are not always used in the publication of nautical charts.

Principal survey equipment and instruments used by FHS are shown in Appendix II.

The hydrographic surveys carried out in recent years were as follows:

Area/Locality	Scale	Period
Rotuma - Oinafa	1:2,000	9-11 May 1991
Suva Harbour - Muaiwalu North Face	1:500	20-21 May 1991
Suva Harbour - Walu Bay Berth	1:500	23-25 June 1992
Suva Harbour - Muaiwalu Two	1:1,000	1-3 Feb. 1993
Ovalau - Waitovu Entrance	1:5,000	15-24 Mar. 1994
Yasawa Islands - Approaches to Malakati	1:25,000	12 Apr.-27 July 1994
Ovalau - Northern Approaches to Levuka	1:5,000	17-23 May 1994
Ovalau - Levuka Wharves	1:1,000	29 Oct.-2 Nov. 1994
Rabi I. - Georgia Cove Jetty Site	1:1,000	29 Nov.-2 Dec. 1994
Suva Harbour - Shell Jetty	1:500	10-11 Apr. 1995
Suva Harbour - Thurston Patch	1:2,000	Apr. 1995
Lau Group - Natewa Bay to Nanuku Passage(*)	1:150,000	10 Aug.-27 Sep. 1995
Lau Group - Vanua Balavu Lagoon(*)	:50,000	19 May-19 June 1996
Lau Group - Nanuku Passage to Lakeba Passage(*)	1:150,000	19 May- 1996
Suva Harbour - Narain Jetty	1:2,000	Oct. 1996
Lau Group - Lakeba Passage to Kabara(*)	1:150,000	16 May-26 Aug. 1997
Nabouwalu - Approaches to Fiji Pine Wharf Site and Malamala	1:25,000 1:2,000	7 May-30 May 1998 do.
Rewa - Nasali Landing	1:500	21-23 May 1998
Approaches to Nabouwalu	1:25,000	9-30 June 1998

(*) indicates the survey carried out in the Study.

4-3-2. Oceanographic observation

As part of hydrographic survey to obtain chart datum for the reduction of soundings, FHS carries out tidal observation by establishing a local tide station using a tide gauge and/or a tide pole during the survey period. However, FHS has no permanent tide station yet. A tide station was established at Port of Suva by NOAA, USA, as part of TOGA (Tropical Ocean and Global Atmospheric Programme) under WMO and ICSU.

The tidal data and such other data as water temperature and meteorological data were automatically sent to TOGA Center in Hawaii, and real time data could be extracted using a

personal computer. This tide station has been used as a standard port tide station for determination of MSL and DL since 1975.

In 1997 NOAA ceased to maintain the gauge and at the request of FHS the National Tidal Facility, the Flinders University of South Australia, took over maintenance and operation of this gauge. It will continue to serve as the standard port tide station for Fiji.

The value of MSL was derived by the UK Hydrographic Office using data from this gauge and is used for predicting tides published in the BA Tide Tables. Tidal predictions supplied by UK Hydrographic Office are given in the annual publication F201 titled "Nautical Almanac" published by FHS. (cf. par. 4-3-4-1)

As for tidal current observation, FHS does not conduct such observation due to lack of instruments and the present priority being placed on hydrographic surveying. At present, the only current data available are shown as arrow marks on nautical charts indicating direction of current flow and speed. Such information is also provided in the annual Nautical Almanac where data are available and in places of importance.

4-3-3. Nautical charting

The Cartographic Section consists of a senior cartographer and three cartographers. All of these officers have been trained abroad, in U.K., New Zealand and Japan. They now have a considerably high level of technique in preparation of nautical charts. They also carry out the duties of maintenance, storage and sale of charts as well as supply and procurement of office expendables.

As for chart publication planning, the "BA Charts Metrication Scheme 1:150,000" prepared by UKHO in 1974 serves as a guideline for chart publication planning by FHS, and is regarded as a long-term chart publication plan. There is no intermediate/long-term chart publication plan at FHS.

The source materials for compilation of a chart are stored according to relevant chart numbers. Each cartographer has his own light table and instruments for charting work. A list of cartographic instruments appears in Appendix III. Some materials, such as transparent plastic sheets, are not available locally but are imported.

Chart compilation and drawing is carried out by the cartographers, and sometimes in consultation with UKHO. Plotting of chart borders is done by UKHO as there is no facility for such work at FHS or in Fiji.

All charts are printed at the Government Printing Office located some 5 km from FHS. An offset printing machine manufactured by Rolland in Germany is installed at the Government Printing Office. The maximum size for printing is 1,020mm × 720mm. The printing plates of nautical charts are stored at the Government Printing Office, to which limited corrections can be made.

Printing of FHS charts is subject to priorities decided by the Government Printer for the whole of government. Due to various types of printing being done at the Government Printing Office, delays in printing charts can be from a few months to a year.

Negatives of strip film for letters, figures, symbols and abbreviations are produced by

the computerized phototypesetting equipment at the Government Printing Office. Subsequent processing to positive is done by the Department of Lands and Survey for use at FHS.

The Department of Lands and Survey has a process camera used for reproducing documents at a different scale from the original. This service is also used by FHS.

The charts currently issued are as follows:

Nautical Charts

Chart No.	Title	Scale	Published
F5	Lautoka to Yasawa Islands	1:150,000	Dec. 1986
F7	Suva Harbour - Nubulekeleke Bay	1:1,500	Dec. 1981
F9	Kadavu Island - Western Portion	1:75,000	Oct. 1995
F10	Kadavu Island - Northern Portion	1:75,000	Oct. 1993
F11	Plans in Kadavu	1:25,000	Dec. 1994
F50	Vanua Levu - Natewa Bay - Southern Portion	1:50,000	Mar. 1987
F51	Vanua Levu - Somosomo Strait to Rabi Channel	1:50,000	Aug. 1986
F52(*)	Natewa Bay to Nanuku Passage Viti Levu-Northern Portion	1:150,000	Mar. 1997
F53(*)	Nanuku Passage to Lakeba Passage Lau Group-Northern Portion	1:150,000	Mar. 1998
F54(*)	Lakeba Passage to Kabara Lau Group-Southern Portion	1:150,000	Mar. 1999
F100	Plans in Koro Sea	Various	Apr. 1996
F105	Plans in Yasawa Islands (7 sheets)	1:25,720	Aug. 1992
F602	Tasman and Coral Sea - Australia to Northern New Zealand and Fiji (under rev.)	1:3,500,000	Sep. 1987
(INT 602)			
F604	Coral and Solomon Seas and Adjacent Sea (under rev.)	1:3,500,000	Sep. 1987
(INT 604)			
F605	New Zealand to Fiji and Samoa Islands (under rev.)	1:3,500,000	Sep. 1987
(INT 605)			

(*) Published as part of the Study

Special Purpose Charts

Chart No.	Title	Scale	Published
F6	Fiji Islands - 200 Mile EEZ	1:3,500,000	May 1981
FMS81/1	Rotuma Island - Internal Waters	1:72,900	May 1981
FMS81/2	Fiji Islands - 12 mile Territorial Waters	1:800,000	May 1981

Besides these charts, there are 24 charts covering Fijian waters published by the U.K. Hydrographic Office. They were first produced from lead-line surveys, and include newer surveys done by FHS which are sent to UKHO for revision and updating of charts.

Within the framework of International Chart Scheme by IHO, Fiji is located in Area L of which Australian Hydrographic Office serves as Coordinator. Fiji has already published three INT charts.

In Fiji nautical charts are sold at FHS and Carpenters Shipping (Neptune House, Walu Bay) in Suva and Savusavu Marina at Savusavu. Fiji is signatory to the SOLAS convention and thus it is a requirement that all registered vessels should carry official nautical charts whilst navigating in Fiji waters. To provide for this Fiji has chart agents one in Australia, three in New Zealand, one in Canada and two in U.S.A.

Charts sold in the recent years are as follows:

Chart No.	1994	1995	1996	1997	Total
F5	217	247	288	166	918
F5 (special edition)	-	325	200	500	1,025
F6	5	3	10	5	23
F7	5	3	8	2	18
F9	-	-	-	23	23
F10	84	57	62	56	259
F11	-	63	35	13	111
F50	19	28	26	31	104
F51	44	44	53	56	197
F52(*)	-	-	-	81	81
F100	-	-	2	30	32
F602 (INT 602)	15	10	8	-	33
F604 (INT 604)	9	9	5	-	23
F605 (INT 605)	10	11	3	10	34
FMS81/1	-	-	-	7	7
FMS81/2	-	-	-	3	3
Total	408	800	700	983	2,891

Fiji nautical charts are printed 150 to 200 sheets at a time, and are stored flat on wooden chart racks in the chart store room of FHS. Correction of charts as well as compilation of Notices to Mariners and Coastal Navigational Warnings are also done in this room. A laminating machine is provided in this room for the service of laminating charts up to A0 size.

Regarding budgetary allotments and expenditure, FHS is at present provided with Revolving Fund Account - Nautical Chart Project for production of nautical charts.

In September 1986, the Cartographic Section was allocated a financial ceiling of F\$15,000.00 for the production of nautical charts of Fiji. The production of charts for local requirements is in direct support of government's Development Plan 9 (DP9) in the fields of Marine and Tourism.

The amount is operating under semi-commercial basis in that all expenditure incurred is recouped from revenue derived from the sale of charts and publications.

The income from the sale of charts and others in 1997 amounted to about F\$15,880.

The operation is in accordance with Finance Act, Finance Regulation and Instruction, Stores and Services Regulations and Instructions and the Accounting Procedures which do not allow any capital expenditure. The types of expenditure involved in the operation are :

- (1) operation and maintenance,
- (2) purchase of raw materials and stationaries,
- (3) subsistence,
- (4) travel, and
- (5) telecommunications.

The chart publication planning at FHS is as follows:

Chart No.	Title/Locality	Scale	Remarks
(a) Domestic			
F747	Navula Passage to Yasawa Islands	1:150,000	New Chart
(b) International			
F602 (INT602)	Tasman and Coral Seas - Australia to New Zealand and Fiji	1:3,500,000	New edition
F604 (INT604)	Coral and Solomon Seas (and adjacent seas)	1:3,500,000	New edition
F605 (INT605)	New Zealand to Fiji and Samoa Islands	1:3,500,000	New edition

4-3-4. Hydrographic publication

4-3-4-1. Nautical Almanac

The only hydrographic publication issued by FHS is Pub. No. F201 "Fiji Nautical Almanac" for each year. This is a comprehensive publication giving information useful to navigation, and the 1998 edition contains the following information:

Preface and General Information

Calendar and Public Holidays 1998

Sunrise and Sunset Times

Moonrise and Moonset Times

Declination of the Sun at the time of Meridian Passage at Longitude 180 ° for 1998

Altitude Correction Tables 36 ° - 90 ° - Sun

Compass error by Amplitude

Tide Tables : Analysis Effects on Tides

Meteorological Effects on Tides

Tides

Tidal Streams

Tidal Levels and Datums

Tidal Diagram

For Finding the Height of the Tide at Times between High and Low
Water

Part I - Daily Tidal Predictions for Standard Port - Suva Harbour
for 1998

Part II - Time and Height Differences for Predicting the Tides at
Secondary Ports

Geographical Range Table

Fiji List of Lights

IALA Maritime Buoyage System

Restricted and Water Skiing Area

Lists of Radio Signals : Abbreviations

Coast Radio Stations

Radio Navigational Aids

Radio Weather Services and Navigational Warnings

Weather Warning Services

Beaufort Scale of Wind

Tropical Cyclones

Meteorological Observation Stations

Vessel Traffic Services, Port Operations and Pilot Stations

Charts and Publications : List of Fiji Charts

Principal Fiji Chart Agents

List of British Admiralty Chart Folio 70

Charts of Other Folios Covering Fiji

Selected Admiralty Hydrographic Publications

Hydrographic Note

Dewpoint Table

Approximate Vapour Pressure (mb) for Temperature ($^{\circ}$ C) Calculated for Standard Pressure

Time, Speed and Distance Table

Distance Timetable

Coastal Distances

Conversion Tables

Phonetic Alphabet and Figure Code

Bridge Instructions

Despite the above, there is no Sailing Directions (Pilot) published by FHS. Fijian waters are covered by British Admiralty Sailing Directions "Pub. No. 62 - Pacific Islands Pilot, Vol. III" and U.S. Defense Mapping Agency Hydrographic/Topographic Center's "Pub. 122 - Sailing Directions (Planning Guide) South Pacific Ocean" and "Pub. 126 - Sailing Directions (Enroute) Pacific Islands".

4-3-4-2. Notices to Mariners and Navigational Warnings

FHS prepares and issues Fiji Notices to Mariners (FNM), as and when necessary, for the correction and updating of Fiji charts. Notices are prepared on receipt of hydrographic reports, information and foreign Notices to Mariners if any Fiji charts are affected. FHS receives weekly editions of Notices to Mariners from the Hydrographic Offices of UK, Australia and New Zealand.

FNM is issued to organisations dealing with interest in maritime matters, e.g. the Harbour Masters at the Ports of Entry, the Royal Suva Yacht Club and principal Fiji charts agents and some foreign hydrographic offices. Correctional tracings are also issued with the notices to all principal Fiji chart agents for accurately carrying out the chart corrections. Correction of charts in FHS are manually done using technical drawing pen and magenta ink. All charts are corrected up to date before sold and issued.

This work is done by a cartographer when available, under the supervision of the senior cartographer.

The number of paragraphs of FNM published recently are as follows:

Year	Paragraphs
1997	10
1996	7
1995	27

The Fiji Coastal Navigational Warnings (FCNW) are prepared by FHS and issued by the Director of Marine, who receives reports on the discovery of new dangers or changes or defects in aids to navigation. FCNW are distributed to various organisations and to Suva Coast Radio Station for broadcast to all ships at sea. Important warnings are published in the local daily newspaper. FCNW cover the range of 200 miles from the coast.

Fiji is located within the Area XIV of the World-wide Navigational Warning System for which New Zealand Hydrographic Office is responsible. Warnings are also despatched to NZHO which repeats and broadcasts the important coastal warnings as NAVAREA XIV Warnings.

The number of paragraphs of the Fiji Coastal Navigational Warnings issued in recent years are as follows:

Year	Paragraphs
1997	44
1996	32
1995	45

The officer in charge of this work is a cartographer under the supervision of the senior cartographer.

4-3-4-3. Publications issued or sold

Number/Description	1994	1995	1996	1997	Total
F200 - Fiji Chart Catalogue	na	na	na	na	-
F201 - Fiji Nautical Almanac	800	767	662	737	2,966
Fiji Notices to Mariners (FNM)	13	27	7	10	57
Fiji Coastal Navigational Warning	43	45	32	44	164

4-3-5. Maintenance and supply of charts and publications

Maintenance and supply of Fiji nautical charts at FHS, as well as compilation of Nautical Almanac and Chart Catalogue, is performed by a cartographer. The BA charts held by FHS for work are corrected using weekly BA Notices to Mariners.

5. CURRENT ACTIVITIES RELATED TO HYDROGRAPHIC SERVICE

Major marine industries, i.e. maritime traffic, fisheries and tourism, which include movement of vessels at sea, were studied from the viewpoint of needs for nautical charts and other hydrographic services.

5-1. Maritime traffic

Vessels called at the Ports of Suva, Lautoka and Levuka, which are Ports of Entry in Fiji, from 1990 to 1997, were as follows:

Year	1990	1991	1992	1993	1994	1995	1996	1997
No.	1,787	2,552	6,558	6,302	5,907	6,337	5,867	5,633
(Foreign)	893	907	1,072	1,077	1,126	1,047	988	978
(Domestic)	894	1,645	5,486	5,225	4,781	5,290	4,879	4,655
GRT(000)	7,260	8,005	8,252	7,644	8,432	9,484	9,002	9,146

(Source : PAF Annual Reports 1994-1997)

The cargo tonnages and containers handled in the Ports of Suva, Lautoka and Levuka from 1993 to 1997 are as follows:

Year	1993	1994	1995	1996	1997
Cargo	2,305,131	2,632,924	2,743,671	2,782,182	2,687,636

Year	1993	1994	1995	1996	1997
Container	39,433	41,057	43,019	42,666	49,085

(Source : PAF Annual Report 1997)

Vessels called the Ports of Suva, Lautoka and Levuka in 1995 were as follows:

Port	Foreign	Domestic	Yacht	Total
Suva	620	1,188	678	2,486
Lautoka	318	3,384	80	3,782
Levuka	109	718	94	921
Total	1,047	5,290	852	7,189

(Source : PAF Annual Report 1995)

According to the above statistics, it is understood that the number of vessels calling Fiji ports has been remarkably increased before 1992 but thereafter the number has been slightly decreased towards 1997, except for a remarkable increase in 1995. The totalled tonnage of vessels entering Fiji ports amounted to 9,145,540GT in 1997, which is 19.6% increase to that of 1993, while the number of vessels is decreased by 10.6%.

Thus, an increase in the size of foreign vessels while a decrease in their number have been observed as the tendency in recent years. The number of domestic vessels is four to five times as large as that of foreign vessels. It is also noted that the great majority of yachts called the Port of Suva in 1995.

Based on the above fact, it is considered that nautical charts and other hydrographic publications such as Tide Tables and Notices to Mariners should be distributed to those ports for the use by mariners, and in particular, Port of Lautoka where more than half of the totalled number of calling vessels visit. It is also observed that demands for them by yachtsmen are far greater in Suva compared to the other two ports.

The largest vessels entered Ports of Suva and Lautoka in 1997 were as follows:

Port	GRT	Name	Type
Suva	70,327	Queen Elizabeth 2	Passenger vessel
	33,935	Trans Pacific No.3	Liquid bulk carrier
Lautoka	40,328	Globulus	Dry bulk carrier
	23,340	Fuji Maru	Passenger vessel

(Source : PAF Data, 1997)

The shipping routes used by domestic vessels are shown in figure 1.

The expansion of economic activities has led to a growing demand for port facilities and related maritime services. Emphasis has also been placed on improving efficiency and productivity of port operations in order to cater for increased international shipping. In line with the public sector reform programme, the Government Shipyard and Public Slipway have been privatised.

The government introduced a shipping franchising scheme in September, 1997, based on an operational subsidy system, to ensure regular services are maintained to the outer islands, in particular to Northern Lau, Southern Lau and Rotuma. This regular service should encourage economic activities throughout the outer maritime region.

The Maritime and Ports Authority of Fiji (MPAF) (Ports Authority of Fiji until May 1998) administers Fiji's three major international ports, i.e. Suva, Lautoka and Levuka. Savusavu has also recently been declared as port of entry, but still it is under the government control.

The EIB funded Port of Suva Master Development Plan study was carried out 1995-1996, and establishment of a container terminal was proposed at Rokobili, which was accepted by the Authority. Reclamation works on Rokobili sub-division Phase I was completed. The Ports Authority is also investing in the inter-island shipping facilities in Suva. Government is responsible for outer island jetties.

Some other private ports, such as Malau and Vuda Point, cater for specific export/import products and accommodate yachts.

The inter-island shipping fleet is a mix of private and government vessels. Larger roll-on roll-off ferries have been introduced on the busier routes, and there has been a reduction in the number of private sector operators involved in the industry.

The government's marine transport policies and strategies are:

- (a) promoting private sector initiatives in developing safe and efficient inter-island shipping services and winding down Government's involvement in competition with the private sector;

- (b) reorganising the Ports Authority of Fiji and the Marine Department into a corporate entity which will operate on a fully commercial basis, with tariffs reflecting the costs of services;
- (c) continuing to fund the construction and maintenance of jetties and navigational aids, while reviewing the scope for recovering maintenance costs from users; and
- (d) providing an adequate level of shipping services to outer islands, through administration of the Shipping Franchising Scheme.

5-2. Fisheries

The Fisheries sector contributes 1.2 per cent of GDP and offers considerable potential for expansion. The industry is important to subsistence sector and also provides a real opportunity to expand exports. The tuna fisheries under the industrial fisheries programme within the Exclusive Economic Zone (EEZ), has almost doubled its catch over the last four years.

There is, however, a lack of major infrastructure such as jetties, slipways, repair facilities, ice plants, and spare parts for vessels and engines in most rural and outer islands. A shortage of berthing, unloading and re-supply facilities also exists due to an increase in medium scale export industrial fisheries.

The unavailability of these facilities has resulted in over-exploitation of resources in certain areas, with other areas remaining under-utilised. A well-balanced measure should be taken to the preservation and utilization of marine resources.

The main components of policy and strategy for the fisheries sector include:

- (a) expanding and consolidating tuna fisheries within Fiji's Exclusive Economic Zone (EEZ) under the industrial fisheries programme;
- (b) encouraging greater efficiency and improvement the quality of fish available to consumers in the small-scale commercial fisheries sector;
- (c) assisting rural fishermen in their transition from subsistence to small scale commercial fishing;
- (d) developing aqua culture through continued research into appropriate production technologies and extension programmes;
- (e) developing the EEZ and territorial water fisheries;
- (f) improving the quality and increasing value-added of exports;
- (g) regulating and controlling all fisheries, on the principles of optimum utilisation and long-term sustainability;
- (h) encouraging the implementation of sound business management methods by local fishermen; and

(i) improving the handling and processing of domestic fisheries.

5-3. Tourism

Tourism is now Fiji's most important industry and largest foreign exchange earner. In 1996 alone, tourism earnings amounted to F\$430 million and they are envisaged to reach over F\$636.5 million by the year 2000. The industry provides employment directly and indirectly to an estimated 40,000 people (15 percent of the labour force) and contributes approximately 17 percent of total production in the economy.

The Number of Visitors, Length of Stay and Expenditure in Fiji from 1986 to 1997 were as follows:

Year	1986	1987	1988	1989	1990	1991
Visitors (000)	258.0	190.0	208.7	250.6	279.0	259.0
Average Length of Stay (Days)	7.9	8.3	8.5	9.2	8.8	8.6
Expenditure (F\$ million)	185.4	148.9	184.0	292.4	317.3	309.9

Year	1992	1993	1994	1995	1996	1997
Visitors (000)	280.0	287.5	319.0	318.5	339.5	359.5
Average Length of Stay (Days)	8.6	8.6	8.5	8.5	8.2	8.1
Expenditure (F\$ million)	367.5	374.4	392.5	405.0	414.5	460.2

(Source : Statistical News - April 1998, Bureau of Statistics)

Of these visitors, the arrivals by air and by ship from April 1996 to March 1997 and from April 1997 to March 1998 were as follows:

	4/1996 - 3/1997	4/1997 - 3/1998
By air	412,563	420,390
By ship	6,554	5,577

(Source : Statistical News - April 1998, Bureau of Statistics)

Namely, the visitors by the sea was about 1.4% of the total arrivals.

Tourism in Fiji is dominated by private sector activity. The industry suffered a major set back in 1987 after a record growth in 1986. There was a loss in profitability, employment and investment in tourism throughout the country. The industry recovered slightly in 1988 but advanced to full recovery in 1990 when a new record of visitor arrivals was set at 279,000.

The recession in major source markets and the deregulation of the Australian airline industry had a significant effect on the industry in 1991, with a 2.3 percent decline in foreign change earnings compared to 1990. From 1993 visitor arrivals have been constantly increasing to the level of 360,000 in 1997. Gross receipts from tourism continue to be Fiji's major source of foreign currency earnings, which has been the trend since 1989.

Policies and strategies for the development of the tourism sector focus on:

- (a) active marketing through the Fiji Visitors Bureau and the private sector to boost visitor arrivals and diversify source markets;
- (b) securing adequate airline capacity through attracting additional foreign airlines into Fiji;
- (c) encouraging investment in tourism plant to realise the full development potential of the industry;
- (d) strengthening linkages with the rest of the economy to ensure increasing retention of the tourist dollar through greater local participation and greater use of inputs;
- (e) enhancing Fijian participation, particularly in rural areas, through encouragement of small business/commercial activities focusing on secondary tourism activities, with direct links to established tourist plants;
- (f) promoting education and training to ensure availability of suitably trained manpower and increased tourism awareness within the community; and
- (g) integrating planning of tourism development.

As regards the development prospects, the government's commitment to the Tourism Masterplan in the medium term, will be focused on implementing the ten point action plan it has already approved. The action plan covers the following points:

- (i) The need to express commitment to tourism development;
- (j) The identification and implementation of tourism development areas (TDA) e.g. Nadi Bay, as one of the mechanisms for encouraging future investments;
- (k) The need for the Ministry of Tourism and Transport and the Fiji Trade and Investment Board to adopt a more pro-active approach in order to secure additional investment in hotels and resorts;
- (l) Investment procedures for domestic and foreign investors should be simplified and withholding tax should be abolished. Additionally, the extension of Short-Life Investment Package for hotels to 2005 and cover a wider spread of accommodation;
- (m) Communicate to the Government of Nauru the significance of the rehabilitation of the Grand Pacific Hotel in Suva to tourism in Fiji and, if necessary, seek private sector investment in the hotel.
- (n) To feature Fijian vernacular architecture on all new tourism developments in Fiji;
- (o) Strengthen the Ministry of Tourism and Transport;
- (p) Increase the budget for the Fiji Visitors Bureau
- (q) Designate the islands of Ovalau and Taveuni as World Heritage sites; and
- (r) Introduce legislation to enforce minimum safety standards in the dive industry and regulations to implement legislation already passed to provide for downtown shopping.

To complement the above actions, the government will ensure that the investment procedures for all investors are streamlined. The industry has great potential to make an expanding and sustained contribution to economic development, provided the present direction and support is maintained.

(Source : Development Strategy for Fiji - Policies and Programmes for Sustainable Growth, Ministry of National Planning, December 1997)

6. ANALYSIS AND ASSESSMENT OF EXISTING STATUS OF OPERATION AND MANAGEMENT SYSTEM OF HYDROGRAPHIC SURVEYING AND NAUTICAL CHARTING IN FIJI

6-1. Introduction

A survey has been made on the operation and management system of FHS which is responsible for planning, producing and maintaining nautical charts in Fiji. It focused on FHS's organisation, human resources (number of personnel, speciality, capability), facilities (survey ship, instruments for control point survey, hydrographic survey, oceanographic observation and cartographic work), recent business activities, budgets (breakdown of budget and expenditure), maintenance of charts and related source materials and data, sorting, storage and chart publication plan (international and national).

It is considered most probable that the maritime traffic, fisheries and tourism in Fiji will be more intensive in the future. This will create a greater need for modern nautical charts covering critical areas in passages, coastal waters, lagoons, ports and harbours for safer and more economical navigation. From this point of view, an analysis has been made on the existing status thus studied, and, in particular, on certain vital points in FHS's charting capabilities for such demands.

6-2. Results of analysis

In the analysis of the existing status of requirements for hydrographic products in Fiji, the following points have been taken into account; demands from domestic and international shipping and other maritime activities, budgetary constraints, and limited availability of qualified personnel. It is noted that qualified personnel and suitable facilities are most important for FHS's more effective service.

6-2-1. Hydrographic surveying

6-2-1-1. Hydrographic Section

It is considered that the staffing of the Hydrographic Section of FHS is adequate at present, but will need reorganisation in the near future. Since there is only one post for Senior Hydrographer who is responsible for field survey operations, there is no alternate at FHS in Suva when the Senior Officer is in the field.

Therefore, there should be another post for Senior Hydrographer so that, while one is out to the field, the other will be at FHS in Suva assisting Chief Hydrographer, offering advice on the general day-to-day operation of the Hydrographic Section, post-processing and checking survey data from the field, etc., thus overcoming the present problem of work back log.

It is also considered advisable that the number of Senior Technical/Technical Assistants will be reduced to one from the present number of two with five vacant posts. This is because they usually serve as carriers of various instruments and materials at the time of field operation. With the introduction of modern equipment, fewer personnel of this level are required. If man-power is needed during field operations, this can be made available by hiring temporary workers.

The Survey Section will desirably be reorganized to have two Senior Hydrographers and one Senior Technical/Technical Assistant in the near future, without increasing the existing number of staff. (cf. Appendix IV)

6-2-1-2. Survey vessel

It is considered desirable that a survey vessel of medium type build for the specific purpose be provided. Such a vessel will preferably be around 200-500 tons equipped with modern survey instruments, such as narrow multi-beam echo sounder, acoustic Doppler current profiler, DGPS receiver, bottom profiler, etc., and it should carry a survey launch on board.

This survey vessel will replace R/V TOVUTO for the reasons described under par. 4-3-1. This new survey vessel will be used exclusively for hydrographic and oceanographic survey operations except for cases of emergency.

The sustainability of such a vessel belonging to the FHS is justified by the fact that the great majority of Fijian waters have not yet surveyed, i.e. of the 1,145,600km² EEZ, only 1% is adequately surveyed, according to IHO Publication S-55 "Status of Hydrographic Surveying and Nautical Charting Worldwide-Jan. 1991). The survey of the Northern Lau Group carried out by the JICA Study has contributed to this percentage by merely 3.5%.

Such a vessel is not necessarily to be a newly built one, but acquisition of an existing one could be considered from any foreign hydrographic office or marine research organisation.

It is also desirable that the survey ship will be able to assist the hydrographic surveying activities of neighbouring island states in the future with its most advanced hydrographic survey equipment.

6-2-1-3. Survey equipment

Some of the existing survey equipment have become outdated and they should be replaced by modern equipment for more effective and accurate survey. The following equipment should be obtained to upgrade the existing survey capability:

- (a) DGPS for control point surveys and large-scale surveys
- (b) Software for navigation and data logging (IBM compatible)
- (c) Computers for field operations (IBM compatible)
- (d) Portable swath sounding system.

6-2-1-4. Training facilities

It is considered essential that the technical staff of FHS should be trained at appropriate training facilities abroad, or experts will be invited to carry out training programmes on the following subjects to maintain their technique and knowledge up-to-date.

- (a) Basic hydrographic survey and nautical charting.
- (b) Tide and tidal current observation and prediction.
- (c) Swath survey technique and data processing.
- (d) Position fixing by DGPS.

- (e) Computer-aided programming of hydrographic survey operation and data processing.
- (f) Computer-aided marine cartography.
- (g) Basic knowledge on electronic navigation charts.

6-2-2. Oceanographic observation

For seafarers navigating in critical waters such as narrow passages, entrances to lagoons, etc., the information on real time tidal current data is vital. In order to provide such information in selected critical areas, tidal current observation will be made and tidal current prediction published in Tide Tables.

At the present stage, it will be sufficient to carry out such tidal current observation in those waters where ships have reported difficulty in manoeuvring. At least 15 days continuous current observation in these areas with moored current meters should be made in different seasons.

Surveyors will need to be assigned and trained for this purpose, and provision of adequate current meters and associated equipment with the assistance of foreign experts will be required at the initial stage.

6-2-3. Nautical charting

6-2-3-1. Cartographic Section

It is noted that the post of Senior Cartographer (Grade NS03) is lower compared to the post of Senior Hydrographer (Grade TG02). Considering the importance of responsibility for production of nautical charts, the post of Senior Cartographer will be upgraded to (Grade NS02) to equate to the level of Senior Hydrographer.

It is also advisable that the post of Senior Technical Assistant be upgraded to Technical Officer Class I or II in view of the importance of their responsibility for cartographic work which requires a considerably high level of technique, knowledge and experience.

In this respect, the work now performed by cartographers not related to cartographic work, i.e. preparation of Fiji Notices to Mariners and Fiji Coastal Navigational Warnings, correction of stored charts, compilation of Nautical Almanac and Chart Catalogue, sale of charts and publications, acquisition, storage and supply of office stationaries and expendables, will be better transferred to a technical officer specially assigned for these tasks.

(cf. Appendix IV)

6-2-3-2. Chart publication planning

If a basic plan for chart publication and hydrographic surveying is developed, this would offer a good guideline for carrying out hydrographic activities every year. Likewise, it is desirable that an intermediate/long-term chart publication plan be prepared in view of increasing maritime traffic and tourist activities.

6-2-3-3. Plotter

To complete the nautical charting work in the FHS, it is considered necessary that a precise co-ordinategraph be provided for plotting chart borders and graticules accurately

enough to fulfil international standard. However, it is observed that such an equipment would not be available in the near future due to its high cost and the limited budget available.

6-2-3-4. Preparation of reference charts

It is considered useful if all the survey results obtained by FHS could be published in the form of nautical charts or reference charts, the latter which are only for referential use by mariners, especially of smaller craft and yachts. This practice will improve the level of cartographers' technique and provide more experience. At the same time, it will enhance the availability of hydrographic survey results to the public.

The quality of such reference charts will be upgraded to so-called Yachting Charts, which are convenient for yachtsmen, giving various necessary information for yachting. Since Fiji will be visited by a greater number of yachtsmen in the near future, the sale of such Yachting Charts will contribute to the revolving fund.

6-2-3-5. Publicity of Fiji charts and publications

It is advisable that the sale of Fiji Charts and Publications would be broadened not only domestic but also abroad so that foreign mariners will navigate in Fiji waters with Fiji charts on board. For this purpose it is necessary to prepare a catalogue for sale, indicating sheet limits of charts for geographical interest, together with numbers, titles, scales, etc.

Certain foreign charts, such as UK and USA, covering Fijian waters will also be indicated on the catalogue.

6-2-3-6. Chart agent

According to the statistics, the number of vessels calling into the Port of Lautoka exceeds that of the Port of Suva. Thus, it is considered advisable that an agent for the sale and distribution of nautical charts and publications be designated at the Port of Lautoka where staff of one or two will be stationed. They will also be of service to timely provision of information for Notices to Mariners and Navigational Warnings to FHS at Suva.

6-3. Follow-up of the JICA Study for preparation of nautical charts

It is advised that, as a follow-up scheme of the present JICA Study, the Fiji Government request the Government of Japan for the following technical cooperation matters:

- (1) Sending experts in swath survey and providing FHS with a portable swath survey equipment, and accepting training of personnel on swath survey.
- (2) Sending experts in tidal current observation and providing FHS with tidal current observation equipment, and accepting training of personnel on tidal current observation and prediction.
- (3) Sending an expert in drawing skeleton sheet of nautical chart and providing FHS with a co-ordinategraph.

7. RECOMMENDATIONS FOR IMPROVEMENT OF THE OPERATION AND MANAGEMENT SYSTEM OF HYDROGRAPHIC SURVEYING AND NAUTICAL CHARTING IN FIJI

Based on the assessment and analysis of the current operation and management system of hydrographic surveying and nautical charting conducted on FHS, the following recommendations are prepared by the Study Team, aiming at improving and upgrading the present capabilities of FHS.

In preparing the recommendations, the Study Team has taking into account the current conditions of Fiji so that the improvements recommended may be carried out in a practicable and cost effective manner.

RECOMMENDATIONS

Recommendation 1. Organisation and staffing (cf. pars. 6-2-1-1 and 6-2-3-1)

Considering more effective operation and management of hydrographic surveying and nautical charting at FHS, it is recommended that the following changes be made in the organisation and staffing:

- (a) The post of Senior Hydrographer will be increased to two;
- (b) The grade of Technical Officer Class I (Cartography) will be upgraded to the level equivalent to that of senior hydrographer;
- (c) The grade of Senior Technical Assistant (Cartography) will be upgraded to the level of Technical Officer Class I and Class II.
- (d) A technical officer will be assigned to handle exclusively the following matters presently dealt with by cartographers but not related to cartography:
 - i. preparation of Fiji Notices to Mariners and Fiji Coastal Navigational Warnings,
 - ii. up-dating corrections to charts in stock,
 - iii. compilation of Nautical Almanac,
 - iv. compilation of Chart Catalogue,
 - v. sale of charts and publications, and
 - vi. acquisition, storage and supply of office stationaries and expendables.
- (e) The posts of Senior Technical Assistant/Technical Assistant (Hydrography) will be traded off to accommodate the above-mentioned changes of staffing, remaining only one seat for this post.
- (f) The recommended reorganisation will be as shown in Appendix IV.

Recommendation 2. Improvement of operation (cf. pars. 6-2-3-2, 6-2-3-4 and 6-2-3-5)

- (1) It is recommended that FHS have a medium/long-term target of nautical charting and hydrographic surveying, by producing a chart publication plan for a medium/long-term.

This plan will include:

- (a) Publication plan of 1:150,000 coast chart series.
 - (b) Large scale harbour charts of principal local harbours.
- (2) It is recommended that, in order to comply with short-term needs, FHS will prepare the following charts at the earliest possible time (cf. figure 2):
- (a) A coast chart on the scale of 1:100,000 covering the waters of Vatu-i-Ra Channel and vicinity, utilizing the survey results recently carried out as well as compiling the existing source materials.
 - (b) Harbour charts of the four Ports of Entry, i.e. Suva, Lautoka, Levuka and Savusavu.
 - (c) Reference charts by making use of the results of surveys recently carried out, thus disseminating the survey results to the public as well as enhancing the cartographers' technique and experience in chart production.
- (3) It is recommended that, for advancing publicity of Fiji nautical charts and publications among navigators both at home and abroad, a sheet of Fiji chart catalogue for sale, indicating, on one side, an index diagram of Fiji chart coverage as well as those of foreign charts covering Fijian waters, and lists of charts on the other.

Recommendation 3. Instrumentation (cf. pars. 6-2-1-3, 6-2-3-3 and 6-3)

It is recommended that the following instruments and materials be made available to FHS in order to carry out hydrographic surveying and nautical charting more effectively and more accurately:

- (1) For hydrographic surveying
 - (a) DGPS for navigation and large-scale survey
 - (b) Software (IBM compatible) for survey data logging and processing
 - (c) Computer (IBM compatible) for survey data logging and processing
 - (d) Portable type narrow multibeam echo-sounder (Seabat)
- (2) For nautical charting
 - (a) Software (IBM compatible) for plotting chart borders, neatlines, graticules, etc.
 - (b) A co-ordinategraph

Recommendation 4. Staff training (cf. par. 6-2-1-4)

It is recommended that, while promoting the technical staff's technique and knowledge by means of on-the-job training in the FHS, each and every staff will be given opportunities to take an active part in the overseas training courses in hydrographic surveying and nautical charting to enhance their expertise.

Recommendation 5. Survey vessel (cf. par. 6-2-1-2)

It is recommended that R/V TOVUTO be replaced by a more economical vessel of smaller size between 200 and 500 tons built for hydrographic survey. Such a vessel will

include a survey motor launch on board for conducting hydrographic surveys exclusively in coastal waters and offshore up to the EEZ limits, and to assist in hydrographic survey activities of neighbouring island states. The vessel may not necessarily be a newly built one, but could be a vessel in serviceable condition acquired from any foreign hydrographic office or oceanographic research organisation.

Recommendation 6. Tidal current observation and prediction (cf. pars. 6-2-2 and 6-3)

It is recommended that FHS carry out a study on the possibility of conducting tidal current observations and tidal current predictions, with the technical cooperation of foreign governments.

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FIGURES

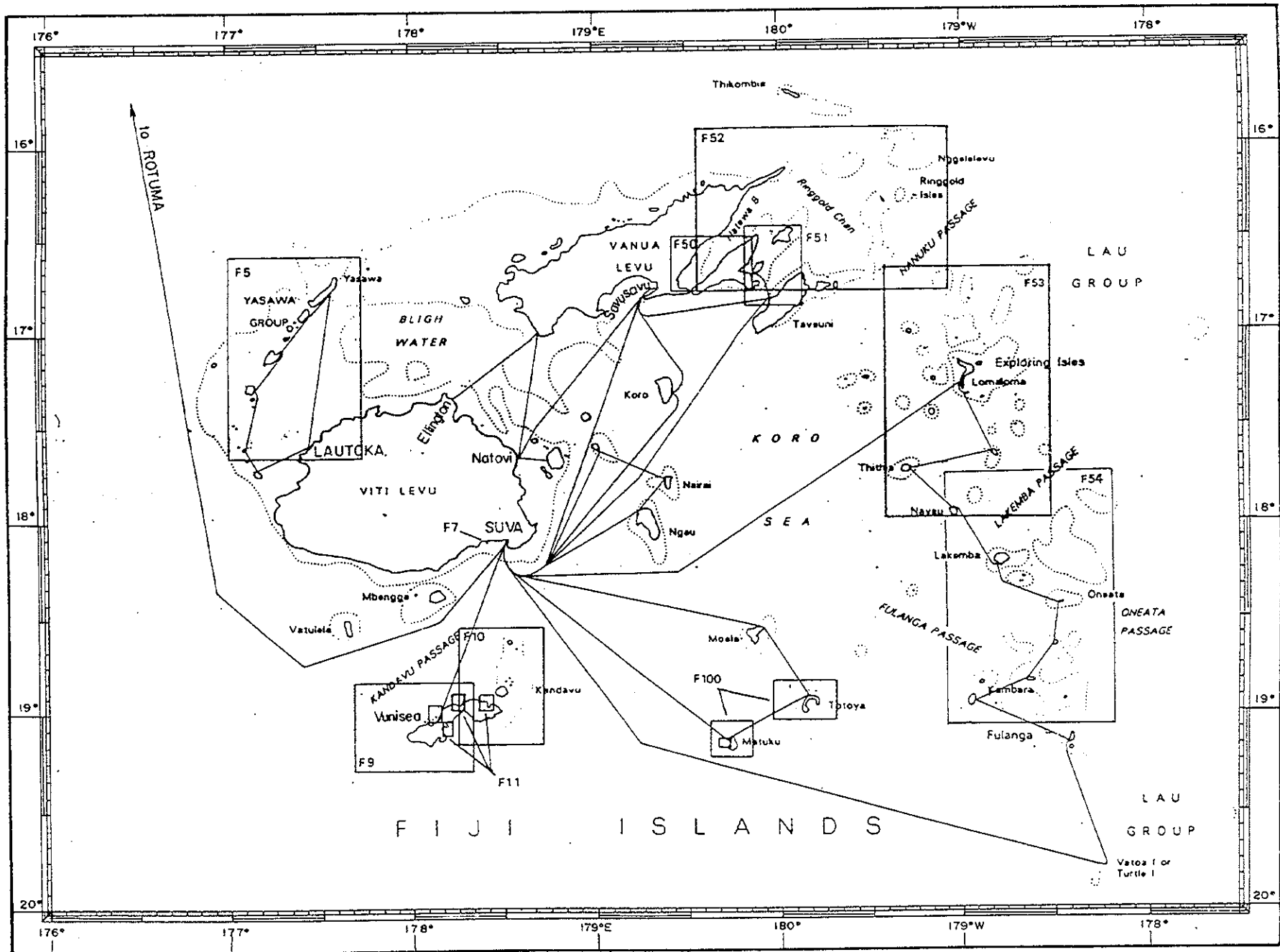


Figure 1. Domestic shipping routes in Fiji

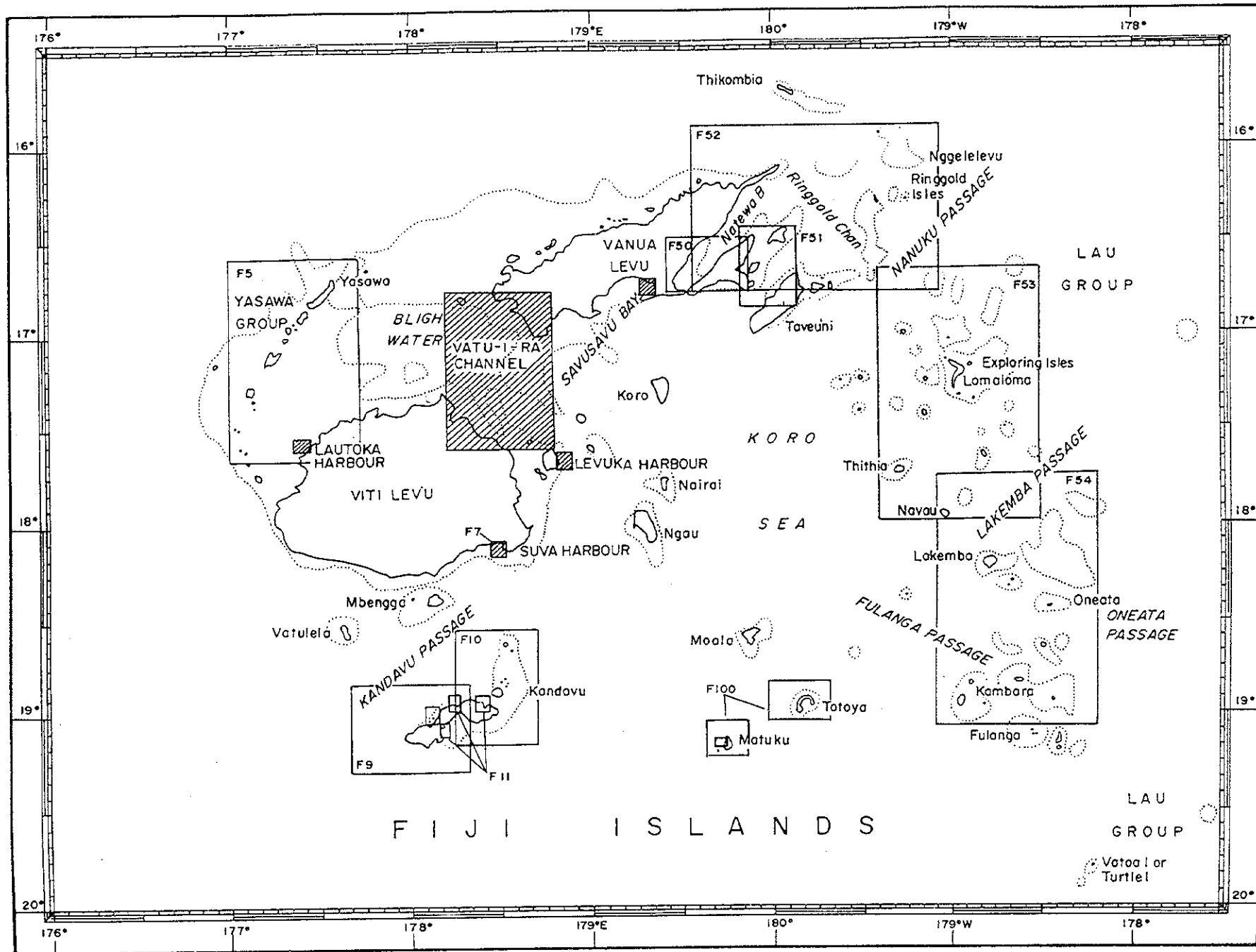


Figure 2. Charts for short-term needs shown as 

