社会開発調査部報告書

No. 55

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 Summary

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

March 1999

JICA LIBRARY
J1150398 [4]

Aero Asahi Corporation
Asia Air Survey Co. Ltd.

JICA
202
65.7
SSF
LIBRARY

SSF
JR
99-022

No.

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 Summary

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

March 1999

Aero Asahi Corporation
Asia Air Survey Co. Ltd.

S S F
J R
99 - 022

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

Exchange Rate

US$ 1 = F$ 1.549 (As of December 1997)
US$ 1 = F$ 1.887 (As of January 1998)
US$ 1 = F$ 1.994 (As of 6 November 1998)

Cover design : Three dimensional view of Study Area F53

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).

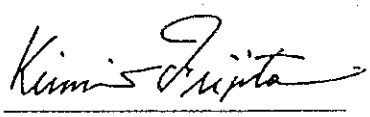
JICA selected and dispatched a study team headed by Mr. Yasuhiro OYAMADA, Aero Asahi Corporation (and consist of Asia Air Survey Co., Ltd.) to Fiji, six times between January 1995 and November 1998.

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

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

EXECUTIVE SUMMARY

EXISTING STATUS OF ACTIVITIES OF FHS AND ANALYSIS AND ASSESSMENT

Item	Existing status	Analysis and assessment
I. Organisation	1. 1 Senior Hydrographer to supervise field survey and to assist Chief Hydrographer for office work. 2. 2 Senior Technical Assistants (and 5 Technical Assistants now vacant) in the Hydrographic Section to help a survey team by providing porter service and other supporting work. 3. No senior cartographer. The present four cartographers are in the technical officer grade 1 and lower. 4. Publication and sales work other than cartography is borne by cartographers.	1. In order to assist Chief Hydrographer and to facilitate office work while the Senior Hydrographer is out to the field, one more Senior Hydrographer is desirable. 2. Porter service and other supporting work can be available at the survey site by employing temporary labour so that the number of this category staff can be reduced to one. 3. Considering the importance of responsibility of chart preparation, the post of senior cartographer can be justifiably upgraded to NSO2 level. Also, the posts of cartographers of lower posts can be upgraded in harmony with the other posts within the Hydrographic Section. 4. Such important work as Navigational Warnings, Notices to Mariners, sales of charts and publications, maintenance of office expendables, can be handled exclusively by an officer, but not by cartographers concurrently with cartographic work. 5. The posts of senior technical/technical assistants in the Hydrographic Section can be traded to accommodate the above-mentioned changes.
II. Chart publication plan	1. No medium/long-term chart publication plan. 2. No chart publication plan for short-term needs. 3. Hydrographic survey data are not always published as nautical charts. 4. Chart catalogue is available only on request.	1. For formulating working plan of hydrographic activities in the future, a medium/long-term chart publication plan is desirable. 2. Harbour charts of the four open ports be published for timely provision of up-to-date information to international mariners. 3. New survey data ideally be compiled into charts for publication, which will enhance the cartographic experience and technique. 4. Fiji Chart Catalogue will be prepared and sold to the public to promulgate Fiji nautical charts and publications.
III. Modern survey and cartographic instruments	1. A limited number of modern instruments are available. 2. No tidal current observation instruments available. 3. No co-ordinategraph for chart border plotting.	Certain instruments, e.g. an echo-sounder for swath survey in shallow water and a co-ordinategraph be provided to FHS for faster and more accurate survey and charting work.
IV. Overseas training	Technical officers are from time to time sent to attend overseas training.	Training of technical officers at overseas institutions should be continued in the future.
V. Survey vessel	R/V TOVUTO (920t, uneconomical for operation) is not exclusively used for hydrographic survey.	R/V TOVUTO will preferably be replaced by a more affordable 200-500-ton survey vessel capable of carrying a survey launch on board.

RECOMMENDATIONS

(Rec. : Recommendation)

I. Reorganisation of FHS

1. To increase one more senior hydrographer's post. (Rec.1(a))
2. To upgrade the levels of technical officers in the Cartographic Section to those equivalent in the Hydrographic Section. (Rec.1(b),(c))
3. To assign a technical officer to take responsibility for such non-cartographic matters that are concurrently handled by cartographers. (Rec.1(d))
4. To trade the posts of senior technical/technical assistants in the Hydrographic Section to accommodate the above-mentioned changes, remaining only one seat for this post. (Rec.1(e))

II. Chart publication plan

1. Preparation of medium/long-term chart publication plans:
   (1) 1:150,000 coast charts series (Rec.2(1)(a))
   (2) Large scale charts of principal local harbours (Rec.2(1)(b))
2. Publication of charts for short-term needs:
   (1) 1:100,000 coast chart covering Vatu-i-Ra Channel and vicinity. (Rec.2(2)(a))
   (2) Harbour charts of the four Ports of Entry, i.e. Suva, Lautoka, Levuka and Savusavu. (Rec.2(2)(b))
3. Publication of reference charts of the areas where survey results are available. (Rec.2(2)(c))
4. Production of Fiji Chart Catalogue for publicity of Fiji nautical charts and publications. (Rec.2(3))

III. Modern instruments/work

1. Provision of the following modern instruments for more effective and accurate hydrographic surveying and nautical charting: (Rec.3(1),(2))
   (1) DGPS for navigation and large-scale survey
   (2) IBM compatible software and computer for survey data logging and processing
   (3) Portable type narrow multi beam echo-sounder
   (4) Software for plotting chart borders
   (5) A co-ordinategraph.
2. Study on possibility of carrying out tidal current observation and tidal current prediction with a technical cooperation of a foreign government. (Rec.6)

IV. Overseas training

Overseas training for technical officers of FHS to enhance their levels of technique and knowledge. (Rec.4)

V. Survey vessel

Replacement of R/V TOVUTO by a smaller and more affordable hydrographic survey vessel of 200-500 tons carrying a survey launch on board, also capable of supporting hydrographic survey activities of neighbouring island states. (Rec.5)

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

Main Report : Volume I - Summary

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

Table of Contents

VOLUME I - SUMMARY

1. INTRODUCTION

For the maritime nation of Fiji, the Northern Lau Islands are located in a region through which exist principal international and domestic shipping routes. However, the nautical charts covering this region are mainly based on outdated hydrographic surveys of late 19th to early 20th centuries, lacking reliability and accuracy for modern navigation.

In order to improve the navigational safety in the region, the Government of the Republic of the Fiji Islands requested the Government of Japan for technical cooperation in a study on the preparation of nautical charts in this region.

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

According to the S/W, the Study aimed at (a) preparing three nautical charts to cover the region, (b) reporting recommendation for improvement of operation and management system of hydrographic surveying and nautical charting in Fiji and (c) transferring modern technology to Fiji counterpart personnel.

This Summary gives the gist of Volume I of the Main Report containing the results of the Study in regard to the objective (b) as above-mentioned.

2. GENERAL ASPECTS OF THE REPUBLIC OF THE FIJI ISLANDS

2-1. Social and economic facts

The principal social, economic and other factors of Fiji are as follows:

Name of country : Republic of the Fiji Islands.
Date of Independence : 10 October 1970.
Population : 781,400 (1997), of which Fijian 51.1%, Indian 43.6%, others 5.3% (1996).
Language : English (official language), Fijian and Hindi.
Religion : Christian 52.9%, Hindu 38.2%, Moslem 7.8% (1996).
Head of state : President Ratu Sir Kamisese Mara (since January 1994).
Cabinet : Prime Minister Sitiveni Rabuka (since June 1992) and 18 Ministers (1998).
GDP : US$1,868.5M (1997).
GDP per capita : US$2,391 (1997)
Growth ratio of GNP : 3.6% (1996).
Rising rate of commodity price : 2.2% (1996).
International trade : Export F$870M, import F$1,220M (1996).
Principal export goods : Sugar (31.9%), gold (9.6%), fish (7.4%), lumber (6.0%), apparel (3.0%)(estimate 1995).
Principal import goods : Industrial products (32.2%), mechanical/transport equipment (28.2%), foods (16.7%), petroleum (14.3%), chemical products (8.6%)(estimate 1995).
Countries export to : Australia (26.0%), U.K. (22.9%), U.S.A. (13.0%), Japan (6.6%), New Zealand (5.3%), Canada (3.6%)(1995).
Countries imported from : Australia (38.8%), New Zealand (15.9%), Japan (7.2%), U.S.A. (7.1%), Singapore (7.1%) (1995).
Currency : Fijian dollar (F$). F$1 = 100 cents (c).
Exchange rate : F$1 = US$0.53 (As of January 1998).

2-2. Geographical fact

The 320 islands, of which at least 100 are inhabited, comprising Fiji are spread over an area between Lat. 12.5° and 22° S and between Long. 174° E and 177° W. The largest island is Viti Levu where the nation's capital Suva is situated. Vanua Levu is next followed by Taveuni, Kadavu, Gau, 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.

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 518km^2 with circumference of about 130km. 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 54km^2 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 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. When Fiji became a British colony in 1874, the British Hydrographic Department took the leadership in nautical charting in Fijian waters, and such cooperation continued after the World War II, until a Fijian hydrographer was nominated as chief hydrographer in 1990.

In 1966, the United Nations (UN) initiated a hydrographic survey as part of a survey for the development of Fijian maritime traffic, and the Fiji-UN Transport Survey Project was commenced in 1968. With this as a momentum, a hydrographic unit was founded in the government. Personnel and equipment was placed in the Fiji Marine Department, which formed the Fiji Hydrographic Unit (FHU) in 1969.

When Fiji became independent in 1970, FHU was transferred to the Naval Division of Royal Fiji Military Forces. With military assistance from the Hydrographic Services of Australia and New Zealand besides UK Hydrographic Office, FHU gradually substantiated its capabilities in hydrographic activities.

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.

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 international (INT) charts in the scheme of IHO were also adopted and printed locally in 1987-88.

In 1987 when Fiji departed from the British Commonwealth as a result of the military coup, the military assistance from Australia and New Zealand was suspended. In 1988, FHU was transferred back to the Marine Department and became Fiji Hydrographic Service (FHS).

The period in the Navy 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, but mainly due to the consecutive appointment of three British Navy hydrographic surveying officers to head the Unit from 1979 to 1990.

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 to attain the original plans of full localization.

As for equipment and survey instruments, FHS was empowered with provision of an aluminium survey catamaran and a dual channel echo-sounder by British aid in 1989.

In 1993, the Government of Fiji requested the Government of Japan for technical cooperation to produce modern nautical charts covering the Northern Lau Islands region for navigational safety. Thus, the present five-year Study started from 1994.

4. EXISTING STATUS OF FIJI HYDROGRAPHIC SERVICE

4-1. Organization and functions

FHS is a division of the Marine Department of the Ministry of Communication, Works and Energy (former Ministry of Infrastructure, Works and Transport). The other divisions are Regulatory and Fleet besides Administration. Navigational Aids are looked after by a sub-division.

The organization, number of staff and function of FHS are as follows:

ADMINISTRATION

Chief Hydrographer : 1.
Duties : Responsible for national hydrographic policy.
Providing technical advice to the Government of Fiji on hydrographic matters, formation 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 FHS.

Secretary : 1.

Messenger : 1.

HYDROGRAPHIC SECTION

Senior Hydrographer (Acting) : 1.
Duties : To conduct hydrographic surveys from start to completion stage according to the standards of IHO. To work out an efficient plan and programme for surveying tasks to accomplish the survey tasks as dictated by the Chief Hydrographer in the time specific.
Responsible for utilising all the equipment available to achieve the above and for training personnel to obtain necessary competence in field work.
Capable of carrying out the duties of a surveying ship master when called upon.
On occasion required for attending meetings and conferences and for presenting papers.

Hydrographer : 2.
Duties : To 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.
Required to assist junior officers in gaining the necessary levels of competence required for their respective grades and for advancement.
Required to carry out all tasks required for setting up survey geodetic stations ashore and for calibration of all equipment used in the survey.
Required to be able to manipulate surveying calculations using manual methods and also computer assisted methods.
On completion of day's field work, 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, required to undertake small uncomplicated hydrographic surveys on his own from start to finish stage.

Technical Officer, Class I (Hydrography) : 4.

Duties : To assist the Hydrographer in boat sounding and field observations for geodetic control.

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 office will extract data and record the observations on the appropriate manner ready for checking by the Hydrographer.

Technical Officer, Class II (Hydrography) : 1.

Duties : 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.

To draw fair sheets and fair tracings.

Senior Technical Assistant (Hydrography) : 2.

Duties : 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.

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.

To clean survey equipment and surveying boats.

To charge batteries for field use.

Technical Assistant (Hydrography) : 0 (vacant)

Duties : 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.

NAUTICAL CHARTING SECTION

Technical Officer, Class I (Cartography) : 1.

Duties : 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 organisations locally and overseas for nautical charting and carry out such other duties delegated by management.

Technical Officer, Class II (Cartography) : 0 (vacant)

Duties : 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.

Senior Technical Assistant (Cartography) : 2.

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

Technical Assistant (Cartography) : 2.
Duties : Responsible to the Technical Officer II (Cartography) for the correction of nautical charts and archiving.

ELECTRONICS SECTION

Technical Officer Higher Grade (Electronics) : 0 (vacant).
Duties : To take overall charge of all electronic surveying equipment, instruments and tools.

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.
Responsible for having defective equipment repaired in the minimum amount of time and be available at all times during field surveying.

Technical Officer, Class I (Electronics) : 1.
Duties : To carry out basic electronic maintenance on surveying equipment.
Maintenance of batteries.
To 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.

Technical Assistant (Electronics) : 1.
Duties : 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.

4-2. Staff and employees

4-2-1. Staff and employees and their qualifications

At FHS there are 20 staff and employees, of which 18 are technical. Their qualifications at present are as follows:

(a) International Hydrographic Surveyor Category A (FIG/IHO)(in UK) : 2
(b) International Hydrographic Surveyor Category B(FIG/IHO)(in UK, Japan, Australia): 4
(c) Basic Survey Technician Certificate (in Australia) : 2
(d) Certificate in Survey Draughting (in New Zealand) : 1
(e) Diploma Land Survey (in Australia, New Zealand) : 2
(f) Hydrographic Data Processing and Marine Cartography (in UK) : 2
(g) Intermediate Marine Science Certificate (in Australia) : 1
(h) Group Training Course in Nautical Charting (in Japan) : 4
(i) Trade Certificate (Electronics) : 1
(j) Grade of Certificates of Seafarers under the STCW Convention Grade 2 (Mate) : 1
(k) Grade of Certificates of Seafarers under the STCW Convention Grade 3 (Mate) : 2
(l) Grade of Certificates of Seafarers under the STCW Convention Grade 4 (Mate) : 2
(m)Grade of Certificates of Seafarers under the STCW Convention Grade 5 (Mate) : 4

4-2-2. Recruitment and training of staff

A staff member is recruited after public announcement of vacant post advertised in a news paper. Applicants should fulfil the minimum qualifications to the post and then they are to face interview by a panel consisting of the officers of FHS and the Personnel Division of the Marine Department. The successful applicant should clear a probation period of one year to receive an official assignment to the post.

After this, 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 : Group Training Course in Hydrographic Survey (FIG/IHO Category B Course); 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 constrains and limited demand.

4-3. Current activities of FHS and achievements

4-3-1. Hydrographic surveying

4-3-1-1. Survey planning

Hydrographic surveying by FHS has been conducted according to requests of various organisations including governmental organisations and private enterprises. 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 for surveying and charting is not practised due to existing circumstances.

4-3-1-2. Survey vessel

The survey vessel R/V TOVUTO belonging to the Marine Department was originally purchased for the purpose of hydrographic survey, but has not been fully utilized as such. TOVUTO has also been used to provide passenger and cargo transportation to outer islands, thus surveying operations are not always carried out as planned.

The high maintenance and operation costs of TOVUTO which is 27 years old also hinder surveying operations.

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.

The hydrographic surveys carried out between 1991 and 1998, excluding the surveys under the Study, were in 16 places with scales ranging from 1/500 to 1/25,000.

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. As a permanent tide station, the tide station established at Port of Suva by NOAA, USA, 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 four 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 issuing Navigational Warnings and Notices to Mariners, compiling Nautical Almanac, chart maintenance, storage and sale, 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. 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. The maximum size for printing is 1,020mm x 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 this, delays in printing charts can be from a few months to a year.

Fifteen (15) nautical charts and three (3) special purpose charts are currently issued by FHS.

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.

At present, one Fiji nautical chart (1/150,000) and three INT charts are planned for publication.

In Fiji, nautical charts are sold at FHS and at sales agents of Carpenters Shipping 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.

A total number of sheets of charts sold in 1996 and 1997 were 983 and 2,891,

respectively.

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 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.

According to the current chart publication planning, a local chart with a scale of 1/150,000 is being compiled as a new chart, and three INT charts are under revision.

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, such as Tide Tables, List of Lights, List of Radio Signals, Weather Warning Services, Vessel Traffic Services, List of Fiji Charts, and Distance Tables. The number of copies sold recently amounts to around 700 to 800 each year.

However, no Sailing Directions (Pilot) is published by FHS.

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, eg. 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, and 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 numbers of paragraphs of FNM published in 1995, 1996 and 1997 were 27, 7 and 10, respectively.

Fiji is located within the Area XIV of the World-wide Navigational Warning System

(NAVAREA) for which New Zealand Hydrographic Office (NZHO) is responsible. Warnings are also despatched to NZHO which repeats and broadcasts the important coastal warnings as NAVAREA XIV Warnings.

The numbers of paragraphs of the Fiji Coastal Navigational Warnings issued in 1995, 1996 and 1997 were 45, 32 and 44, respectively.

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

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, were increased from 1,787 vessels amounting 7,260,000 tons to 5,633 vessels amounting 9,166,000 tons. The numbers of vessels between 1992 and 1997 were ranging around 6,000,000 tons per year, but their tonnage increased from 8,252 to 9,146 tons. This indicates a general increase in the size of vessels.

As for the volume of cargo handled and the number of containers from 1993 to 1997, they increased by about 400,000 tons and 9,600 TEU, respectively,

The number of foreign vessels, domestic vessels and yachts called these three ports in 1995 were 1,047, 5,290 and 852, respectively.

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

Besides establishment of a container terminal at Rokobili, the Ports Authority is also investing in the inter-island shipping facilities in Port of Suva.

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

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.

5-3. Tourism

Tourism is now Fiji's most important industry and largest foreign exchange earner. 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 percentages of visitors arriving by air and those arriving by ship during April 1996 and March 1998 were 98.6% and 1.4% of the total arrivals.

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.

6. ANALYSIS AND ASSESSMENT OF EXISTING STATUS OF OPERATION AND MANAGEMENT SYSTEM 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 taking 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.

The only one post for Senior Hydrographer responsible for field survey operations indicates that there is no alternate at FHS in Suva while he is in the field. Therefore, another post for Senior Hydrographer should be provided so that, while one is out to the field, the other will be at FHS in Suva assisting Chief Hydrographer and doing day-to-day operation of the Hydrographic Section.

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.

Thus, the Hydrographic 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.

6-2-1-2. Survey vessel

It is considered desirable that a survey vessel of 200-500 tons equipped with modern survey instruments build for the specific purpose be provided. Such a vessel 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 been surveyed, i.e. of the 1,145,600 km^2 EEZ, only 1% is adequately surveyed, and 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 could be made available by acquisition of an existing one from any foreign hydrographic office or marine research organisation.

It is 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 swathe 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 be made and tidal current prediction be published in Tide Tables.

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

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 should 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, are better transferred to a technical officer specially assigned for this work.

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 necessary that a precise co-ordinategraph be provided for plotting chart borders and graticules accurately enough to fulfil international standard.

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 number 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 I.

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. Appendix II):

(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

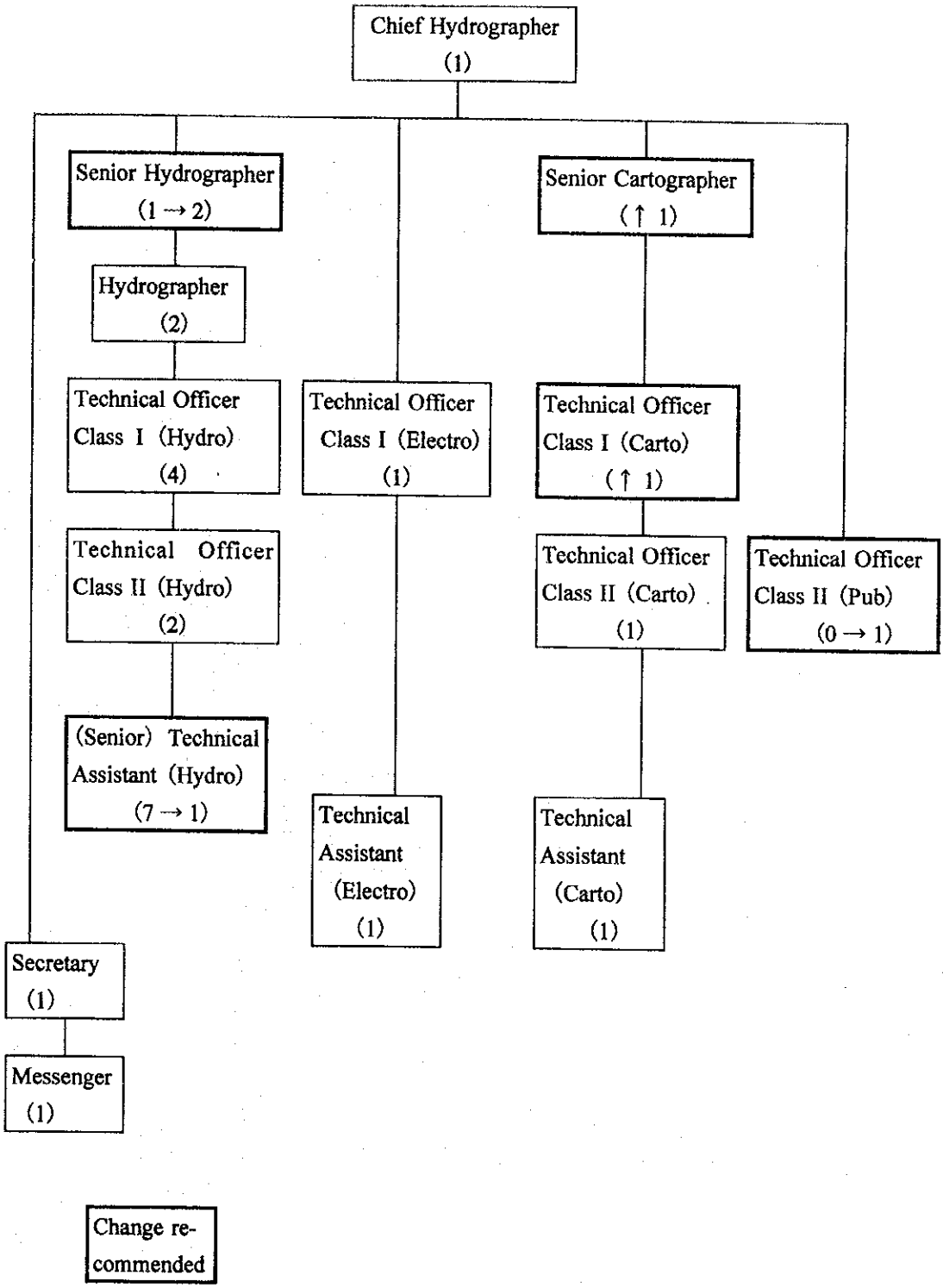
include a survey motor launch on board for conducting hydrographic surveys exclusively in coastal waters and offshore up to the EEZ limits, and to assist in hydrographic survey activities of neighbouring island states. The vessel may not necessarily be a newly built one, but could be a vessel in serviceable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

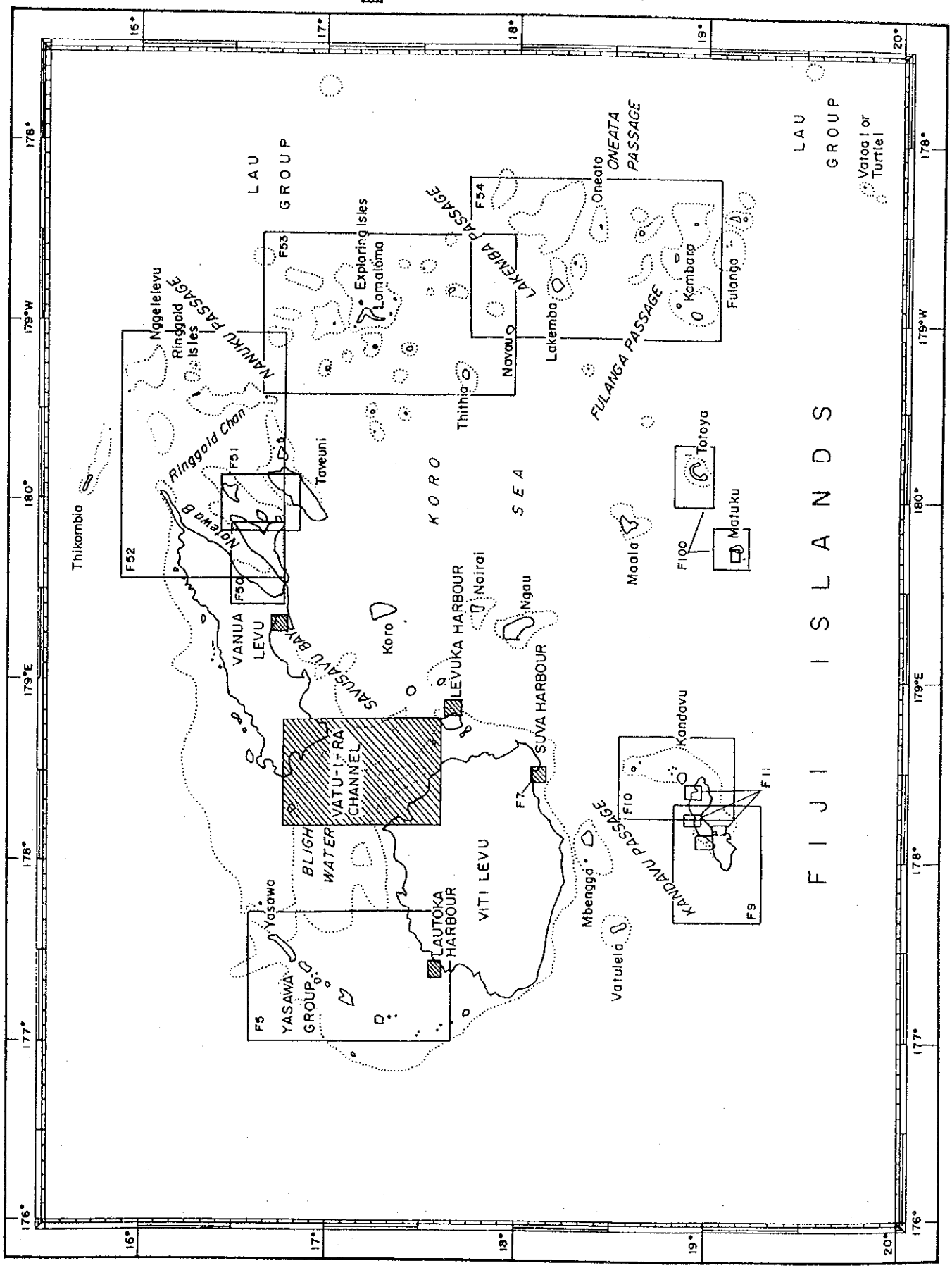
APPENDICES

RECOMMENDED REORGANISATION OF FHS



FIJI NATIONAL CHART SERIES

: Charts for short-term needs



JICA