THE MINISTRY OF AGRICULTURE,
FISHERIES AND FOREST

THE REPUBLIC OF FIJI

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR CONSTRUCTION OF
THE MARINE STUDIES FACILITIES,
THE UNIVERSITY OF THE SOUTH PACIFIC
IN
THE REPUBLIC OF FIJI

February 1996

Japan International Cooperation Agency

Fisheries Engineering Co.,Ltd.

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PREFACE

In response to a request from the Government of the Republic of Fiji, the Government of Japan decided to conduct a basic design study on the Project for the Construction of The Marine Studies Facilities, The University of The South Pacific and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Fiji a study team from August 21 to September 13, 1995.

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

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

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

February, 1995

Kimio Fujita
President
Japan International Cooperation Agency

February, 1995

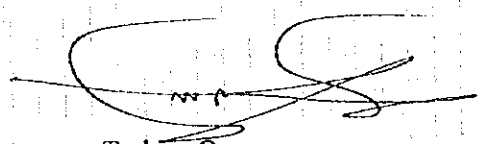
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for the Construction of The Marine Studies Facilities, The University of The South Pacific in the Republic of Fiji.

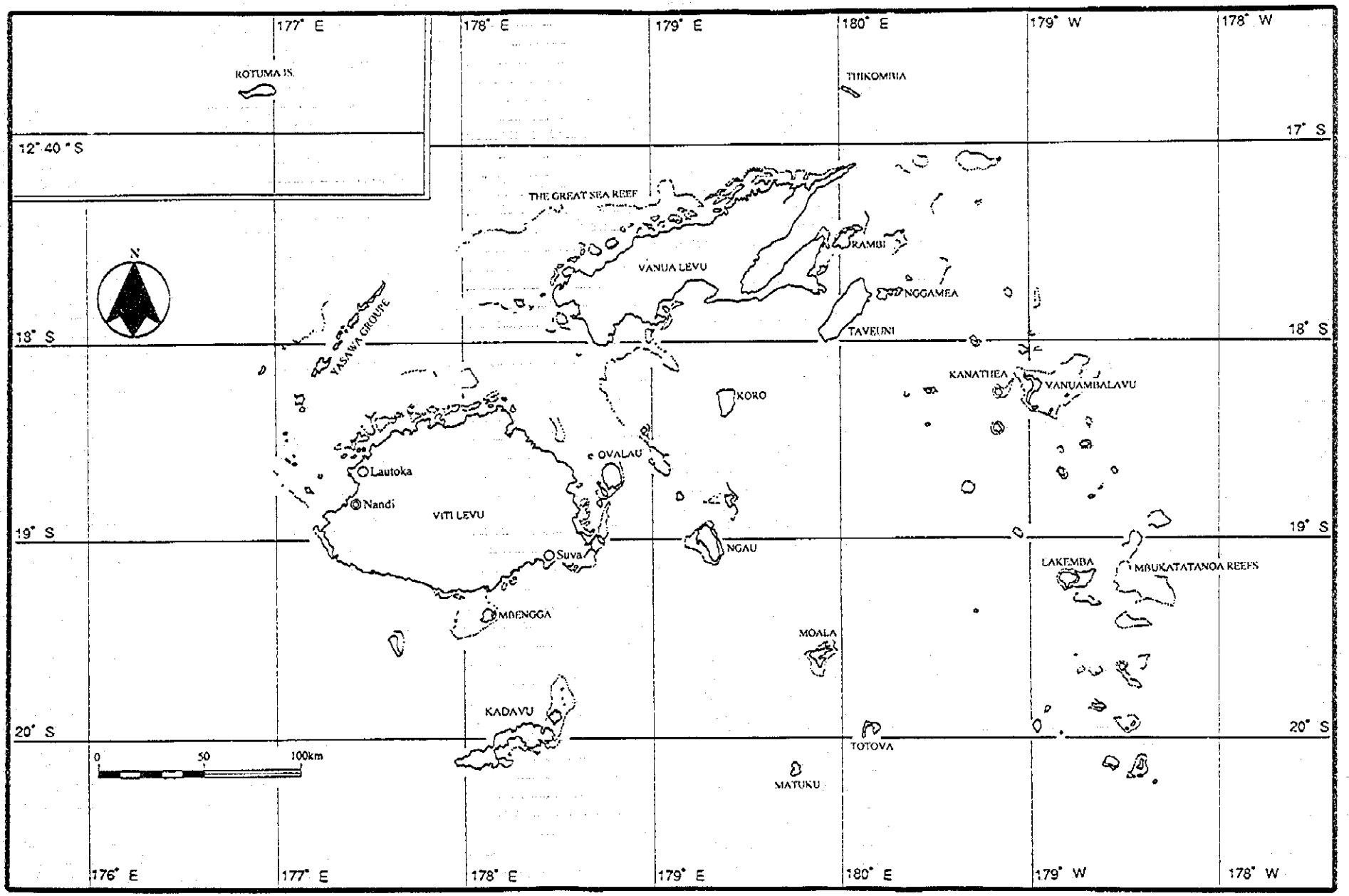
This study was conducted by Fisheries Engineering Co.,Ltd., under a contract to JICA, during the period from August 20, 1995 to December 9, 1995. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Fiji and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

Very truly yours,



Toshiya Ogasawara
Project Manager,
Basic design study team on the Project for
The Construction of The Marine Studies Facilities,
The University of The South Pacific
Fisheries Engineering Co., Ltd.



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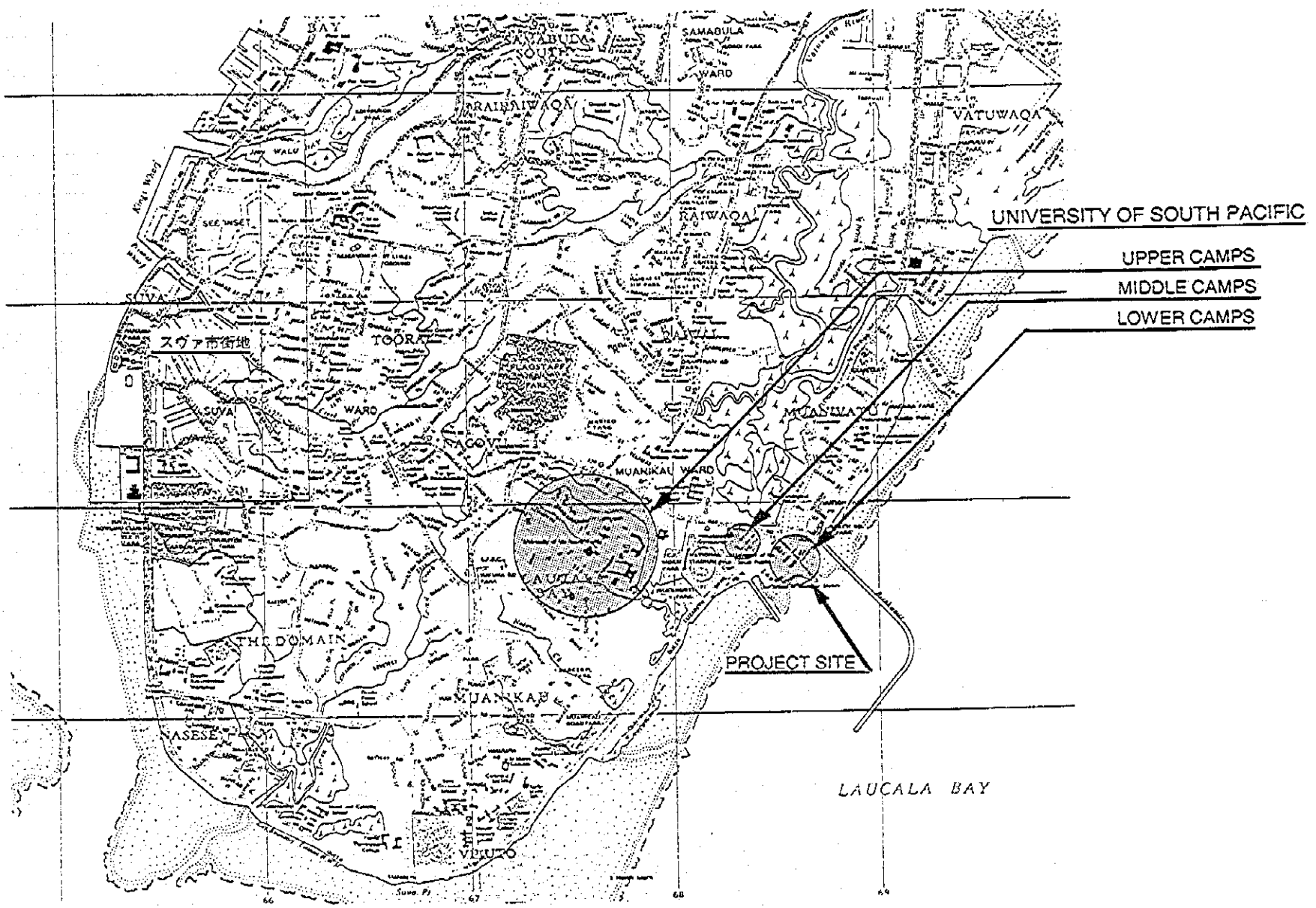
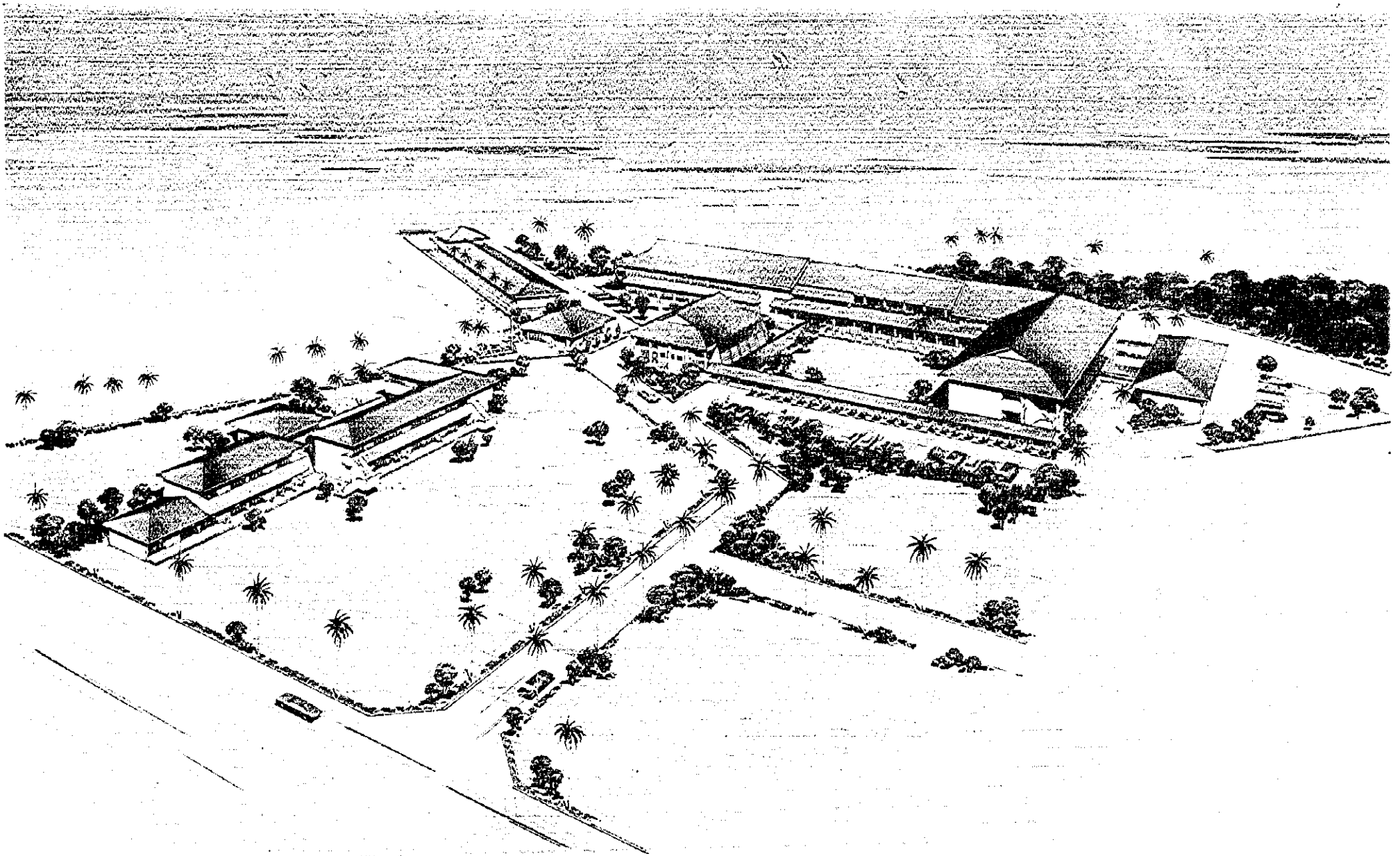


PROJECT SITE LOCATION MAP



PERSPECTIVE OF THE MARINE STUDIES FACILITIES, THE UNIVERSITY OF THE SOUTH PACIFIC

ABBREVIATIONS

ARP :	Atoll Research Programme
ASFA :	Aquatic Science & Fish Abstracts
CCOP :	Committee for the Coordination of Joint Prospecting for Mineral Resources in South Pacific Offshore Areas
CSA :	Cambridge Scientific Abstracts
EC :	European Community
EEC :	European Economic Community
ESCAP :	United Nations Economic and Social Commission for Asia and Pacific
FAO :	Food and Agriculture Organization of the United Nations
IAS :	Institute of Applied Science
ICOD :	International Center for Ocean Development
IMR :	Institute of Marine Resources
IOI :	International Ocean Institute
MS Center :	Marine Studies Center
MSP :	Marine Study Programme
NGO :	Non Government Organization
ORMP :	Ocean Resources Management Programme
PIMRIS :	Pacific Islands Marine Resources Information System
SOA :	School of Agriculture
SOH :	School of Humanities
SOPAC :	South Pacific Applied Geoscience Commission
SPAS :	School of Pure and Applied Science
SPC :	South Pacific Commission
SSED :	School of Social Economic Development
UNDP :	United Nations Development Programme
UNESCO :	United Nations Educational Scientific and Cultural Organization
USAID :	United States Agency for International Development
USP :	University of South Pacific

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APPENDICES:

CHAPTER ONE BACKGROUND OF THE PROJECT

The University of the South Pacific (USP) is a regional institution, headquartered in Suva, capital of the Republic of Fiji, comprising 12 member countries : Fiji, Western Samoa, Solomon Islands, Vanuatu, Tonga, Kiribati, Tuvalu, Nauru, Cook Islands, Niue, Tokelau, and the Marshall Islands (which joined in 1991). The University was established on the recommendation of a Higher Education Mission to the South Pacific in 1966 which was set up by the governments of the U.K, New Zealand, and Australia, with its campus located on Laucala Bay in the suburbs of Suva. Enabling legislation was passed by Fiji in the following year (1967), with operations formally launched in February, 1970, after the enactment of a university charter, though the initial class had been admitted two years earlier, in February, 1968.

Student enrollment at the time of founding was 154, but this figure has steadily grown to a total of 3,352 matriculated students in fiscal 1995 and 5,419 External students. About 70% of the total student body is of Fijian nationality, followed by 5 - 6% each from the Solomon Islands and Tonga. Since the small member states are in no position to support their own high-caliber universities, the bulk of the graduates move on to important posts in their home countries, so that USP has come to play an important role in the region as the highest seat of learning among the island countries of the South Pacific.

The faculty and staff of USP are, in principle, recruited publicly from many countries, serving under 3-year contracts. As of December, 1994, faculty and staff totaled about 390 persons, with 65% drawn from member countries and 35% from outside the area. By country, Fiji nationals represent the largest single contingent at 46% of total, followed by 6 - 8% each from Western Samoa, Australia, U.K., and the U.S.

USP is funded broadly from three sources : contributions from its 12 member countries, tuition revenues, and aid from various foreign countries. Member government contributions are set on the basis of their respective financial circumstances, with the Fiji Government shouldering more than 70% of total. Operating revenues for fiscal 1994 amounted to F$ 32,898,229. However, as external funding was also provided for separate research projects, the actual level of operating revenues in that year exceeded the operating budget.

The USP presently comprises four faculties : the School of Agriculture, School of Humanities, School of Pure and Applied Sciences, and School of Social and Economic Development. The

School of Agriculture is located in Western Samoa, on the Alafua Campus in the suburbs of Apia, the capital, with the remaining Schools all based in Fiji.

Courses include Preliminary (only available through University Extension), Foundation, Undergraduate, and Postgraduate. The undergraduate programs lead in turn to a Certificate, Diploma, and Bachelor's Degree, with course requirements reflecting the student's particular field of specialization. In addition to the option of full-vs. part-time matriculation, certain courses may also be taken through University Extension basis.

The Laucala Campus at Suva comprises 3 individual campuses : Upper, Middle, and Lower. The Upper Campus forms the core of USP, containing the three Schools mentioned above, the headquarters of the Fiji Center for University Extension, the Media Center the Computer Center, the Library, and various attached research bodies, along with administrative, service, and accommodation facilities. The major portion of these facilities has been provided under aid programs from the U.S., Canada, U.K., Australia, New Zealand, and other countries as well as the EC (EU), UNDP, UNESCO, and other international organizations. However, since the completion of a meeting house in 1993, built with assistance from the U.K. and the Fiji Government, no major new buildings have been constructed.

The countries of the South Pacific region share a strong common interest in the development, effective utilization, and conservation of marine resources. In 1988, amid the growing need for enhanced capabilities for marine research and education in these fields, the USP inaugurated a Marine Studies Advisary Board which, in 1991, formulated a Marine Studies Programme Five Year Plan. In 1993, Marine Studies Programme (MSP) was established as an interdisciplinary organization, not attached to any particular school , to conduct research and provide courses on marine oriented subjects.

MSP's activity mission has been expressly stated as covering the following three areas :

1) to provide the necessary opportunities for Pacific Islanders to understand, conserve, develop, manage and utilize their living and nonliving resources in a rapidly changing world;

2) to provide Pacific Islanders with the widest possible range of opportunities for research, education, training and employment in the marine sector; and
3) to provide for improved collaboration between the University of the South Pacific, Island Nations, Regional and International bodies in their common goals in the marine sector.

MSP currently offers courses in tropical fisheries ocean resources management, Ocean Resources Management and Policy , Fisheries Economics and Management, and Earth Science and Marine Geology, while also developing its research activities in cooperation with research institutes and educational organizations from various countries. In addition, the 1 Operation Center of the International Ocean Institute (IOI), an NGO (non-government organization), is housed within MSP, maintaining its own curricula, including short-term courses in related fields. MSP also maintains cooperative ties with such international organizations as the Food & Agriculture Organization (FAO), United Nations Development Programme (UNDP), South Pacific Commission (SPC), and South Pacific Earth Science Commission (SOPAC).

MSP operations are based in a wooden building complex of approximately 2,000 m^2 on the Lower Campus facing Laucala Bay, incorporating laboratories, offices, a workshop and other facilities. However, the existing facilities have been in use for over 50 years, having previously served as a flying-boat base of the Royal New Zealand Air Force .

In view of the advanced degree of superannuation, there are no lecture rooms, while the existing rooms are cramped and inadequate even as research facilities. As a consequence, to gain access to the facilities and equipment required for lectures and training, MSP has been forced to rely on other university schools in particular for the School of Pure and Applied Science. This situation has not only impeded the conduct of MSP programs but, coupled with the fact that, for many years, the expansion of teaching facilities has been unable to keep up with the steadily growing student body, has also been putting considerable pressure on the activities of other USP schools.

Under the above circumstances, the Fiji Government, as one of the primary contributors to USP, has requested a grantaid from Japan to upgrade the Marine Studies Facilities at USP, which are both superannuated and cramped, with a view to developing substantial, world-class programs for research, education, and training in the marine sector.

CHAPTER TWO: CONTENTS OF THE PLAN

2.1 Objectives of the project:

The University of the South Pacific (USP) is an international institution, comprising 12 island states, which is the highest-level seat of learning in its constituent areas. As such, it plays a key role in developing leadership resources at the highest national levels. In 1991, the Marine Studies Coordinating Committee of the USP, which had been inaugurated in 1988, drafted a Marine Studies Programme (MSP) to respond to scientific and educational needs in the field of marine resources, which hold the key to economic development in the nations of the South Pacific area. The functions of the MSP are to strengthen intra-regional ties, provide opportunities at an international level for marine research, education, and training, and thereby cultivate the skills and knowledge required to conserve, develop, and utilize marine resources throughout the area. In order to develop an integrated marine studies program within the USP, the MSP was formally launched in 1993 as an independent Programme, not attached to any specific department of the university.

The problems confronting MSP are, firstly, the marked deterioration, notably from insect damage and rotting, of its present wooden research and teaching facilities, which have already been in service for half a century. Continuing utilization of these buildings based on patch-work repairs has reached practical limits, with a portion of the complex already subject to use restrictions, which has made it difficult to secure space commensurate with the scope of the Institute's programs. In addition, the present research equipment has become functionally inadequate in terms of meeting research demands, thereby obstructing the performance of marine research, educational, and training activities. Accordingly, in order to develop and support new research programs, given the inadequacy of the existing research equipment, new facilities suitable to MSP research programs, including a marine research vessel, will have to be provided.

The objective of the subject Plan, is to revitalize the Institute's research and educational activities by providing new research and teaching facilities and equipment, to relocate the present facilities, which have been deemed inadequate, and to enhance the environment for marine research and education. This upgrading program will facilitate the conduct of programs at world-class levels, thereby helping to provide the know-how and skills required for conservation, development, and utilization of marine resources by the peoples of the region, while also contributing to the development of leadership talent therein.

2.2 Basic Concepts of the Project :

The USP was established in 1968 as a regional university, with an initial student body of 154 and a faculty of 31, though the actual size of the first graduating class was reportedly only 17 students. The number of students commuting to the Suva Laucala Campus reached the 2,000 level during the mid 1980s and since then has expanded dramatically, by more than 1.5 times, to a current enrollment of over 3,300.

Since the formal launching of USP in 1968, in line with the growth of the student body, there has been a continuing effort to expand university facilities. However, while 53 major facilities are shown on the current campus map, the fact is that, since the completion of the Faculty for the School of Social and Economic Development in 1982, no major construction of educational or research facilities has been undertaken, with the current plant in chronically inadequate condition.

The facilities presently used by the MSP are located in the southeastern shore section of the Lower Campus, comprising mainly an administrative building, research laboratory, mooring dock, and equipment storage area. However, these existing buildings, which are all of wooden construction, have become seriously superannuated after 50 years of use, having now reached the practical limits of continuing use through repairs. Considering the usage conditions at the existing USP facilities, it has been confirmed through field discussions that the university cannot be expected to provide the replacement facilities demanded by the MSP research programs and that the present research equipment can no longer respond functionally to actual research requirements.

In order, therefore, to enlarge the scope of MSP's marine research and educational programs while raising the caliber of these activities to international levels, and considering the inadequacy of the present facilities in both spatial and functional terms as well the problem of its aging facilities, the grant aid has been requested for construction of marine research and training facilities, related research equipment, and a marine research vessel.

Through the provision of more effective research and training facilities and equipment and overall revitalization of the MSP research and education programs, the subject project can be expected to contribute to the development of marine research and education at an international level while also fostering the skills and knowledge required to conserve, develop and utilize marine resources in the areas covered by the university and helping to cultivate leadership personnel in the subject region. On this basis, it has been determined that implementation of this project merits a high priority within the framework of Japan's grant-aid cooperation program.

The basic concept underlying this Plan is to furnish new facilities and equipment to eliminate the serious deficiencies which are hindering the continuation of effective research and educational activity at the MSP on the Lower Campus of the USP. The Plan facilities will include construction of an MS (Marine Studies) Center for research and teaching activity, a workshop for maintenance checks on facilities and equipment, accommodations for both students and visiting researchers, and a canteen; along with the provision of a wide variety of marine survey and educational / training equipment, including diving gear, processing equipment, test equipment, field equipment, workshop equipment, teaching equipment, computer network equipment, vehicles, and equipment for extension study courses.

However, the requested slipway facility has been eliminated from the present Plan, inasmuch as the existing public slipway adjacent to the Plan area is still usable. The requested extension to the existing jetty has also been excluded, since, owing to the shallow water in front of the Plan site, it will not be possible to obtain sufficient water depth to construct this extension on the scale desired, whereas the existing jetty is still quite usable at high tide.

2.2.1 Contents of the Request :

The contents of the requested "The Project for the Construction of The Marine Studies Facilities, the University of the South Pacific", as validated through our discussions, incorporate the following items :

2.2.1.1 Plan Site :

The main Fiji campus of the USP is situated in the Laucala Bay area southeast of the capital, Suva. The total area of this campus is about 73 hectares, comprising 3 sub-campuses : an Upper Campus, Middle Campus, and Lower. Campus.

The Plan site occupies about 2.9 hectares on the east side of the Lower Campus, which contains the Institute of Applied Sciences (IAS), the Fiji Center for Extension study courses, and the existing facilities of the Marine Studies Programme (MSP), which is the target facility of the subject Plan.

2.2.1.2 Implementing Body :

The Plan is being implemented by the Ministry of Agriculture, Fisheries and Forest, and Counterpart for project implementation will be the University of the South Pacific (USP) .

2.2.1.3 Contents of the Request :

(1) Marine Study Facility		5,014.00m²
1) Teaching and Researching Areas		
a) Seminar Room	3 rooms	192.00m² (60/35/16)

b) Laboratory Station

Laboratory Station			20.00m² x 23
Associated Marine Organization			20.00m² x 6
Visitor s Research Laboratory			20.00m² x 1
c) Specimen Collection Room			40.00m² (8)
d) Computer Teaching Room		2 rooms	96.00m² (10/32)
e) Laboratory			
Physico-chemical Laboratory			218.00m² (50)
Biological Laboratory			224.00m² (80)
Seawater Laboratory			220.00m² (12/36)
f) Inorganic / Organic Laboratory			192.00m²
Chemical Storage		Preparation Room	
Isotope Room		Balance Room	
g) Microbiology Laboratory			72.00 m²
Incubator Laboratory		Autoclave Laboratory	
Dark Laboratory			
h) Attached Research Room			
Microscope Room	1 rooms	Analytic Laboratory	3 rooms
Balance Room	1 rooms	Clean Room	2 rooms
Oven Room	1 rooms	Fumecuboard Room	1 rooms
i) Post Harvest Laboratory			96.00 m²
Freezers Cool Room			32.00 m²
j) Chemical Storage		6 rooms	128.00 m²
Store Issue Area		Preparation Room	
Dangerous Chemical Store		Chemical Storage	
Clean Up Room		Equipment Store	
k) Lecture Theater			222.00 m²

2) Administration Area

a) MSP Director's Office / Secretarial Room	3 rooms	64.00 m²
Records Room		
b) MSP Director's Office / Secretarial Room	2 rooms	40.00 m²
c) Meeting Room		320.00 m²
d) Library	11 rooms	20.00 m²
e) Printing / Binding Room	1 rooms	20.00 m²
f) Publication Room	1 rooms	20.00 m²
g) Dark Room	1 rooms	20.00 m²
h) Electric Work Shop	1 rooms	20.00 m²

3) Common Room

a) Toilet / Tea Room	b) Elevator Machine Room
c) Gardener s Store	d) Machine Room
e) Entrance Area, Corridor, Store, Stair	

636.00 m²

(2) Workshop

a) Machine Work Shop	b) Electric Work Shop
c) Service Room	d) Boat Shed & Garage / Repair Shop
e) Diving Gear Store	f) Compressor Room
g) Field Equipment Room	h) Geology Preparation Room
i) Office	j) Living Room
k) Toilet / Bath Room / Locker Room	l) Machine Room

m) Storage

n) Others (Toilet / Corridor)

(3) Accommodation 729.00 m^2

1) Student Dormitory 20 rooms
2) Visiting Researcher Dormitory 5 unit
3) Recreation Room 1 unit

(4) Canteen 82.00 m^2

a) Dining Room
b) Kitchen
c) Pantry
d) Rest Area
e) Toilet & others

(5) Other Related Facilities

1) Mooring
2) Slipway
3) Seawater Tanks

(6) Equipment :

The equipment shown in the Request is intended to broaden the teaching and research capabilities at MSP. The items include laboratory equipment, oceanography research equipment, fishing gear, diving gear, equipment for post harvest fisheries, seawater laboratory equipment, audio-visual equipment, computer and network, equipment for workshop equipment, and vehicles. The main equipment items are as shown below:

1) Laboratory Equipment :

Muffle furnace, freeze drier, hot-plates, incubators, water distillation apparatus, water purifier, centrifuges, autoclaves, glassware washer, biological microscopes, stereo scopic microscopes, inverted microscopes, measuring instruments (for pH, DO, conductivity, salinity, temperature, and other items), electrophoresis apparatus, liquid chromatograph analyzer, ion chromatograph analyzer, gas chromatograph analyzer, spectrophotometers, fluorescent photometer, chime-luminescence photometer, atomic absorption spectro photometer, nuclear magnetic resonance spectrometer, X-ray fluorescent spectrometer, scanning electron microscope, flow injection analyzers, total organic carbon analyzers, electronic analytical balances, fume cupboards, laminar flow units, and other items.

2) Oceanography Research Equipment :

Water samplers, bottom samplers, plankton nets, CTDS, thermometers, salinometers, dissolved oxygen meters, fluorometer, current meters, depth gauges, echo sounder, other items.

3) Fishing Gear :

Tuna long-lines, vertical long-lines lures, bottom fishing gear, other trawl nets, glints, trawl nets, beach seines, cast nets, other items.

4) Diving Gear :

Regulators, tanks, diving monitors, buoyancy, masks, fins, snorkels, wet suits, gloves, boots, other items

5) Equipment for post-harvest fisheries:

Refrigerator, freezer, ice-maker, air blast freezer, processing table, work table, smoker, boiler, vacuum packer, other items.

6) Seawater lab. equipment :

Intake pumps, blowers, filters, UV sterilizers, water tanks, piping materials, other items.

7) Audio-visual equipment :

Overhead projectors, slide projectors, video projectors, video players, monitors, other items.

8) Computer and Network :

Computers for graphics, satellite communication systems, work stations, local area network (LAN)

9) Equipment for Extension Service:

Video cameras, microphones, controller, cabling, other items

10) Workshop Equipment :

Lathe, bench planner, cutting machine, grinder, welding machine, hand tools, other

11) Vehicles :

Forklift, pickup truck

12) Other Items :

Copiers, bookbinders, guillotine, print processors enlargers, vacuum cleaner, washing machine, other items.

(7) Research Vessel Single-hull steel research Boat 1 vessel

2.2.2 Consideration of the Request Items:

2.2.2.1 Required Functions of the Building Facilities :

The requested building facilities comprise the MS Center, a workshop, an accommodation, and a canteen. We shall now evaluate the need for the various facility functions by individual item.:

(1) MS Center:

A request has been made for an MS Center to play a core role in the educational, training, and research programs at MSP. It is to comprise teaching and research rooms, administration rooms, and common areas with a multiplicity of functions.

We have assessed, as follows, the requirements for the functional areas to be incorporated in this Center.

1) Teaching and Research Areas

a) Seminar Rooms :

Since lectures related to MSP programs will be closely tied to MS Center functions, such as the requirement for practical laboratory instruction and specimen collection, they will presumably take place whenever possible at this Center. In the Request document, 3 separate seminar rooms of varying sizes have been requested to permit selection based on attendance.

Education being one of the most important functions of the MSP, these seminar rooms are absolutely vital to the smooth conduct of the courses. Considering the wide range in class sizes, it has been deemed necessary that different size rooms be provided to enhance the effectiveness of the lectures.

b) Laboratory Station :

Private rooms have been requested for research and administrative activities to accommodate MSP staff, staff from related organizations, and visiting researchers and scientists.

At MSP's existing research / administrative facilities, separate offices have been provided at the Lower Campus facility for the MSP Director, researchers, MSP staff, and personnel from the International Ocean Institute (IOI) and other international organizations in the marine field. In the dry lab, research and office desks have been provided for 4-5 post-graduate students and researchers, along with about 10 rooms at the Upper Campus for research use. The requested rooms have been deemed to be essential as focal points for daily research and administrative activities involving the MSP office staff, faculty and research staff, visiting researchers, and personnel from related organizations.

c) Specimen Storage Room :

While facilities have been provided at the present MSP complex for the storage of specimens collected in the course of the Programme's diversified marine education, training, and research activities, the area devoted to this purpose is very confined, making proper organization, classification, and storage quite difficult. At the USP as well, as part of its research program, the Center of the South Pacific Regional Herbarium stores fauna and plant specimens collected throughout the South Pacific, which is said to be the world's largest such coverage area. Although this facility was renovated in 1988, based on aid from New Zealand, as a result of the active research program that has developed over the seven years that have passed since the remodeling was completed, this storage area has not only become exceedingly cramped but is now being used for both storage and research purposes. Furthermore, in many instances, the work flow actually runs through the storage areas, creating serious functional problems as a specimen storage facility. A pressing need has, accordingly, developed for a new specimen area, which would consolidate in one location all specimen varieties, which are now being stored in separate rooms, thereby rationalizing the entire storage function.

As one of the major fruits of research activity, specimen collection and storage play an important role at USP. Specimen observation is an indispensable part of the practical training courses, and the opportunity to view specimens covering many fields provides a very meaningful benefit to students and researchers alike. It has been determined, therefore, that a specimen room should be incorporated in the subject Plan.

d) Computer Teaching and Research Lab.:

This facility is to be used as a computer training and research area, comprising both classrooms for undergraduate students and research rooms for researchers and post-graduate students. This area is not intended simply to teach computer operations or science but rather to provide guidance in data compilation based on the entry and output of computer-processed data, as well as in data processing, referencing, and computer graphic techniques so as to provide practical instruction in effective data collection, analysis, and processing, as required by each specialized field. Along with the development of computer science and the diffusion of equipment, various applications will become possible for various academic disciplines. Thus, considering the need for training geared to specialized fields, it has been determined that the subject functions are required.

e) Research Laboratories :

A request has been made for three types of research laboratories, all geared to practical training courses. a Physico-Chemical, Biological, and Seawater Lab..

At the USP, 3-5 hours of laboratory work are scheduled per week for courses in the Natural Sciences Department, and about 1 hour per week in the Sociology Department, and so teaching laboratories are needed in this connection.

These research laboratories should be differentiated, with facilities and equipment adapted to the specific requirements. Based on the training curricula, it has been determined that a considerable need exists for the three types that have been requested : viz., a Physico-Chemical, Biological, and Seawater lab..

f) Inorganic /Organic Laboratory

The Institute of Applied Science (IAS), a research organ of the USP, conducts high-level precision analyses not only for the University itself but also for outside clients. Since the work of the MSP duplicates that of the IAS in analyzing marine life, coral rock, bottom materials, and water quality, an analytical facility for organic and inorganic materials has been planned with a view to raising the productivity while reducing the cost of research activity by incorporating a portion of the duplicated IAS functions into the new Plan facility. A chemical store, an isotope room, a balance room, and a preparation room have also been requested as attached facilities.

Considering the need for the effective and efficient conduct of the diversified analytical procedures expected of a world-class research and teaching institution, the requirement for the requested analytic facility at MSP has been confirmed.

g) Microbiology Laboratory:

This facility will serve as a microbiology research lab, as incorporated within the target research fields at MSP. A dark lab, autoclave, and incubator room have been requested as attached facilities.

The subject lab is closely related to research on the environment, marine resources, and food processing, making it indispensable to the MSP research program. The need for this facility has, therefore, been firmly established.

h) Attached Research Facilities :

As adjunct rooms containing specialized equipment for joint use by researchers, a request has been made for a microscope room, balance room, oven room, clean room, fumecopboard room and analytic laboratories.

In the case of the microscope room, protection must be provided against vibration while, in the balance room, where precision weighing is to be done, special consideration must be given to preventing not only vibration but also excessive convection. We have, therefore, determined that both these rooms should be independent facilities. The other rooms contained in the Request (oven

room, clean room, fumecopboard room, and analytic lab), which are required to provide specialized support equipment to enhance the effectiveness and flow of research activity, have also been deemed appropriate.

i) Post-harvest Laboratory:

This facility is intended primarily for fish processing and for education program in collaboration with MSP. The Request specifies a freezer/coolroom along with a post-harvest processing lab. The post-harvest lab will be geared to the effective utilization of fish resources in edible form, which is positioned as a particularly essential field in future research and development throughout the South Pacific region. It has been concluded, therefore, that the request for the freezer / coolroom, for maintaining the freshness of fish targeted for processing use, juxtaposed to the post-harvest lab is fully justified.

j) Chemical Storage: :

Certain dangerous chemical stores and reagents used in the research and analytic laboratories will require careful handling and storage, owing to their combustibility, toxicity, and/or narcotic properties. A request has, therefore, been made for a chemical store to store and control such special products, along with a storage area for related equipment, a cleanup room, a preparation and an store issue office.

The USP has already introduced a strict system of controls and storage for chemicals so as to ensure the smooth and safe conduct of its teaching and research programs. This comprehensive system has proved to be highly effective and indispensable, and so it has been determined that the subject facilities, as requested in conformity with the USP system, are both appropriate and necessary to the present Plan.

k) Lecture Theater :

A lecture theater, with a capacity of 200 persons, has been requested for lecture diploma on tropical fisheries by MSP, joint MSP seminars, university-oriented lectures, and as a venue for international conferences.

The present facilities for large-scale seminars at USP comprise three areas: a 290-seat seminars room in the Lecture theater, completed with assistance from the U.K. in 1978; a 135-seat seminars room in the building housing the School of Social and Economic Development Building, completed in 1982 with aid from Australia; and a 108-seat seminar room in the School of Pure and Applied Science Building, built with Canadian assistance in 1973. These large halls are being used for a total of 17 courses, each targeted at 150 students or more, with lecture time totaling more than 40

hours per week. Usage of the lecture theater, in particular, exceeds 70% of capacity, imposing serious constraints on the organization of large classes and joint seminars. These large seminar facilities, moreover, are all concentrated on the Upper Campus, and so MSP, which is scheduled to move the bulk of its lectures to the Lower Campus, is quite concerned about the inevitable inconvenience and constraints in scheduling joint seminars or lectures with a large attendance. The MS Center to be provided under this Plan is being positioned as a core facility on the USP Lower Campus. Thus, the benefits of a hall accommodating joint seminars and large classes as well as international conferences will not only accrue to MSP but will also contribute in a major way to improved class scheduling throughout the USP. From this standpoint, the provision of a large lecture hall in the MS Center accommodating 200 persons, which is presently lacking on the USP Lower Campus, may be deemed highly significant to the project.

2) Administration Areas :

a) Executive Offices :

The Request calls for a private office for the MSP Director, the Director of the Analytic Laboratory, secretarial services rooms for the clerical staff and record room for the storage of students and staff members' records.

There rooms, which will accommodate the general manager of MSP, the manager in charge of analytic operations, and the secretarial staff, will be the nucleus of MS Center operations and so are considered essential and appropriate for the subject Plan.

b) Library :

The library facility will serve all individuals concerned with the MSP organization, including undergraduate students, post-graduate students, researchers, and faculty. It will comprise a reading room, stack area, issue desk, audio-visual user area, and workroom.

A large collection of specialized materials, books, documents, and dissertations on marine subjects has accumulated over the broad spectrum of the educational, training, and research activities carried out to date at MSP. These collections are housed partly at the Main Library of USP for use by the general student body and are also spread among the various libraries, document rooms, and research locations within the MSP facility. However, this scattered storage arrangement has created serious inconvenience in classifying, organizing, and perusing the subject materials. Since the primary users of these specialized marine materials are persons connected with MSP and considering, in the case of the materials stored in the main USP library, the distance between the Upper and Lower Campuses, it is feared that, under the present setup, serious problems will

develop in accessing these reference materials after the new MSP complex is completed. It is felt, accordingly, that centralized storage of marine-related materials is a vital function in facilitating their productive use in MSP study and research programs.

e) Other Rooms :

The Request specifies various other rooms at the MS Center, including a printing and binding room, publication room, dark room, and an electric workshop. These areas are required for PR activity, publishing, preparation of teaching materials, and for maintenance checks on precision machinery. We concur that all of the proposed rooms are necessary to the smooth conduct of research activities as well as for supporting educational programs at MSP. Although not included in the original Request, we have elected to include an additional small meeting room for liaison between MSP and officials of related organizations, which has been deemed necessary to the effective conduct of the Center's research and teaching programs .

3) Common Areas :

The common areas in the Request include a tea room , toilets, gardener s store a storage room for cleaning equipment, a second storage room, a room for electrical switchboard, and an elevator for handicapped persons and moving research equipment, with an adjacent machinery room. All of these rooms are deemed indispensable for optimizing operations at the MS Center.

(2) Workshop:

This facility has been requested to support MSP's wide-ranging educational and research programs in the marine field. The specific rooms required are a machine workshop, compressor room, electrical workshop, garage, boat shed / repair shop, diving gear store, field equipment room, geology preparation room, nap room for the night watch, various storage areas, machinery room, showers, lockers, and toilets.

All of the above rooms are needed, as a supplementary function of the MS Center, to conduct light repairs and maintenance checks on facilities, installations, vehicles, vessel equipment, research equipment, and other items. They can therefore, be termed indispensable in relation to the size of the facilities and equipment inventory at the planned MS Center.

The nap room for night watchmen is considered essential both as a nighttime security facility for the entire complex and for assisting in night mooring operations at the jetty and guarding the research vessel when at anchor.

A need has also been confirmed, as support facilities for the Center's diverse research activities, for a machine room to store electric generators for maintaining power supply during blackouts, a shower and lockers room for divers, toilets for common use, and storage areas.

(3) Accommodation:

The Request includes an accommodation building incorporating a student dormitory with 20 rooms for matriculated undergraduates and post-graduate students as well as 5 apartment units, equipped with bath, toilet, and kitchen, for use by visiting researchers; a kitchen, pantry, and recreation room (including a laundry area) for breakfast and rest periods.

Current enrollment at USP is about 3,300, of which some 2,000 students are said to originate from abroad or other parts of Fiji. The number of rooms required at the dormitory, then, can be estimated at a minimum of 1,500. Against this demand, the present dormitory facilities comprise only about 600 rooms and so are unable to meet current needs. While the USP recognizes an urgent requirement for 300 additional rooms, on which construction is now underway, it is anticipated that, owing to fiscal constraints, no more than about 50 rooms can be completed by next year.

As of 1995, MSP had a total of about 300 students, accounting for some 10% of total USP enrollment, of which postgraduate students totaled 18, representing a steady annual increase from the 12 students recorded in 1992. By 1998, the year the Plan facilities would be completed, assuming project implementation, postgraduate enrollment is expected to increase still further to about 30 students. Judging from the serious deficiency in student dormitory facilities at USP, the request for 20 additional dormitory units, targeted at matriculated undergraduate and postgraduate students, represents a reasonable requirement, and so these new accommodations can be expected to be effectively utilized after completion.

With regard to the accommodations for visiting researchers as well, at the present time, there are only 80 accommodation unit on campus for the 300 employees of USP. While another 120 persons or so can be accommodated in rented quarters near the campus, there remains a particularly acute shortage of family accommodations for visiting researchers. Although a construction program is currently underway to increase the supply of on-campus rooms for these visitors, it will be difficult, for fiscal reasons, to complete these quarters by the next fiscal year. It is essential to the continuing development of the MSP research and teaching programs that outstanding researchers be invited to take up residence at the university. Thus, the request for 5 units in the new accommodation is felt to be most necessary and appropriate, considering the chronic shortage of staff housing at USP.

(4) Canteen :

A canteen has been requested, comprising a dining room, kitchen, pantry, and dressing room / rest area, to provide meal and snack service to students, staff members and visiting researchers residing on the Lower Campus or at the accommodation.

At the present time, a canteen is operated on the Upper Campus, serving meals and snacks to students and staff, but no such facility is available on the Lower Campus. After completion of the MS Complex, a considerable complement of students and staff will be staying on the Lower Campus, generating a need for canteen service, particularly for students in residence at the dormitory. Thus, the request for a canteen is deemed appropriate.

(5) Other Related Facilities :

a) Mooring Jetty :

Water depth at the existing mooring jetty is about 2 m, which will make it difficult to moor the research vessel during ebb tide periods. As a result, mooring and unloading operations will have to be confined to high-tide periods, with the vessel regularly anchored offshore in service-ready condition. However, safe water depths can be obtained offshore about 15m - 20 m from the end of the existing dock, and so a request has been made for installation of a pontoon jetty extending out to the safe-depth point.

Based on the water survey, even a 300 m extension from the end of the existing jetty to the point where safe depths can be obtained would not be sufficient. In addition, since the Plan site is continuously subject to the predominant southeasterly trade winds, a simple pontoon jetty would make it difficult to secure a safe mooring area. If, on the other hand, a fixed jetty were to be built, the benefits derived from just a single research vessel would be too small to justify the considerable construction cost. For the preceding reasons, since the existing jetty is still amply serviceable, though its use would necessarily be confined to high-tide periods, both the pontoon and fixed jetty have been eliminated from the subject Plan.

However, inasmuch as the mooring position and crown pavement at the end of the existing jetty show marked superannuation , we have determined that there is a need for repair work in this area.

b) Slipway :

The small boats owned by MSP landing at the public slipway adjacent to the southern edge of the property, sharing use of this facility with a neighboring marine training facility and private pleasure craft. However, because of the overlapping use of this slipway, waiting times can be protracted, and the absence of a pulling winch facility is most inconvenient. A request has, therefore, been

made for construction of a new slipway, exclusively for MSP use and fitted with a pulling winch, on the south side of the existing jetty.

MSP presently has 5 small vessels that use the slipway for unloading and storage, but these boats do not all operate on a daily basis. On weekdays, when most of the MSP vessels operate, there is presumably very slight competition from private recreational boats. In addition, with regard to the requested installation of a pulling winch, it may be noted that the bulk of users tend to use a vehicle to drag the cradle to the storage area. And since the target vessels are lightweight, it is difficult to conclude that the winch facility is particularly crucial. Accordingly, the slipway and pulling winch installations have been eliminated from the subject Plan.

Nevertheless, we have determined that, in order to secure easy access between the public slipway and the Plan site, it will be necessary to provide an access slope together with a safety gate.

c) Seawater Tanks :

At present, MSP's seawater supply for experimental use is carried, as required, from clean offshore waters, to use the closed circulation method. In the past, seawater was taken directly via intake pipes from the water in front of the facility but, since saline density would often drop considerably, particularly during the rainy season, while the pollution of adjacent water supplies from local sewage prejudiced experiments requiring clear seawater, this method has had to be abandoned. Consequently, since offshore seawater will continue to be used even at the new facilities, a seawater storage tank has been requested.

A supply of experimental seawater will be essential to research activities at the new MS Center for use in breeding experiments and studies on fish and other forms of marine life inhabiting the surrounding waters. This water will also be important to students as teaching material for ecological observation courses. It has been determined, therefore, that a seawater tank facility is essential for these purposes.

While use of stored seawater is, admittedly, not desirable in research experiments, practically speaking, since the logistics do not permit reliance on seawater in front of the Plan site, we have concluded that the storage method must be accepted as the next best alternative.

However, depending on the type of experiment involved and the particular season, it may be possible at times to utilize the front seawater as well. In this connection, we plan to supply two storage tanks - one for seawater brought in from offshore and the other for water drawn from the area in front of the Plan site. In this way, the optimum seawater source can be selected, depending on the intended application, thereby reducing the cost of seawater cartage.

2.2.2.2 Required Functions of the Equipment :

(1) Laboratory Equipment :

The equipment that has been requested for the research laboratories embraces a large spectrum of products, ranging from such general-use equipment as dryers, heaters, autoclaves, distilling apparatus, centrifuges, incubators, washing equipment, and optical instruments, to analytical equipment such as chromatographs, electrochemical, spectrophotometric, electromagnetic analyzers and extending from simple equipment for use in student experiments to research equipment of considerable sophistication. Considering the fact that MSP is a university whose functions embrace both education and research, one can readily appreciate the need for all of the desired equipment.

However, because the requested laboratory equipment covers so broad a spectrum, in the subject Plan, we have given priority to expanding MSP's teaching capabilities, providing laboratory equipment that is deemed indispensable to the school's curriculum. While the following items of analytical equipment in the Request are indeed required for the expansion being undertaken at MSP in its teaching and research programs, we feel that it would be appropriate to reconsider these items at the stage when a specific practical usage plan has been developed.

- instruments related to air pollution measurement (air sampler, chemi-luminescence spectrophotometers),
- Nuclear magnetic resonance spectrometer,
- X-ray fluorescence spectrometer,
- Scanning electron microscopes and related instruments (e.g., ultra-microtomes, critical point dryer, high vacuum pump and sputterer),
- Fourier transform infrared spectrophotometers,
- Spectrofluorophotometer,
- Gas chromatograph with mass spectrometers,
- High performance liquid chromatographs,
- High performance ion chromatograph,
- Total organic Carbon Analyzers,
- Flow injection analyzers

(2) Marine Survey Equipment :

Marine surveys are one of the most basic and important research areas in the MSP research program, offering its students numerous opportunities for practical training.

The requested equipment comprises items, such as specimen collection gear and water quality

measuring instruments, that are all vital to marine research. In selecting this equipment, we have divided the items into two groups : sophisticated equipment targeted at researchers and simple equipment for student training purposes. With respect to the latter, we feel it would be appropriate to stress water quality measuring instruments for use in future on-vessel training exercises, such as the measurement of salinity, pH, and dissolved oxygen .

(3) Fishing Gear and Equipment :

In most of the USP member countries, fisheries development has been positioned as the pillar of national development plans. Thus, one of the most critical tasks at MSP is to provide systematic fisheries education to students who are expected to assume future national leadership.

The requested fishing gear are deemed necessary to the BI307 fisheries training curricula as well as for specimen collection use in connection with both teaching and research programs. Among the Requested items, scientific sounder system is geared mainly to gaining an understanding of the resource size of relatively large fish school, but is unsuited for use in low-latitude tropical waters characterized generally by a large variety of low-volume biomasses. In addition, since the scientific sounder system uses highly sensitive transducer, it is sensitive to noises and so not appropriate as rigging on short vessels, such as the research vessel included in this Plan, which can easily pick up captivation noise from the propellers. As a result, in our judgment, it would be proper to specify ordinary color fish-finder for this project. Moreover, the depth measurements, which are vital to marine surveys, can also be accomplished using this color fish-finder.

(4) Diving Gear :

At the MSP, diving surveys are frequently conducted both as part of the student training courses and as a standard research method in such fields as biological and ecological studies and specimen collection in lagoons and shallow water areas. Thus, diving gear is indispensable to MSP activity.

However, USP presently has no equipment for refilling cylinders with compressed air and so must rely on outside contractors in Suva for this service, which constitutes a burden in terms of both cost and labor. The requested equipment, comprising replacements for the present diving gear, which has reached the end of its usable life, as well as equipment for compressed air refills, has been deemed to be appropriate. Engine-driven refilling equipment is available at the Field Station on Dravuni Atoll and is presently being used by students and researchers for this purpose, but as the engine is superannuated, making maintenance difficult, it would be proper to provide replacement equipment under the subject Plan.

(5) Equipment for Post-harvest Fisheries :

The development of fish processing capability is vital to all Pacific countries, both as a means of adding value to their limited resource base and from the standpoint of effective resource utilization.

MSP plans to implement research, teaching, and training programs in post harvest fisheries, based on a technical collaboration with SPC in this field. The requested items are felt to be important for practical training on the principles of post-harvest fisheries, such as proper fish handling methods after catch, the usefulness of low-temperature storage to maintain freshness, and food processing techniques. Apart from the requested size of certain items, we have confirmed the appropriateness of the desired equipment.

(6) Seawater Laboratory Equipment :

The quality of the water in front of the MSP complex is not necessarily suitable for conducting rearing experiments on marine life, owing to a conspicuous drop in salinity during the rainy season and the impact of mud entering the area from the Vatuwaqa River and other sources.

For this reason, a plan has been proposed to permit cultivation based on a closed circulation system, equipped with a cooling device for storing 50 - 100 m³ of offshore seawater in a tank. However, it was felt that this approach would not be suitable, owing to the excessive operating costs that would be entailed.

An alternate system was then proposed for installing an intake facility offshore, but, in that case, in order to obtain water of stable quality, the intake pipe would have to be extended at least to the vicinity of the reef, resulting in a length of over 1,000m, which was deemed to be quite impractical. The capital investment and operating costs involved in building a full-scale facility at the present MSP site for the experimental rearing of marine life would be very high, and so inappropriate for this Plan. On the other hand, we recognize the vital importance to MSP activities of a rearing facility for fish and other forms of marine life inhabiting surrounding waters for both research purposes and to provide teaching material for students, and so sea water intake and rearing facilities are definitely required at the Plan site.

It has, accordingly, been determined that, except for the seawater circulation and filtration system, the requested items of equipment is generally appropriate, though the functions and scale of the planned facilities must necessarily be limited. It is, thus, desirable that the plan for a full-scale aquaculture experimental station at MSP be made the subject of a future project.

(7) Audio - visual Equipment :

The requested items of audio-visual equipment, as validated through the discussions, have been found to be proper and necessary for use in lectures and for self-study.

(8) Computers and Local Area Network (LAN) :

The USP Computer Center is presently equipped with 3 mainframes and individual work stations that are linked in a university-wide LAN system. In the case of MSP, however, which is located on a detached site, the LAN connection is via public telephone circuits, resulting in slower communications and inconvenience. The Request seeks to improve access by linking the Plan facilities with the LAN via optical cable and, considering striking advances in computer communications, this request is felt to be entirely proper.

The LAN system to be provided under this Plan is to run from the border of the MSP site to the interior of each facility, with the Fiji Government furnishing the cable facilities, via a public roadway, from the MSP site boundary to that of the Upper Campus, and the USP providing the facilities from the Upper Campus line to the Computer Center along with the hookup to the existing LAN. With respect to the workstation terminals, the number shown in the Request document is considered proper and so will be reflected in the subject Plan.

(9) Equipment for Extension Service :

USP seeks to establish an extension service system whereby students residing in the other member countries will be able to attend lectures via satellite communications. In order to realize this plan, a request has been made for installation of reflex equipment in the various MSP classrooms, which would be connected to the USP Media Center, thereby enabling students in remote areas to participate in class instruction.

However, the present state of the correspondence course program is primarily based on traditional methods, involving the shipment of textbooks and teaching materials recorded on video-tape. Even on the Upper Campus, not all of the classrooms are equipped with even this conventional equipment. Since the extension service program is a university-wide project at USP, at the present juncture, there would be little to gain from installing such equipment only at MSP. Accordingly, in the subject Plan, empty piping will be placed in the classrooms to facilitate future wiring work as and when equipment for satellite communication is installed. However, no special equipment for this purpose will be included.

(10) Workshop Equipment :

The requested workshop equipment comprises the machinery and hand tools required to maintain the Plan research vessel, the existing MSP boats, outboard motors, and research equipment as well as the preparation of teaching materials and fishing gear, as needed in the practical training programs. All of these items are required to support MSP activities and so have been deemed appropriate for the Plan.

(11) Vehicles :

The requested vehicles include a pickup truck and a forklift. The pickup has been deemed necessary for the transport of people and equipment in connection with periodical field surveys on shore environmental quality. The forklift is considered necessary for loading and unloading diving gear, oceanography research equipment, fishing gear, and other heavy items on or off the research vessel. However, this item will not be included in this project, since it is assumed that, at the present stage, operating frequency will not be sufficient to keep it in regular use.

(12) Other Items :

In addition to the above, the Request also calls for dark room equipment, office equipment, domestic appliances, and furniture. While the necessity for all of these items has been recognized, bookbinders, vacuum cleaners, and coin-operated washing machines are best acquired locally, as required, and so have been excluded from the subject Plan.

2.2.2.3 Required Functions of the Research Vessel :

The type of survey vessel shown in the original Request had a twin-hull design. This type of vessel would provide an adequate deck area with a sufficiently shallow draft to conduct shallow-water surveys in lagoons and similar areas and permit moorage at the existing jetty, which is located in shallow water. However, as the twin-hull style has had only limited experience in marine research projects, while there is concern also over its seaworthiness on the high seas, a single-hull vessel was recommended and approved as the optimum design for satisfying the basic conditions set forth above. The Request originally set the cruising range of the new vessel at 1,000 nautical mile, but discussions were held with a view to initially confining operations to Fiji waters. While a cruising speed of 12 knots had been requested, it was decided that the Basic Design Survey Team would determine this speed, based on the use of an engine with an economical horsepower. The Request was later modified to increase the maximum crew complement from 5 to 6 persons, while also increasing researcher boarding capacity from 4 to 6 persons.

2.2.3 Examination of the Plan Scope :

2.2.3.1 Scale of the Rooms and Facilities :

In this section, we shall consider the scale of the rooms and facilities to be deployed within the MS Center, workshop, accommodation, and canteen, as required for the "The Project for the Construction of The Marine Studies Facilities, the University of the South Pacific", based on the USP Request.

The USP is a regional university, with facilities dispersed over several of its constituent countries. When implementing a facility plan, the USP makes a strenuous effort to achieve parity in construction standards at all locations. To avoid any regional disparities in facility specifications, the university applies its own standards with regard to such items as floor area, ceiling height, indoor lighting, and air conditioning equipment. It is a basic premise in connection with the Plan facilities as well that these standards will be scrupulously observed.

We have applied the following procedures in determining room sizes, with due regard for the basic conditions set by the USP.

a) Establishing the functions, occupancy, and required fixtures for each area.
b) Calculating required floor areas from USP standards and, in the case of rooms not covered by these standards, computing the necessary floor area on the basis of fixture layout and proper flow space.
c) Verifying the appropriateness of the computed floor areas in terms of the laws and regulations related to the calculation of floor areas as well as a comparative evaluation of similar facilities.
d) Setting overall facility size after adding an allowance for corridors, entrance areas, and other common space to the total calculated floor area.
e) subject Plan, making suitable space allowances for existing equipment as well as possible additional equipment in response to future changes in the nature of the teaching and research programs.

(1) MS Center :

The required areas, functions, occupancy levels, and number of rooms for the facilities to be incorporated in the MS Center are as shown in Table 2.2.3-1.

However, two of the required areas for the post-harvest lab and the storage of dangerous chemical stores are to be segregated in a separate "Annex". Furthermore, it is planned to locate the machine room in an Attached, owing to the vibration and noise that will be produced by the generator that is

to be housed in this room.

In the case of the processing facility, it is feared that foul odors and irritating noise may develop during the experimental stage, while, with regard to the chemical storage facility, special controls will be required to ensure safety from foul smells or the combustible nature of the chemicals to be stored.

Also, in the case of the lecture theater, owing to the need for relatively wide spans and high ceilings and the difficulties that would be encountered in fitting the theater specifications into the span width and floor height plans for the MS Center, it is planned to locate this theater in its own building.

Table 2.2.3-1 The required areas, functions n the MS Center

Name of Room	No.of psn/Room	No.of Room	Function
MS Center			
1) Seminar Room			
a) Seminar Room	60/35/16	1	Classrooms for seminars and lectures are to be built in 3 different sizes.
b) Laboratory Station			
Laboratory Station	1-2	18	These are private research rooms for use by faculty members and MSP researchers
Associated Marine Organization	1-2	6	These are private research rooms for use by related organizations.
Visitor's Research Laboratory	1-2	2	These are private research rooms for visiting researchers.
c) Specimen Collection Room			This will be a specimen storage room, comprising storage areas for marine species, algae, corals, and flora, together with a research preparation room.
d) Computer Teaching Room	32	1	This will be a classroom for instruction and training in data analysis and information processing.
Computer Lab.	8	1	This is a research room for graduate students and researchers.
e) Laboratory			These are laboratory facilities to support teaching and
Physico-chemical Laboratory	50	1	research activities.
Biological Laboratory	50	1	
Seawater Laboratory	-	1	
f) Inorganic / Organic Laboratory			This is an analytical research facility composed of
Chemical Storage	-	1	2 main research rooms and 4 attached rooms.
Preparation Room	-	1	
Isotope Room	-	1	
Balance Room	-	1	
g) Microbiology Laboratory			This is a laboratory composed of a main research
Incubator Laboratory	-	1	room and 3 attached rooms
Autoclave Laboratory	-	1	
Dark Laboratory	-	1	
h) Attached Research Room			For operating specialized equipment and conducting
Microscope Room	-	1	research activities in support of teaching and
Balance Room	-	1	research programs.
Oven Room	-	1	
Analytic Laboratory	-	3	
Clean Room	-	1	
Fumecuboard Room	-	1	

Name of Room	No.of psn/Room	No.of Room	Function
2) Administration Area			These are administrative offices for the MS Center.
a) MSP Director's Office / Secretarial Room		1	
b) Director's Office / Secretarial Room		1	
c) Meeting Room	18	1	
d) Library	50	1	
e) Printing / Binding Room	-	1	
f) Publication Room	-	1	
g) Dark Room	-	1	
h) Electric Work Shop	-	1	
3) Common Area Rest Area, Tea/clean room (for heating water and Storing cleaning utensils), Elevator Machine Room, Machine Room, Storage Area, Entrance Area, Corridors, Stair			
Annex Building			
1) Post Harvest Laboratory		1	A laboratory composed of a post-harvest processing
Freezers Cool Room		1	laboratory and an attached freezer/cool room.
2) Chemical Storage			This is a special storage area composed of an store
Store Issue Area		1	issue room, 4 chemical store, a cleanup room,
Preparation Room		1	equipment store, a preparation room and Machine
Dangerous Chemical Store		2	Room.
Chemical Storage		1	
Clean Up Room		1	
Equipment Store			
3) Machine Room			
LECTURE THEATER			This will be a large lecture hall plus a lecture preparation room, acoustical control room, and Equipment Store to be used for MSP large classes, joint seminars, and international conferences.
1) Lecture Theater	200	1	
2) Preparation From]			
3) Common Area Toilet / Equipment Store / Entrance Room / Corridor			

1) Teaching and research area:

a) Seminar Room

The request calls for 3 class rooms holding 60 / 35 / 16 persons. However, the largest seminar occupancy will be 97 persons, as calculated from the hourly distribution of current courses. There are 2 overlapping courses, in which the number of students was 37 and 17 respectively.

The Plan calls for one seminar room accommodating 96 persons, which can be divided in to two sections, based on the number of students, via movable partitions. The required floor area of the 96 seat seminar room has been calculated at 144.00m^2, based on the USP space standard unit area of 1.50m^2 per student.

The calculated floor area will be ample for conducting seminars, even after allowing for the placement of the necessary fixtures and lecture dais, along with adequate flow space.

The layout plan for the seminar room is shown in Figure 2.2.3-1.

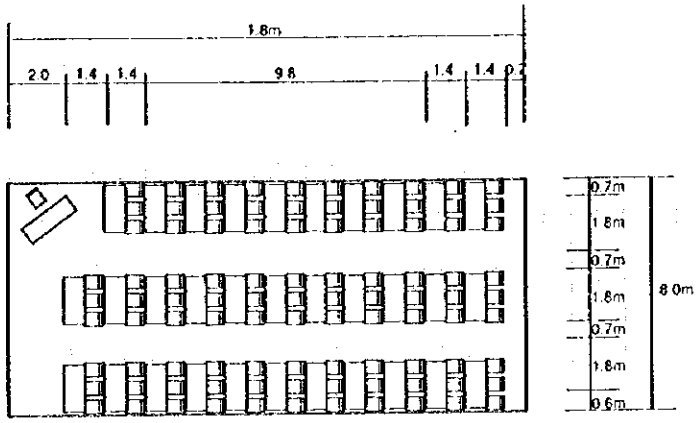


Figure 2.2.3-1 Seminar Room

b) Laboratory Station :

The Request anticipates that the Plan facility will have to accommodate 23 MSP staff members, 6 persons from related organizations, and a visiting researcher, creating a requirement for 30 research rooms.

The MSP staff currently comprises 2 professors, 2 managers/ coordinators, 11 lecturers, and 3 technical officers, for a total of 18 persons in all. In addition, 6 officials are to be accommodated from affiliated organizations, such as IOI, PIMRIS , and IAS, along with 2 - 4 visiting researchers from related programs, plus specialists from IOI and Japan. Since all of these individuals are necessary to the Center's teaching and research programs, the requested figure of 26 rooms is felt to be appropriate.

The requisite floor area for the research rooms and offices as well as the research laboratories has been established, as follows, in accordance with the upper limit of the unit floor areas set at by function and by researcher s status shown in Table 2.2.3-2.

Table 2.2.3-2 USP space standards

Name of Room	Space standards	Name of Room	Space standards
Head of School	20.00m²	Biology, Physics & Chemisty	10.00m²
Professorial	18.00m²	Engineering	12.00m²
Assoc. Professor	14.00m²	Computing Science	6.00m²
Senior Technician	8.00m²		

So that the requested Laboratory Station can respond flexibly to use by various classes of researchers, resulting from changes or reassignment, the plan is to attach a small research laboratory to each Laboratory Station, providing a room area of 20.00m².

The requested room size of 20.00m² is deemed to be sufficient, after allowance for fixture placement and flow space. The layout plan for the Laboratory Station is shown in Figure 2.2.3-2

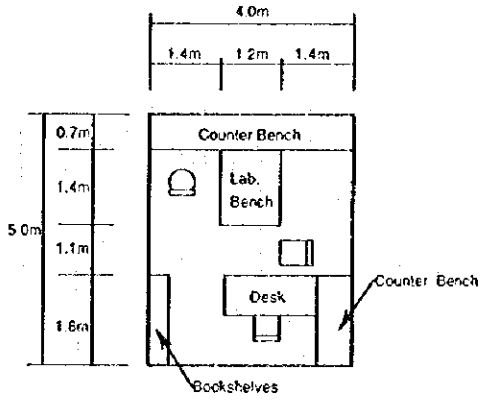


Figure 2.2.3-2 Laboratory Station

c) Specimen Collection Rooms :

This facility is intended to consolidate in one location the marine specimens that are presently scattered among the existing MSP storage areas and various research rooms as well as in the fauna collection now stored in the USP Herbarium.. The requested floor area is 442.00m². The present marine specimen room at MSP has a floor area of 86.00m² and contains about 15,000 specimens stored in a rack format. The total space devoted to specimen storage in the various research offices may be estimated at about 50.00m². The Herbarium contains about 40,000 specimens, covering a floor area of 81.00m², with the specimens stored in cabinets.

Since there are no floor area limitation in the USP space standards for specimen storage areas, this requirement has been calculated on the basis of the volume of specimens to be stored.
The existing storage areas are all already cramped, with the marine collection expected to increase steadily in the years ahead. We have, therefore, set the space requirement for the specimen storage room at about 322.50m², which is 50% larger than the sum of the existing storage areas (165.00m²) plus the individual storage rooms (50.00m²). In addition to the above space, there is a need for an attached anteroom, research room, and preparation room to provide adequate working space for 5 persons each in the marine and fauna specimen areas. Based on the USP unit floor area standard of 6.00m² per person in research and preparation rooms, the required floor area for these attached rooms becomes 60.00m². The resulting total of 382.50m² is slightly less than the area requested (442.00m²), but this amount of space is deemed appropriate for the subject facility. Allowing for their placement, along with suitable flow space, the required room area has been set at 384.00m².
The layout plan for the specimen storage area is shown in Figure 2.2.3-3.

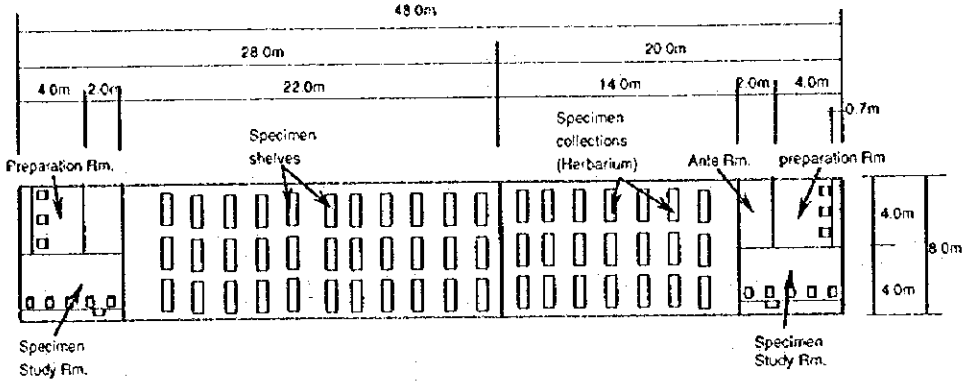


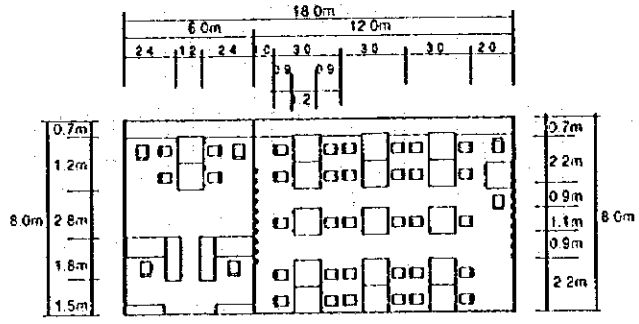
Figure 2.2.3-3 Specimen Collection Rooms

d) Computer lab. and Teaching Room :

These areas are intended to provide guidance in computer data compilation, input, and output, as well as in tabulation, referencing, and graphic processing, with training to be given on computer techniques for efficient collection, analysis, and processing geared to the requirements of each specialized field.

The Request calls for a computer lab., with a floor area of 40.00m^2, accommodating up to 8 persons (graduate students and researchers). Fixtures for this facility will include a computer table and bench. The computer teaching room will have a floor area of 96.00m^2, capable of accommodating up to 32 students. The fixtures are to include 16 computer table and chair sets, to be used by 2 persons each.

The unit floor area for laboratory has been set at 6.00m^2 per graduate student or researcher, which is the upper limit of the USP space standard, while that for the seminar room is 3.00m^2 per undergraduate student. However, after allowing for fixture placement and flow space in the computer lab, the requested area of 40.00m^2 has been found to be insufficient. We have, therefore, set an area for this room of 48.00m^2, based on the USP standard values. But the teaching room area shown in the Request (96.00m^2) appears to be reasonable. The layout plan for the computer lab. and teaching room is shown in Figure 2.2.3-4.



Computer Lab. Computer Teaching Room

Figure 2.2.3-4 Computer lab. and Teaching Room

e) Research Laboratory :

Three types of laboratories have been requested: a physico-chemical, biological, and seawater lab. The anticipated capacity of the physico-chemical and biological facilities has been set at 50 persons each, with a desired floor area of 224.00m^2, including a preparation room. Fixtures will include a lab table and chairs. The seawater lab is intended for graduate students and researchers, with a requested floor area of 224.00m^2, including a preparation room.

The requested floor area for the physico-chemical and biological labs is set at 4.00 m^2 per student, which is at the upper limit of the USP standard for this class of facility. Allowing for the necessary fixtures and proper flow space, the 224.00m^2 figure that has been requested, including preparation rooms, has been found to be appropriate. The layout plan for the lab. facilities is shown in Figure 2.2.3-5.

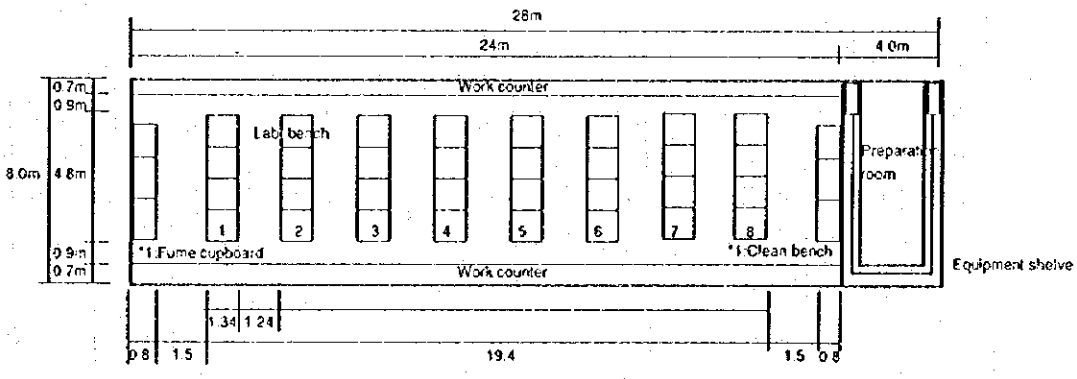


Figure 2.2.3-5 Research Laboratory
*1:Fume cupboard (Physic. Lab.), Clean bench (Bio.Lab.)

In the case of the seawater laboratory, targeted at undergraduate students, postgraduate students and researchers. The number of researchers involved is not fixed, but from 2 up to 12 persons. The request call for a laboratory for researchers, a teaching lab. for students, a water lab. and store. The main fixtures will include about 500 liter water tanks and work tables for the laboratories. After making a small allowance for fixture deployment, flow space, and installation of additional equipment, the required floor area works out to 192.00m^2, slightly smaller than the 220.00m^2 originally requested for this facility. The layout plan for the three lab facilities is shown in Figure 2.2.3-6.

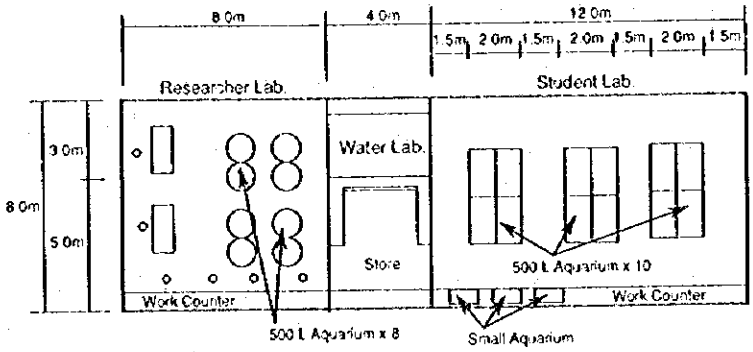


Figure 2.2.3-6 Seawater laboratory

f) Inorganic and Organic lab. :

The Request calls for 2 labs, with a floor area of 64.00m², for analyzing organic and inorganic materials plus 4 attached rooms: a preparation room of 32.00m²; a chemical storage area of 16.00m², an isotope room of 8.00m², and a balance room. Usage has not been specified for any of these rooms, but from 2 up to 6 persons per room.

The requisite floor area for this facility has been computed after allowing for the necessary equipment deployment, suitable flow space for analytical operations, and possible future equipment installations. 4 standard USP lab benches, analytic counters, and fixture shelves will be placed in the 2 main analysis rooms, while analytic counters will also be provided in the attached rooms. The fixture equipment by room will be as shown Table 2.2.3-3.

Table 2.2.3-3 Fixture Equipment

Name of Room	Fixture Equipment
Inorganic Laboratory	Fume cupboard , Centrifuge, TOC Analyzer
Organic Laboratory	Fume cupboard , Laminar flow unit
Chemical Storage	Working Table
Preparation Room	Chemical cabinet
Isotope Room	Storage cabinet
Balance Room	Balance

The required floor area for the above facility has been computed after allowing for equipment deployment and proper flow space for analytical operations. Based on this estimate, we have determined that the 192.00m² requirement shown in the Request document is appropriate. The layout plan for the Inorganic and Organic lab. is shown in Figure 2.2.3-7.

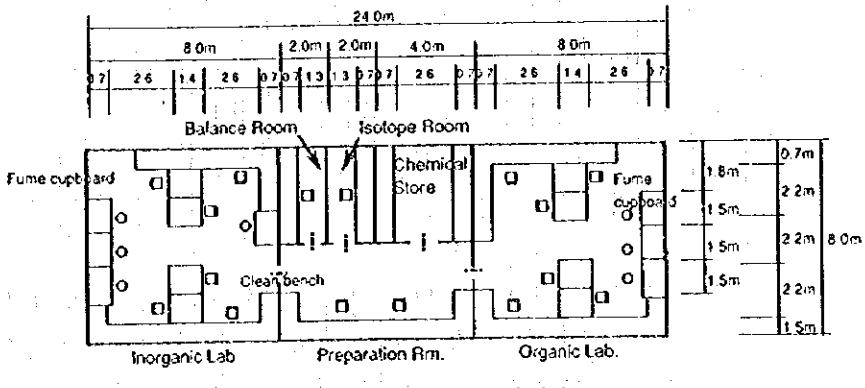


Figure 2.2.3-7 Inorganic / Organic lab.

g) Microbiology Laboratory :

The Request calls for a microbiology lab, with a floor area of 24.00m², plus 3 attached rooms: a 20.00m² dark lab, an 8.00m² incubator, and a 6.00m² autoclave. Usage has not been specified for any of these rooms, but a maximum presence of 4 persons each should be planned. The space requirement for these facilities has been computed with an allowance for fixture deployment, flow space, and future equipment acquisitions. The fixtures will include a work counter and shelving in the microbiology lab and analytic counters in the attached rooms. Store for research equipment will be provided in the dark room.. The main fixtures for each room are shown Table 2.2.3-4.

Table 2.2.3-4 Main Fixtures

Name of Room	Fixture Equipment
Microbiology Lab.	Microscope, Microstone
Dark Lab.	Shelves for equipment
Autoclave Lab.	Autoclave
Incubator Lab.	Incubator

The floor space we have computed for the above areas, including an allowance for equipment deployment and adequate flow space for analytical operations, is in line with the Request figure of 60.00m², which we find to be appropriate. The lay-out plan for the microbiology lab facility is shown in Figure 2.2.3-8.

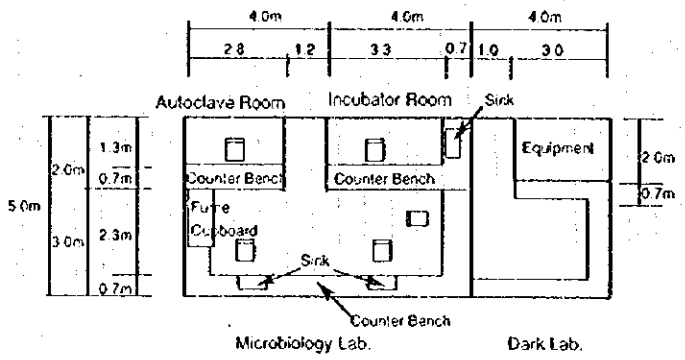


Figure 2.2.3-8 Microbiology Laboratory

h) Attached Research Rooms :

8 attached research rooms have been requested. 3 analytic labs, with a floor area of 20.00m² each, along with a microscope room, oven room, clean room, balance room (with a floor area of 10.00m²), and a fume cupboard room. Occupancy was not specified for any of these areas, but a maximum of 3 persons per room can be anticipated. The floor area requirement for these rooms has been calculated after making appropriate allowances for necessary equipment placement, proper flow space, and space for future equipment additions. Work counters and fixture shelves will be placed in each room.

The floor space computed for the various rooms, after allowing for equipment deployment and suitable space for analytic operations, fully confirms the appropriateness of the floor area shown in the Request document. The layout plan for the attached research rooms is shown in Figure 2.2.3-9.

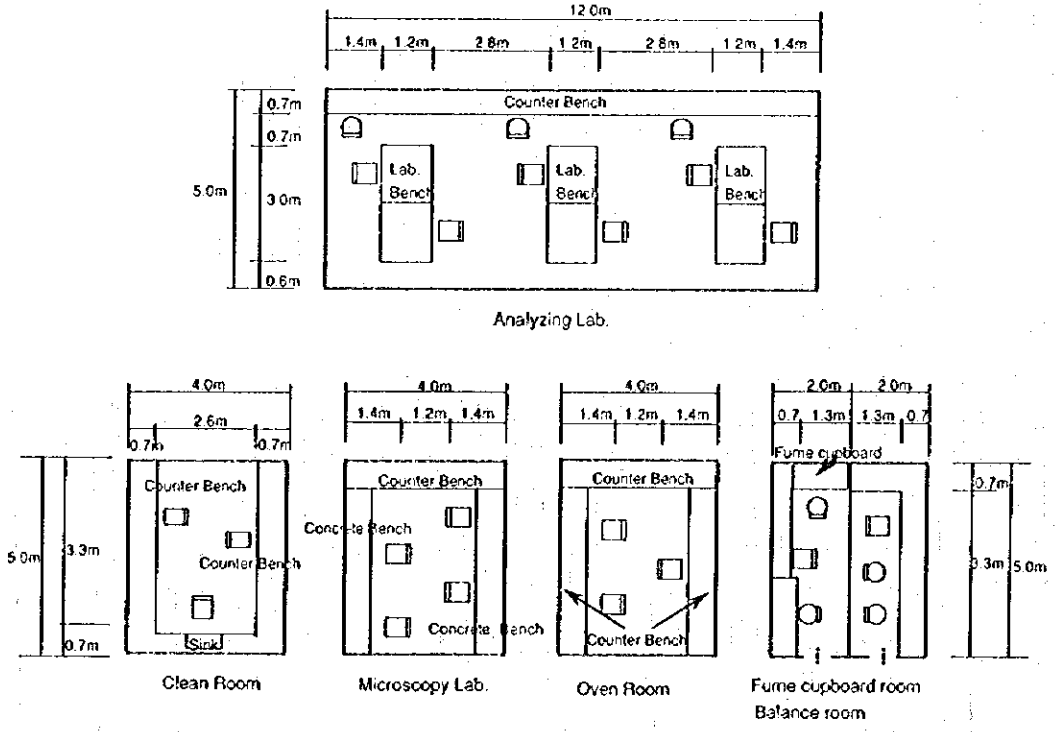


Figure 2.2.3-9 Attached Research Rooms

2) Administration Area :

a) Rooms for the MSP Director, Secretarial Services Room, and Records Room :

In the USP standards, the office of the chief executive of MSP is allocated a unit floor area of 20.00 m^2. In our judgment, even allowing for the placement of desk and chairs, file drawers and other fixtures, along with a proper flow space, this size room should be fully functional as the office of the MSP Director.

The secretarial services room should be large enough to provide working space for one secretary and 2 typists as well as storage space for student and staff records. According to USP standards, the unit floor area for an office of this class should be set at 8.00m^2 per occupant. In addition to the 24.00m^2 area required for the three staff members, additional provision should be made for reception, materials storage, and flow space, creating an overall requirement of 42.00m^2 for the

office staff and files. The layout plan for the Director's office, including the secretarial services and records rooms, is shown in Figure 2.2.3-10.

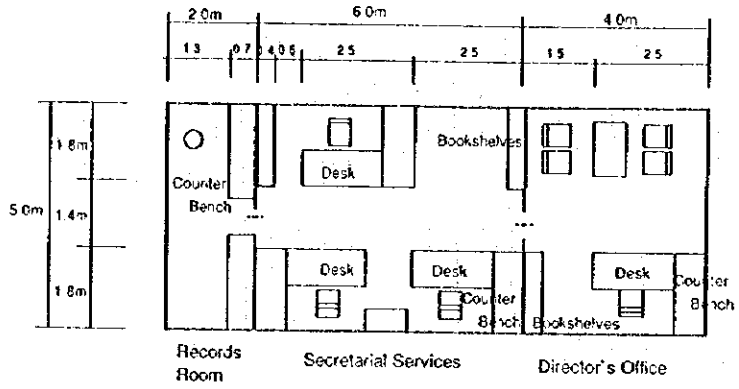


Figure 2.2.3-10 MSP Director s Office Secretarial Services Room, and Records Room

b) Offices for the Director of the Analytical Laboratory and Secretarial Services :

According to USP standards, the office of the Director of the Analytical Laboratory Should be commensurate with Head of School status, with a unit floor area of 20.00m^2. Even after provision for desk and chairs, file drawers and other fixtures, and suitable flow space, this size room should be adequate to carry out the functions of a Director's office.

The secretarial services office should accommodate one secretary and one typist while providing working and reception space. In addition to the 16.00m^2 required for the two employees, space must also be provided for the reception function and flow, resulting in a total area of 20.00m^2 for this room. The layout plan for the Analytical Director's office, including a secretarial services room, is shown in Figure 2.2.3-11.

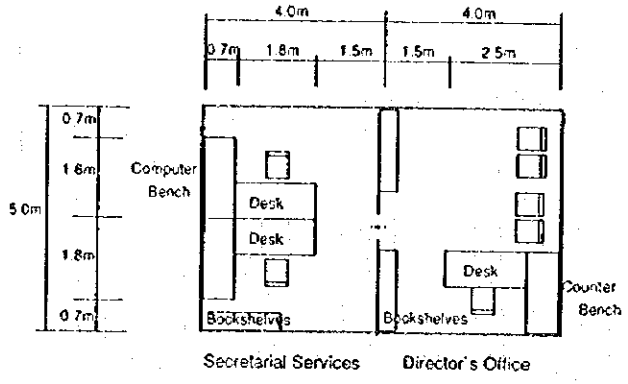


Figure 2.2.3-11 Analytical Director s Office and Secretarial Services

e) Meeting Room :

This room will serve as a meeting room for the MSP staff. Since there is no provision in the USP standards for this type of facility, its area has been calculated on the basis of the fixture layout. This room should accommodate about 18 persons, comprising the entire present staff. Fixtures will include conference chairs and table. Allowing for their placement, along with suitable flow space, the required room area has been set at 48.00m^2. The layout Plan for the meeting room is shown in Figure 2.2.3-12.

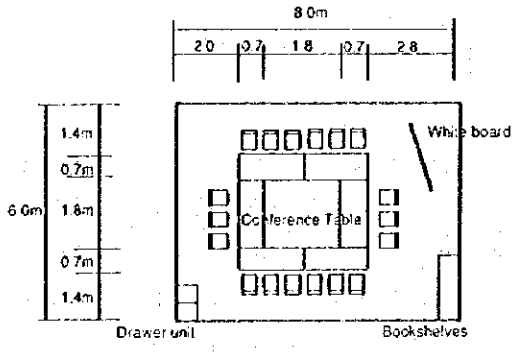


Figure 2.2.3-12 Meeting Room

d) Library :

This space will house the marine and fishery library, targeted at undergraduate students, postgraduate student, researchers and staff members at MSP . The Request calls for 60 seats, with a total area of 320.00m^2.

According to USP space standards, the number of seats in the reading room should be one-third of total student enrollment, while the unit floor area is given an upper limit of 2.20m^2 per person. With respect to the library collection, assuming both closed and open stacks, storage density has been set at 248 volumes per m^2 for the closed stacks and 215 volumes for the open.

Based on the MSP enrollment of 300 students, 100 seats must theoretically be provided in the Marine Library. However, in view of the fact that general reference books are stored in the main USP library, we feel that it would be sufficient to provide 50 seats (one-half of the USP standard) in this library. The total number of books to be stored is said to number about 25,000 volumes, including manuscripts, typed materials and audio visual tapes converted to their book equivalent.

The USP Main Library presently uses a dual closed- and open- stack system. At the Plan facility, however, given the specialized nature of the MSP library, referencing and controls should not be difficult, and so the it is planned to use only a closed-stack system. Based on the above considerations, the required floor areas for the reading room and stack area have been calculated at 110.00m^2 and 100.00m^2 respectively. After allowing additional space for an audio visual (AV.) user area, an issue desk, and a work room, the total area for the library facility becomes 288.00m^2. The layout plan for this facility is shown in Figure 2.2.3-13.

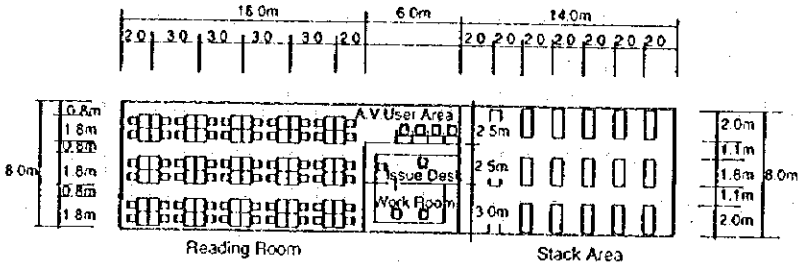


Figure 2.2.3-13 Library

e) Other Rooms :

These rooms, comprising printing binding rooms, a publication room, dark room, and electric workshop, are all key support facilities for MSP research and educational programs. A unit floor area of 20.00m^2 has been requested for each of these rooms. Since there are no area limits in the USP standards for these rooms, the required area has been determined on the basis of fixture and equipment layout plus an allowance for proper flow space. The equipment and fixtures to be deployed in each room are as shown Table 2.2.3-5.

Table 2.2.3-5 Equipment and Fixtures to be deployed in each room

Name of Room	Equipment
Printing / binding room	Guillotine
Publication room	Photocopier
Dark room	Enlarger, Pronto processor
Electric work shop	Hand tools

The necessary floor areas computed for the above rooms, based on equipment placement and flow space, confirm the adequacy and appropriateness of the areas shown in the original request. Floor areas and fixture layout plans for these rooms are shown in Figure 2.2.3-14.

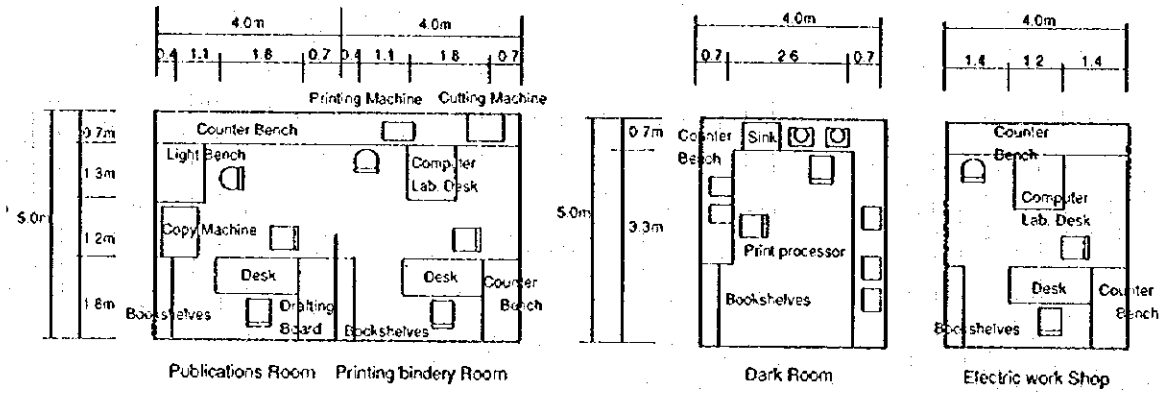


Figure 2.2.3-14 Other Rooms

3) Common Areas :

The common areas for this plan include rest rooms, a tea/clean room (for heating water and storing cleaning utensils), a machine room, elevator machine room, storage area, entrance area, and corridors.

a) Rest Rooms :

Target users of the rest room facilities include the entire MSP staff of 47 persons [faculty and researchers (21), graduate students (5), staff form related organization s (6), and administrative / technical staff (15), plus the average number of undergraduates in residence (50 - 60). Special consideration will also be given to use by handicapped individuals. Since the current male / female ratio at USP is 4 : 1 for staff members, and 6 :4 for undergraduates, the target users from the MSP staff of 47 should comprise 37 males and 10 females, while the 60 undergraduate users should break down 36 : 24 .respectively Thus, these facilities should accommodate a total of 74 males and 33 females.

Based on facility size, it has been determined that 4 rest rooms will be required, scattered around the building. Rest room use by staff members can be expected to be distributed fairly equally among the 4 locations; thus, staff use at each facility should be about 1/4 of target users (i.e, 10 males and 3 females). Undergraduate use, on the other hand, is likely to be skewed to toilets nearest the classrooms, with usage per toilet therefore set at one-half the total student target (30 students), comprising 18 males and 12 females. Thus, each rest room facility should be capable of serving a maximum of 28 males and 15 females.

The USP standards stipulate that each men's room should contain 2 toilet seats, 2 urinals, and 2 washbasins, while each ladies room should be equipped with 2 toilet seats and 2 washbasins. .A separate toilet for handicapped persons will be installed on each floor, to be shared by both sexes.

The required floor areas of the rest room facilities, as derived from the layout plan, have been set at 30.00m^2 each for the general-use toilets and 6.00m^2 each for those dedicated to the handicapped. The layout plan for the rest room facilities is shown in Figure 2.2.3-15.

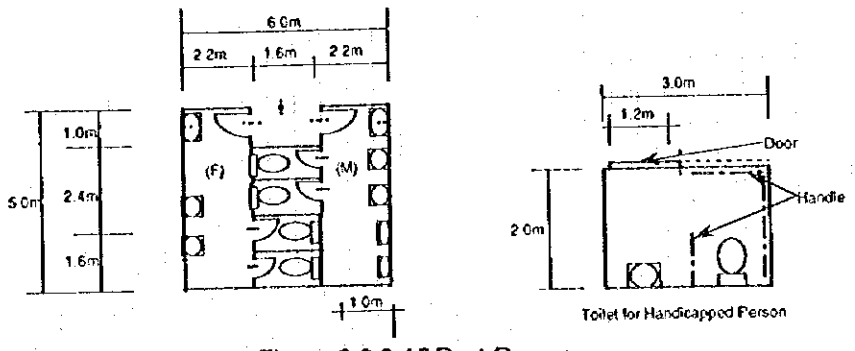


Figure 2.2.3-15 Rest Rooms

b) Tea/Clean Rooms :

Based on the size and composition of the tea/clean rooms, it has been decided to install two facilities in different locations, plus another serving just the MSP Director's office and meeting room, out of consideration for the visitors that these rooms will draw.

The requisite fixtures for these rooms will include work benches, sinks, cupboards, refrigerators, and utensil storage shelves. Allowing for both fixture placement and flow space, the required floor area for the tea/clean rooms has been set at 4.00m² per room. The layout plan for the tea/clean rooms is shown in Figure 2.2.3-16.

c) Elevator Machine Room:

The machine room facility will house the elevator and related machinery. The required floor areas, as determined from fixture deployment, has been calculated at 24.00m² for the electrical equipment room and 10.00m² for the elevator and machinery room. The layout plan for these rooms is shown in Figure 2.2.3-16.

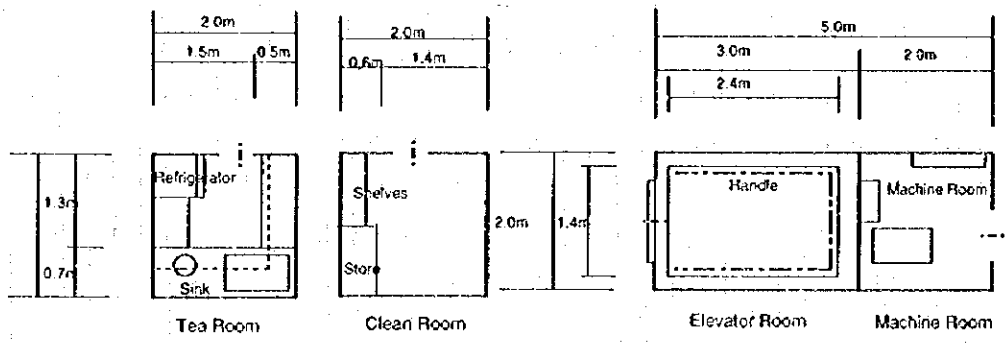


Figure 2.2.3-16 Tea/Clean Rooms and Elevator Machine Room

d) Gardener's Store, Storage Rooms, Entrance, and Corridors :

The area of the other storage rooms, the gardener's store, entrance area, and corridors will be examined in conjunction with the surface plan for the MS Center .

The scale of the various rooms to be incorporated in the MS Center, as derived from the above analysis, is summarized in Table 2.2.3-6.

Table 2.2.3-6 Scale of the Rooms in MS Center

Name of Room	No.of psn/Room	No.of Room	Room Area(m^2)
1) Teaching and Research Areas			
1. Seminar Room	96	1	144.00
2. Laboratory Station			
Laboratory Station	1-2	18	360.00
Associated Marine Organization	1-2	6	120.00
Visitor s Research Laboratory	1-2	2	40.00
3. Specimen Storage Room	-	-	384.00
4. Computer Teaching Room	32	1	96.00
Computer Lab.	8	1	48.00
5. Laboratory	-	-	-
Physico-chemical Laboratory	50	1	224.00
Biological Laboratory	50	1	224.00
Seawater Laboratory	-	1	192.00
6. Inorganic / Organic Laboratory			192.00
7. Microbiology Laboratory	1-4		60.00
8. Attached Research Room			
Microscope Room	1-3	1	20.00
Balance Room	1-2	1	10.00
Oven Room	1-2	1	20.00
Analytic Laboratory	1-2	3	60.00
Clean Room	1-3	1	20.00
Fumecuboard Room	1-2	1	10.00
2) Administration Area			
1. MSP Director's / Secretarial Room, Records Room	1/3/-	3	60.00
2. Director s Office / Secretarial Room	1/2	2	40.00
3. Meeting Room	18	1	48.00
4. Library	-	-	288.00
5. Printing / Binding Room	1-2	1	20.00
6. Publication Room	1-2	1	20.00
7. Dark Room	1-2	1	20.00
8. Electric Work Shop	1-2	1	20.00
3) Common Area			
Toilet	-	6 unit	132.00
Tea Room	-	3	28.00
Elevator Machine Room	-	1	10.00
Store, Corridor, Entrance Are			*
Total Floor Area			2,910.00

* :to be considered in connection with Floor Plan

(2) Annex :

1) Post-harvest Laboratory :

The Request includes a post-harvest laboratory, to be made up of two rooms, a processing laboratory, with a floor area of 96.00m^2, and a freezer / coolroom, with an area of 48.00m^2. Since capacities have not been specified for either type room, the floor areas have been computed on the basis of the required equipment deployment, space for processing operations, and an allowance for

future equipment acquisitions. The main items to be installed in the processing lab are a processing table, vacuum packing machine, drier, food processor, and smoking unit. For Equipment Store, a store is prepared. The freezer / coolroom area will contain primarily a cold storage unit, freezer, ice-maker, and blast-freezer.

The required floor areas for the processing lab and the freezer / coolroom, calculated on the basis of equipment deployment and the space needed for analytical and other research operations, have been set at 96.00m^2 and 48.00m^2, respectively.

The layout plan for the post-harvest laboratory facility is shown in Figure 2.2.3-17.

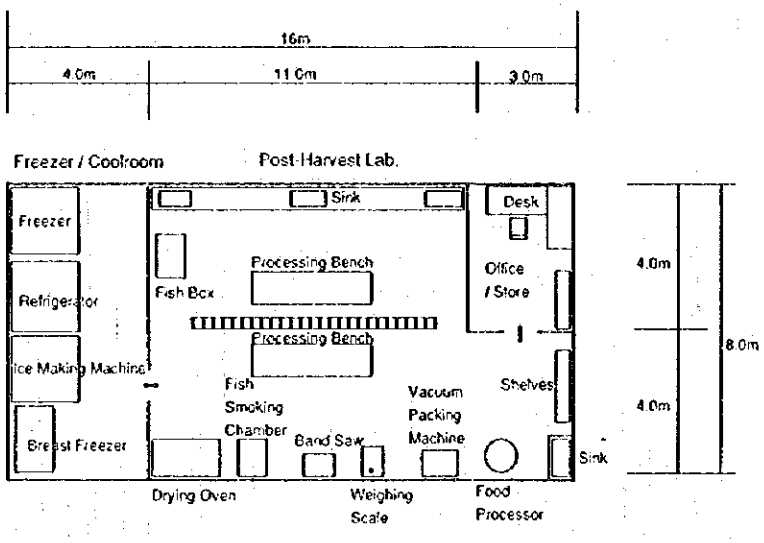


Figure 2.2.3-17 Post-harvest Laboratory

2) Chemical Store :

This facility is to serve as a storage area for the chemicals required in MSP research operations and will comprise a store issue office, a chemical store for safe products, and a dangerous chemical store, an equipment store , an equipment cleanup room, and a preparation room.

The required floor area for the store issue office has been calculated based on occupancy by 2 persons, and the areas of the other rooms on the basis of the required equipment placement plus a small space allowance for future equipment additions.

The floor area for the store issue office has been set at 16.00m , which works out to 8.00m^2 per occupant , which is the upper limit of the USP space standard. The total area for the other rooms has been calculated at 112.00m^2, after allowing for the required fixtures and adequate flow space. The layout plan for the chemicals store facility is shown in Figure 2.2.3-18.

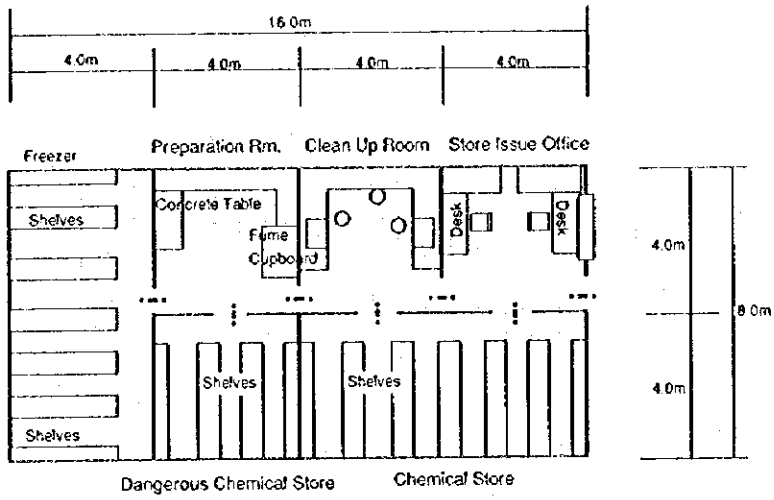


Figure 2.2.3.18 Chemical Store

3) Machine Room

The machine room, which is to accommodate the switchboard and generator, has been allocated a total floor area of 32.00 m^2, as required by the necessary equipment layout and to provide suitable working space.

The shape and area of corridors and other areas will be considered in conjunction with the surface plan for the Annex. The room sizes in the Annex, as derived from the above analysis, are summarized in Table 2.2.3-7.

Table 2.2.3-7 The room sizes in the Annex

Name of Room	No.of psn/room	No.of Room	Room Are (m^2)
1. Post Harvest Laboratory	-	1	96.00
Freezers Cool Room	-	1	32.00
2. Chemical Storage			
Store Issue Area	-	1	16.00
Preparation Room	-	1	16.00
Dangerous Chemical Store	-	2	48.00
Clean Up Room	-	1	16.00
Equipment Store	-	1	32.00
3. Machine Room	-	1	32
Corridor			*
Total floor area			288.00

* :to be considered in connection with Floor Plan

(3) Lecture Theater :

1) Lecture Hall :

In the Request, the capacity of the lecture theater has been set at 200 persons. The advantages put forth for a theater configuration were twofold to provide a direct line-of-sight from the student audience to the dais, and ease of obtaining a high ceiling over the podium, which in turn would make it possible to install a relatively large projector screen.

This configuration, moreover, has been adopted in the largest lecture hall at USP. A system of stationary chairs, with attached writing bench, will be used, since this has already been successfully introduced in the large classrooms at the university.

The floor area requirement for the 200-seat seminar hall has been set at 220.00m^2, based on the USP unit standard of 1.20m^2 per student. Even allowing for the stationary chairs with writing bench, aisles and corridors, and suitable flow space, this size facility can be expected to function effectively as a lecture theater. The layout plan for this hall is shown in Figure 2.2.3-19.

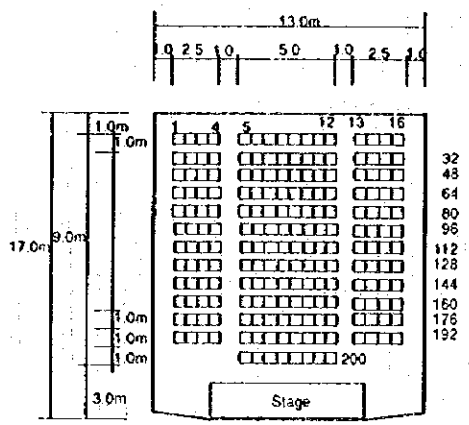


Figure 2.2.3-19 Lecture Theater

2) Common Rooms :

The rest room facilities in the Lecture Theater will theoretically be used by a maximum of 200 persons. However, as the average number of students in a large class is about 140, roughly 70 - 80% of theater capacity, while, during busy periods, the plan is to permit the students to use the facilities in the adjoining MS Center Building, the assumption is that, in practice, the toilets in the Lecture Theater will be used by 140 persons, with a male-female ratio of 84 : 56. Based on the size of the theater, one rest room installation should be ample. The USP space standards for a men's toilet is 4 toilet seats, 4 urinals, and 4 washbasins and , for a ladies' toilet, 4 toilets and 4 washbasins.

The required floor areas for the rest room facilities, as computed from the layout plan, have been set at 20.00m^2 for the men's toilet and 16.00m^2 for the ladies'. The layout plan for these facilities is shown in Figure 2.2.3-20.

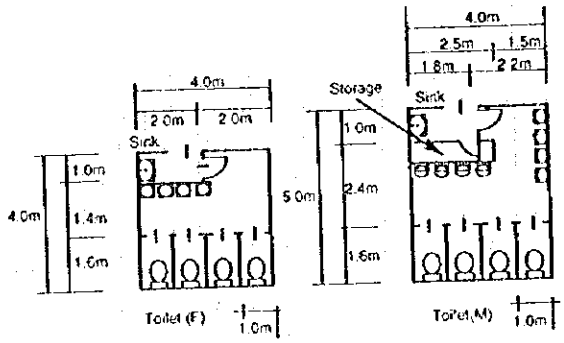


Figure 2.2.3-20 Rest Rooms

The shape and area of the entrance hall, waiting area, corridors and preparation room to be used store and preparation of audio visual equipment will be calculated in conjunction with the surface plan for the subject facility. The scale of the various component rooms of the Lecture Theater are as shown in Table 2.2.3-8.

Table 2.2.3-8 Scale of Lecture Theater

Name of Room	No.of psn/room	No.of Room	Room Are (m^2)
1. Lecture Theater	200	1	220.00
2. Common Area			
Toilet	-	1	36.00
Preparation Room, Gardener s Store, Entrance Room, Corridor			*
Total floor area			256.00

* :to be considered In connection with Floor Plan

(2) Workshop :

The functions, capacities, and number of the rooms comprising the Workshop facility are shown in Table 2.2.3-9.

Table 2.2.3-9 Plan Rooms for the Workshop Building

Name of Room	No.of Room	Function
1) Repair Facilities		
1. Machine Work Shop	1	This is a room for performing repairs and maintena-
2. Electric Work Shop	1	nce checks on equipment and facilities sustaining
3. Service Room	1	MS Center operations.
4. Boat Shed & Garage / Repair Shop	1	
2) Research-preparation Facilities		This room is concerned with field research activities
5. Diving Gear Store	1	and will be mainly used for storing and maintaining
6. Compressor Room	1	survey equipment and for conducting first-stage
7. Field Equipment Room	1	processing on samples and specimens that are
8. Geology Preparation Room	1	collected.
3) Administrative Facilities		These are rooms for office administration and
9. Office	2	the night shift.
10. Living Room	1unit	
4) Common Rooms		These are common areas in the workshop and will
11. Toilet	2	be equipped in accordance with their respective
12. Bath Room / Locker Room	2	objectives.
13. Machine Room	1	
14. Others (Toilet / Corridor)		

1) Repair Facilities :

The machine workshop will perform maintenance checks on outboard motors, pumps, and other equipment and will also fabricate piping materials and undertake woodworking and metal-working operations.

This facility will have to accommodate a lathe, drill press, welding machine, and compressor, a worktable and other machine tools, and fixtures, while also providing adequate working space for 2 - 3 persons.

The electrical workshop will be concerned with maintenance and check-ups on electric motors. Equipment will include battery chargers and hand tools. Space will be provided for 2 - 3 workers grouped around a work bench.

The service room will perform repairs and maintenance checks on diving gear, including wet suit repairs and regulator adjustments. Flow space will have to be provided for 2- 3 workers grouped around a worktable.

The required floor space for the machine workshop, electrical workshop, and service room, as calculated on the basis of the equipment and fixture layout, including a suitable allowance for flow space, has been set at 64.00m^2, 32.00m^2, and 12.00m^2 respectively. The layout plan for these facilities is shown in Figure 2.2.3-21.

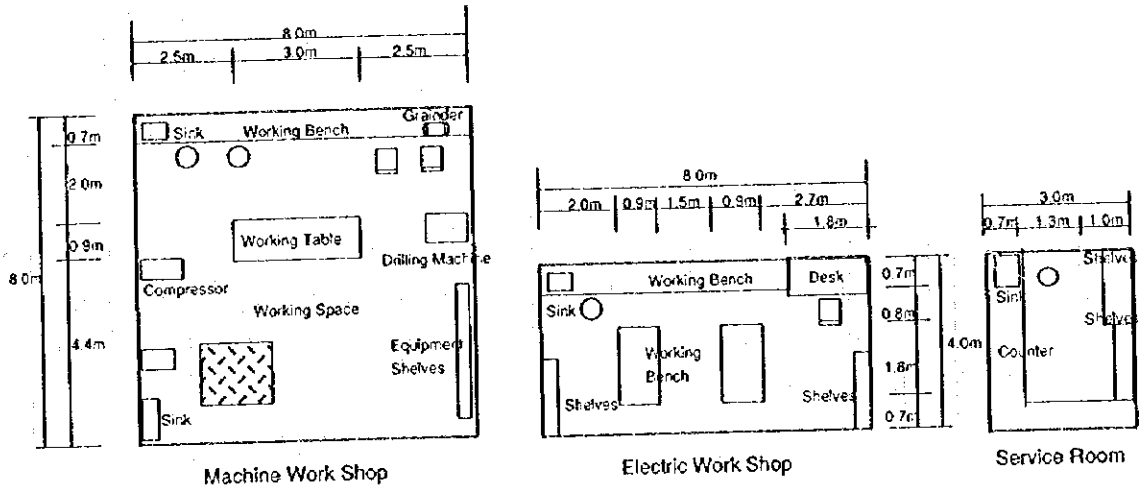


Figure 2.2.3-21 Repair Facilities

The repair and storage area for vehicles and boats will focus on storage, repair, and maintenance of 4 small outboard vessels and one vehicle and wooden working machine, which will be employed in research programs at the MS Center.

The largest area requirement at this facility will be that for the simultaneous storage of the vehicle and boats, and the floor area has been computed on the basis of this storage requirement. The total area for the boat shed and garage/ repair shop has been set at 160.00m^2. The layout plan for this facility is shown in Figure 2.2.3-22.

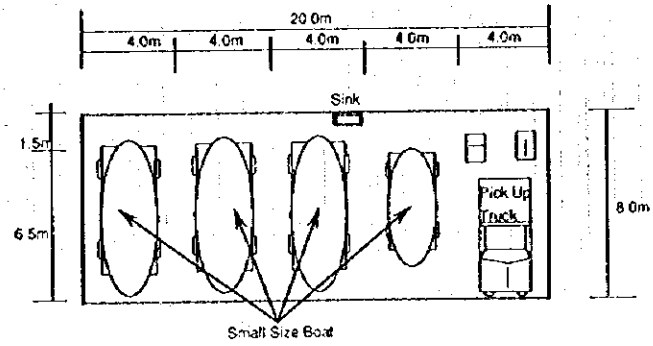


Figure 2.2.3-22 Repair and Storage Area for Vehicles and Boats

2) Research-preparation Facilities :

The diving gear store is designed for the storage of diving cylinders, diving suits, and specimen collection gear along with preparation and check of equipment used in diving research activities.

The compressor room will be used to inject compressed air into the diving cylinders, ensure safety in the handling of high-pressure containers, and secure pure air supplies free of odor or dust.

The field equipment store will store, prepare, and check bottom samplers, water samplers, and fishing gear for use primarily in field surveys utilizing the research vessel.

The geology preparation room is to perform first-stage processing - crushing, drying, and beaching on specimens of sea bottom rocks, coral rocks, mud, and other materials collected for geologic surveys. The equipment layout will include a rock crusher and cutter, drier, with provision also required for adequate working space.

The respective floor areas that have been computed on the basis of the required equipment and fixture deployment in the diving gear store, compressor room, field equipment store, and geology preparation room are 16.00m², 12.00m², 64.00m², and 32.00m². The layout plan for these various research-oriented areas is shown in Figure 2.2.3-23.

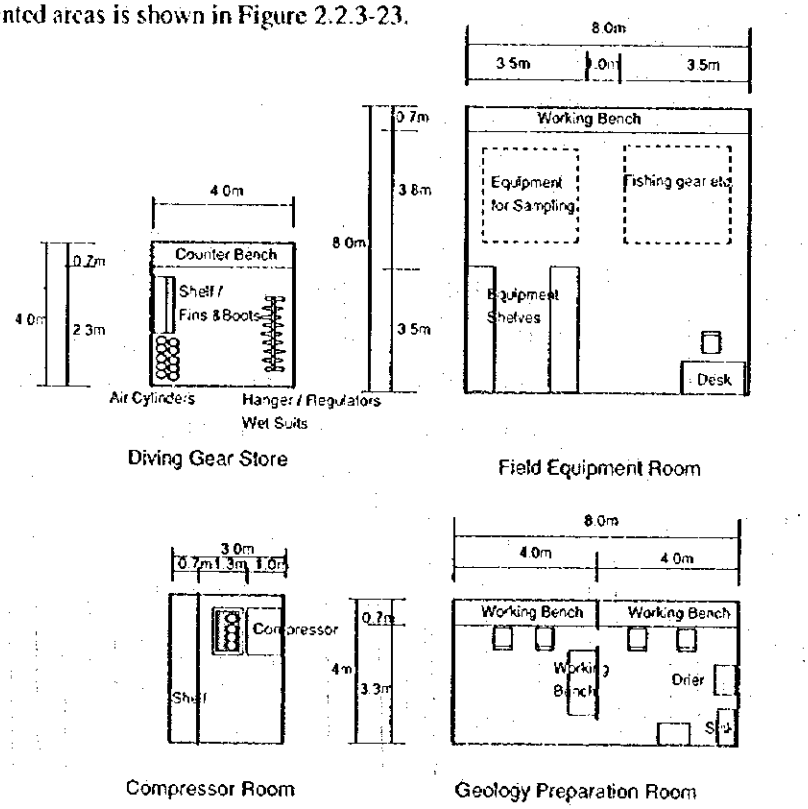


Figure 2.2.3-23 Research-preparation Facilities

3) Administrative Facilities :

This office will be attached to the machine workshop and the vehicle / boat shed and garage repair shop, which are the main components of the Workshop Building. It will maintain records on equipment and repairs and perform administrative duties. This space will be occupied by 2 persons and has been assigned a floor area of 16.00m², based on this occupancy level and the required equipment layout.

The quarters for the night watch will provide night-time administration at the MSP Complex, lending support to research vessels returning to port at night and overseeing their mooring operations. This facility will be manned by 2 - 4 persons and will comprise a bedroom, dining-

kitchen area, and toilet/ shower stall. The requisite floor area for the night quarters, computed on the basis of the equipment layout, has been set at 76.00m^2. The layout plan for this facility is shown in Figure 2.2.3-24.

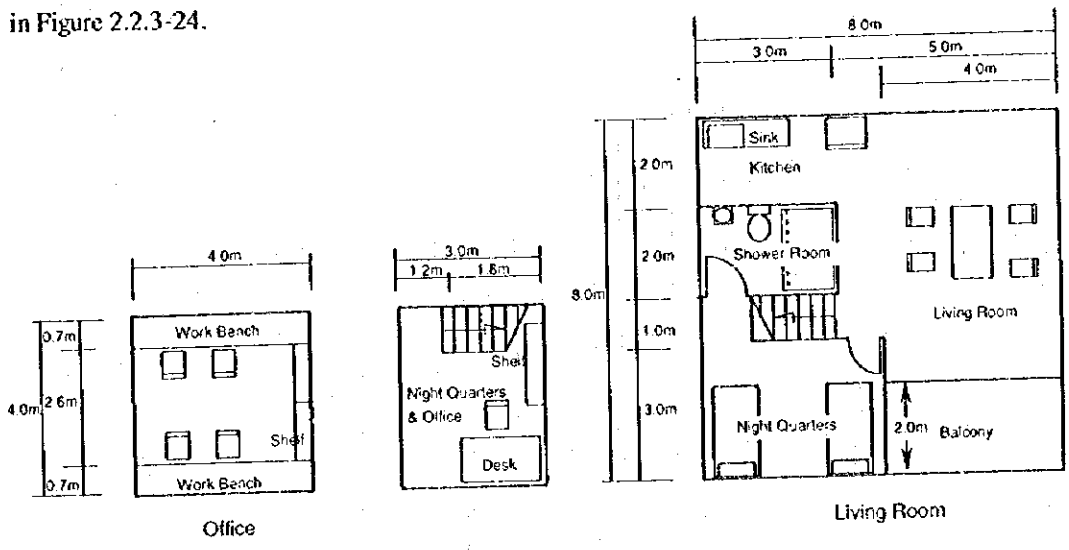


Figure 2.2.3-24 Administrative Facilities

4) Common Rooms :

The common rooms will comprise a toilet, shower, and locker room for the workshop staff, along with a machine room, storage area, and corridors.

Since the toilet is for use by the workshop employees, it may be assumed that the number of persons using the facilities at any one time will be relatively small: perhaps 5 - 10 males and 3 - 5 females. Accordingly, one each for male and female use toilet will be installed, fitted with 1 each toilet seat, in conformance with the USP space standard for a toilet facility of this size.

The shower and locker room will serve the diving survey team. The number of users has been set at 5 men and 5 women, based on team composition.

Based on the layout plan for the shower stall, lockers, and dressing room, the required floor area has been computed at 18.00m^2. The layout Plan for the toilet, shower / locker area is shown in Figure 2.2.3-25.

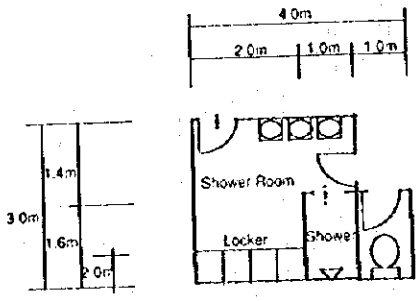


Figure 2.2.3-25 Toilet, Shower

The machine room will be used to store a backup generator for the main machinery items at the MS Center, seawater pump, Filtering Tank, Compressor and Pump. The requisite floor area for this facility, based on the layout plan for the above equipment items as well a suitable allowance for flow space, has been set at 16.00 m^2. The layout plan for the machine room is shown in Figure 2.2.3-26.

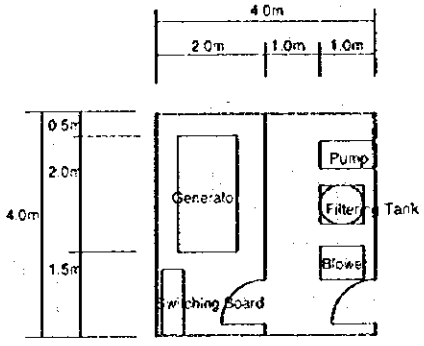


Figure 2.2.3-26 Machine Room

The shapes and sizes of the other common areas, such as storage space and corridors, will be considered in conjunction with the surface plan for the Workshop Building.

The sizes of the component rooms in this building are summarized in Table 2.2.3-10.

Table 2.2.3-10 Sizes of rooms in Workshop

Name of Room	No.of psn/room	No.of Room	Room Are (m^2)
1) Repair Facilities			
1. Machine Work Shop	2-3	1	64.00
2. Electric Work Shop	2-3	1	32.00
3. Service Room	2-3	1	12.00
4. Boat Shed & Garage / Repair Shop	3	1	160.00
2) Research-preparation Facilities			
5. Diving Gear Store	1	1	16.00
6. Compressor Room	-	1	12.00
7. Field Equipment Room	1	1	64.00
8. Geology Preparation Room	2-6	1 unit	32.00
3) Administrative Facilities			
9. Office	4	1	16.00
10. Living Room	2-6	1unit	76.00
4) Common Rooms			
11. Toilet	-	2	3.00
12. Bath Room / Locker Room	-	2	18.00
13. Machine Room	-	1	16.00
14. Others (Toilet / Corridor)	-		*
Total Floor Area	-		521.00

* :to be considered in connection with Floor Plan

(3) Accommodation :

This facility will be composed of a 20-room student dormitory for use by both matriculated undergraduate and post-graduate students; a breakfast / recreation room; and 5 apartments for visiting researchers, equipped with bath, toilet, and kitchen .

The upper limits of the floor area of the student dorms and visitor quarters in the USP space standard will be as shown in Table 2.2.3-7. The unit areas shown in the original Request for the student rooms (21.50m^2) and apartments (43.00m^2), like those in Table 2.2.3-11, are also within the USP space standard range.

Table 2.2.3-11 Floor area of Student Dorms and Visitor Quarters in the USP Space Standard

	Student Dorms		Visitor Quarters	
Name of Room	Request Standard	USP Standard	Request Standard	USP Standard
Living & Dining	-		15.00	(20.00)
Kitchen	-		8.00	(8.00)
Bath,	5.50	(20.00)	5.00	(5.00)
Bed Room	-		15.00	(12.00)
Combination living room	16.00	(16.70)	-	-
Total Floor Area	21.50m^2	(21.70) m^2	43.00m^2	(45.00)m^2

The student quarters will contain 2 rooms (a combination living room / bedroom and an adjoining bathroom with shower.) The floor plan for the apartments for visiting researchers will provide a bedroom and living room on either side of a rest room and kitchen. Based on the placement of the required fittings and a suitable allowance for flow space, we have determined that the areas for these respective units, as shown in the original Request, are quite appropriate.

There are no USP standards applicable to the recreation room. The required floor area has, thus, been calculated on the assumption of simultaneous usage by 10 students, half of the 20 that are to occupy the dormitory rooms. The dining room has been accorded a floor area of 36.00m^2, based on the furniture layout (including a dining table and chairs and a recreation table and chairs) and a suitable allowance for flow space.

The floor area for the kitchen, pantry, laundry, and toilet has been computed at 28.00m^2, again based on fixture placement and flow space. The size of the recreation room and its component areas is shown in Table 2.2.3-12.

Table 2.2.3-12 Size of Recreation Room

Name of Room	No.of psn/room	No.of Room	Room Are (m^2)
1. Rest Room	10	1	36.00
2. Kitchen, Pantry, Laundry, Toilet			28.00
Total Floor Are			64.00

The layout plans for the student dormitory, recreation room, and visitor quarters are shown in Figure 2.2.3-27.

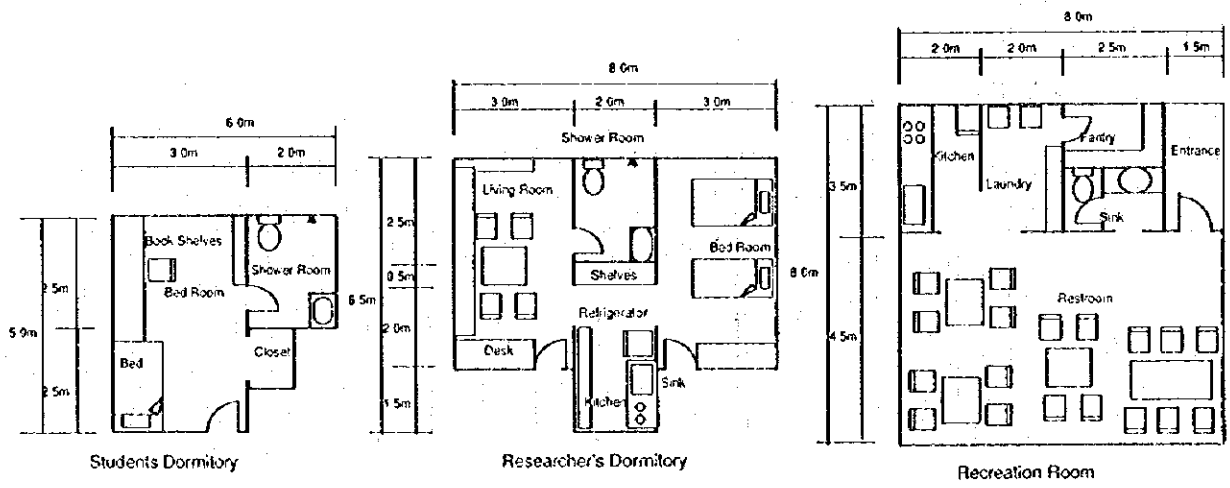


Figure 2.2.3-27 Accommodation

(4) Canteen :

This area will comprise a dining room serving meals and light snacks to students residing on the Lower Campus and at the dormitory as well as to the MSP staff, along with a kitchen, rest / locker room, and pantry. Although not included in the original Request, a toilet has been added for the convenience of students, staff members and employees working at this facility.

1) Dining Room :

The dining room will be divided into student and staff sections, with usage projected at 32 and 16 persons respectively. In the case of the students, while a maximum of 300 persons could gather at the Lecture Theater and for joint lectures in other seminar rooms, it is estimated that the average requirement for meal service will be in the order of 150 - 200 students.

Anticipating that the lunch hour will run from noon to 2:00 PM, and assuming 20 - 30 minutes per sitting, with a turnover of 6 sittings during this period, the seating requirement in the student dining room will be 25 - 33 seats. The number of student diners per sitting has, accordingly, been set at 30 persons.

In the case of the staff dining room, it is estimated that target users will be 25 persons roughly 50% of the MSP employees. Assuming that the lunch hour will run one hour from 1:00 - 2:00 PM, with a dining time of 20 - 30 minutes and a turnover ratio of 2, the seating requirement may be calculated at 13 for staffs. On top of that it is required seats of visitors anticipated. On this basis, the target number of diners per sitting in the staff dining room has been set at 15 persons.

Under USP standards, the unit area in student canteen is set at 1.50m² / student. On this basis, the required floor area for the student dining room at the Plan facility has been calculated at 45.00m²
Since no USP standards are specified for staff dining areas, we have applied the same student standard (1.50m²) to the staff dining room, resulting in an area requirement of 22.50m².
The layout plan for the dining room is shown in Figure 2.2.3-28.

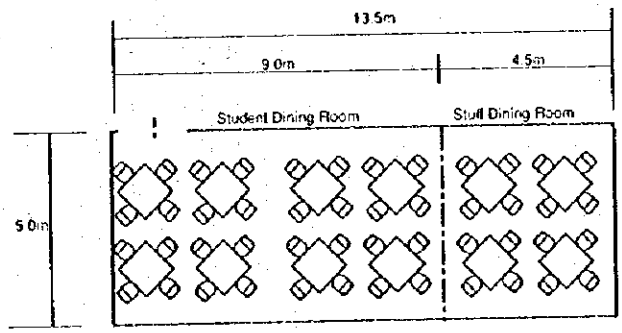


Figure 2.2.3-28 Dining Room

2) Kitchen, Pantry and Rest area :

The kitchen will have to accommodate 4 - 5 workers as well as a pantry room for storage of utensils and ingredients and a rest area equipped with lockers for the kitchen staff.

The USP unit standard for kitchens, including pantry space and locker room, is 0.80m² per occupant. On this basis, the floor space requirement for the Plan kitchen can be calculated at 36.00m². The layout plan for the Kitchen, Pantry and Rest area is shown in Figure 2.2.3-29.

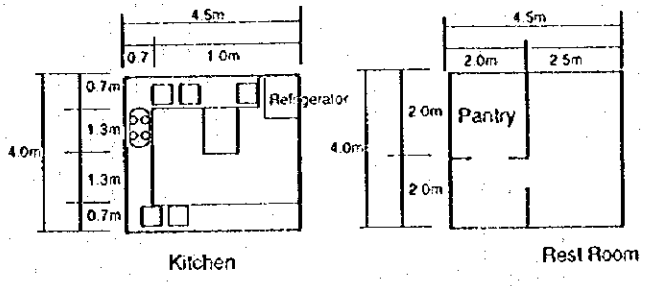


Figure 2.2.3-29 Kitchen, Pantry and Rest area

3) Toilet :

The target users of the toilet facility will comprise employees plus a portion of the dining patrons. While prospective usage has not been established, it is not likely to be large. Thus, a minimum-size men's and ladies' toilet will be specified, with 1 toilet seat, 1 urinal, and 1 washbasin to be installed in the men's facility and 1 toilet seat and 1 washbasin in the ladies'. The required floor area for the two toilets (men's and ladies' combined), as computed from the layout plan, has been set at 10.00m^2. The layout plan for the toilet is shown in Figure 2.2.3-30.

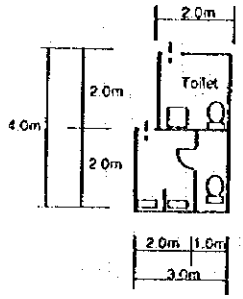


Figure 2.2.3-30 Toilet

The sizes of the various dining room areas, as determined above, are given in Table 2.3.2-13.

Table 2.2.3-13 Canteen

Name of Room	Room Area (m^2)	Total Floor Area
Canteen		
Student Sections	1.5 x 30 =	45.00
Staff Sections	1.5 x 15 =	22.50
Kitchen, Pantry, Rest Room	0.8 x 45 =	36.00
Toilet	- -	10.00
Total Floor Area		113.50

We have concluded that the space allocated, even after allowing for fixtures and proper flow space, will be functionally adequate and appropriate for Plan purposes.

(5) Other Related Facilities :

The items under this heading include mooring facilities at the tip of the existing jetty and repair work on the crown pavement, which has deteriorated significantly. The mooring area project involves provision of a bollard, and water supply facilities for mooring the research vessel. The paving work will cover an area of about 360.00m^2, extending 20 m from the end of the jetty, so as to provide preparation space for loading research equipment aboard this vessel.

An access slope and safety gate are also required to improve access between the public slipway and the Plan site. Their size should be sufficient to ensure the safe cartage of small boats between the two locations. Allowing a slight safety margin in the width of the target boats and pulling vehicles, a gate width of 5m is planned, with the access slope leading up to this gate.

2.2.3.2 Equipment

(1) Laboratory Equipment:

1) Equipment for student lab use :

The biological microscopes and stereoscopic microscopes will be widely used in the student labs, with many hours of exclusive use by individual students. This plan will provide sufficient supplies of these items for 40 persons, which is considered, for the time being, the maximum number of students that will be enrolled in biological lab courses. 20 units of each type are planned, with one unit to be shared by 2 students. Hot plates, water baths, evaporators, membrane filters, colorimeters, and other items will be allocated on the basis of 1 unit for every 4-10 students, depending on demand. The pH meters, conductivity meters and balances will be distributed on the basis of 1 unit for each laboratory. 3 fume cupboard will be assigned to the physical / chemical lab, while the biological lab will receive 2 laminar flow units, 2 incubators and 2 centrifuges.

2) Equipment for analytical laboratories use :

Equipment for joint use by researchers will be distributed over many disciplines, including precision analysis and microscopic observations. In this Plan, we have provided highly generalized equipment, with the principal types comprising fume cupboards (2 units), laminar flow units (2), a freeze dryer, an ultracold freezer, a centrifuge, and an autoclave. Since microscopes are used by the bulk of the MSP researchers, and given the need for supplementing functions not being satisfied by the student s microscopes, we shall provide a biological microscope and 3 units of stereoscopic microscopes, along with a pair of inverted microscopes. A portion of the above microscopes will incorporate photomicrographic and video apparatus.

3) Preparation room (Chemical Store):

The preparation room will be used chiefly for collecting equipment that has been used in student experiments, washing it down, and preparing it for the next experiment. In view of the large number of glass ware to be handled, there will be a need for an automatic glass washer, an ultrasonic bath, and an autoclave.

In order to supply pure water for use in equipment washing and practical training classes, there is also a requirement for a distillation deionizer and a water purifier.

4) Specimen study rooms:

While the equipment required to produce, preserve, and observe specimens in the specimen study rooms, the equipment in this plan, will cover a refrigerator ,a freezer and a fume cupboard for each study room.

5) Organic / inorganic laboratory:

The organic / inorganic lab is used primarily by IAS. They perform mainly water quality analyses, which are intimately related to MSP work, along with food and soil analyses. Since the great majority of the instruments used for these purposes will be transferred from the IAS laboratories, this Plan will provide 3 fume cupboard.

6) Other :

In the post-harvest lab, a hydrometer, salinity refractmeter, thermometer, and other measuring instruments are required, while, in the seawater laboratory, there is a need for a water analyzer, biological microscope, stereoscopic microscope, and certain other types of equipment.

(2) Oceanography research Equipment:

The marine surveys planned at MSP cover a wide range of waters, from shore areas (including lagoons), to deep-sea waters down to depths of 2,000 m. Survey topics too cover a wide spectrum, including water quality, bottom materials, topography, tides, living species and environment conditions. If we were to attempt to cover all of these survey areas, the types and quantities of the required equipment would be enormous. In this Plan, therefore, we will provide only equipment necessary to conduct surveys in depths not over 200 m. In marine surveys conducted in waters not over 200 m deep, there will be a need for CSTD, to measure depth, water temperature, conductivity, and salinity and a turbidity meter. As instruments for on-vessel measurements for collected water specimens, a pH meter, a dissolved oxygen meter and a sailnometer will be provided. Water samplers are widely used, not only in the marine field but also in biological and chemical training programs, and so 10-1.7 liter water samplers have been included in the plan.

There is also a requirement for shallow water bottom samplers including core sampler and dredger, plankton nets as well as reversing thermometers, a tide gauge, an anemometer and a set of read time differential GPS.

A CTD unit capable of simultaneously measuring depths down to 2,000m, water temperature, conductivity, salinity, dissolved oxygen, pH, turbidity, fluorescence and current be proper to implement this provision at the time of the plan research vessel was confirmed.

(3) Fishing Gear:

Among the requested fishing gear, the longlines, vertical long lines, and other trawl net will be carried aboard the Plan research vessel. The objective of the fishing training courses at MSP is to impart basic knowledge about fisheries in general and so not intended to cultivate career fishermen. Thus, the gear for this plan can be small in size, sufficient to conduct modest pilot experiments. No

importance will be attached to catch efficiency ; the items are planned only as examples of the items comprising a typical set of fishing gear. In the Request, the netting depth for the otter trawl net was set at 800m. However, this depth was found to be unrealistic, and so the Plan net have been given a depth of not over 200 m. In any case, since fishing grounds suitable for trawl net operations in Fiji waters are limited, it was necessary that an appropriate depth be reflected in the detailed design.

The Plan will provide 2 sets of bottom fishing line, aimed at bottom species down to a depth of 500 m, beach seines, gillnets, trammel nets, and trap nets that can be used by the existing small boats, along with netting for making miscellaneous types of gear.

(4) Diving Gear :

It is anticipated that a maximum of 15 divers will be simultaneously involved in experiments, with 2 to 3 diving tanks required for each person, resulting in an overall need for 30 to 45 tanks. However, since a moderate number of the existing tanks are still in usable condition, the Plan quantity has been set at 15 units.

Among the remaining items of required diving gear, the Plan will provide only regulators, buoyancy compensators, and diving assist gauges. The compressor for compressed air refills will be given a capacity sufficient to permit the 40 tanks to be refilled during regular working hours, based on joint use with the air reservoir. In addition, the replacement compressors for use at the Dravuni Experimental Station will be comparable in capacity to the existing units.

(5) Equipment for Post - harvest Fisheries :

The post-harvest fisheries segment of the MSP plan involves a program of instruction ranging from freshness retention of catches through the development of processed products and markets. The curriculum anticipates simultaneous use of the processing facility by a maximum of 12 undergraduate students.

It may be estimated that each student will conserve at most 1 kg of fish for his or her processing experiments, and, even when tuna or other large species are employed, the total daily requirement should not exceed 100 kg. From this perspective, we feel that the capacities shown in the Request for both the ice-maker (500 kg / day) and refrigerator and freezer (12m³ combined) are excessive.

We plan, accordingly, to provide, as the minimum scale of equipment to meet Plan requirements, an ice-maker with a capacity of 100kg / day and a refrigerator / freezer with about 6 m³ each. All of the other requested equipment items - the quick-freezer, band saw, smoker / dryer, cooker, and vacuum packing machine-- have been found to be necessary and appropriate in terms of size, but, in

the case of the processing table, a somewhat larger size is planned to enhance operating efficiency.

(6) Seawater Laboratory Equipment:

As already discussed, a full-scale seawater experimental laboratory at MSP is to be built at a different site under a future plan. The facility for the subject Plan will, thus, be small in scale, sufficient for student training purposes, with species to be retained for just a short time and the facility geared to only a limited number of individuals. Moreover, the species to be stocked will necessarily be confined to those that are compatible with the water quality and volume that can be intaked in the Plan area.

The rearing experiments are to be conducted in easy-to-handle water tanks of about 500 liter capacity. 5 polycarbonate cylindrical tanks and 10 small aquariums are to be provided. The required water supply will be drawn mainly from seawater directly in front of the Plan area, but 2 types of pipes will also be laid to permit water to also be drawn, as required, from offshore sources. The offshore seawater operation will utilize primarily the existing research vessel (Aphareus).

The water intake point will be conducted at near the tip of the existing jetty, and the Facility Plan sets a maximum limit of 10,000 liters of rearing water for concurrent use. The equipment required for this facility including pumps, blowers, elevated water tanks, sand filter, and ultraviolet sterilizer will be supplied under the provision of building equipment. In order to enable the seawater experiment room to be flexibly and freely utilized, no piping will be installed inside the room. The Plan is rather to supply piping materials, hoses, air stones, submersible pump, and cartridge filters, to be installed by MSP as it deems fit.

(7) Audio-visual Equipment :

As required equipment for lectures and seminars, overhead and slide projectors have been provided in quantities of 2 units each, along with a video projector, and video players and monitors (5 units each, including the 2 units for library use).

(8) Computers and LAN :

Out of the 66 work stations shown in the original Request, 32 units are intended for computer training use in the computer classroom; this Plan will provide 16 units, representing half of the number requested.

LAN connections in the subject Plan are to be provided only for the MSP Plan facilities.

(9) Workshop Equipment :

As workshop equipment, the Plan will provide a drill press, welder, and other machine tools, spanners, wrenches, screwdrivers and other hand tools for use in fabricating auxiliary teaching materials as well as for maintaining facilities and equipment.

(10) Vehicle :

A 4 - wheel drive pickup truck, with double cabin, will be provided, capable of accommodating 3 to 4 survey personnel while hauling diving gear and research equipment.

(11) Other Items :

The other Plan items, as required for MSP activities, include : dark room equipment; photocopier, facsimile, guillotine, and other office equipment and VHF radiotelephones; plus desks, chairs, shelving, and other furnishings.

2.2.3.3 Research Vessel:

We shall now consider the appropriateness of the conditions shown in the Request with respect to crew size, cruising range, and cruising speed, which, in turn, exert a considerable influence on vessel size.

(1) Crew Size:

It was asked that the research vessel be designed to accommodate a crew of 6 persons as well as 6 researchers to conduct on-board surveys, resulting in a total boarding capacity of 12 persons. If the vessel is to undertake cruises of over 24 hours, requiring a 3-shift watch, then the minimum crew size would indeed be 6 persons. Should a need develop in the future for long cruises, on which it would be difficult for the 6-man crew to assist in cooking and other chores, it would be necessary to increase the crew complement. In contrast to crew size, the number of researchers to be carried will vary from voyage to voyage, depending on the requirements of the particular survey plan.

General marine surveys in coral reefs and other shore areas can be broadly classified into surveys on fish, algae, and the marine environment. Supposing that a pair of researchers and assistant (student or others) was to be boarded for each of such studies, and making these marine surveys performed on one trip, it would be appropriate, from the standpoint of operating economies, to set a maximum of 6 researchers, as requested.

In addition to the above, it was also requested that the vessel accommodate a maximum of 40 students for transfer to the Dravuni Field Station and other survey sites and for fish training programs as well. At the present time, when MSP transfers students and researchers to the survey sites for diving and other survey work in nearby waters, the normal practice has been to transport up to 9 persons on the HALIMEDA. On this basis, a party of more than 10 persons would have to use the new research vessel for similar purposes. When moving people to the Dravuni Field Station, based on past performance, these groups normally range from 20 - 25 persons, though a party of 32 passengers has been reported. Since the capacity for this sort of passengers on the Aphareus is set at 16 for the open seas, two round trips have been required to transport a group of this size, resulting in excess transportation costs while also upsetting the curriculum schedule.

In the subject Plan, students for transfers to other locations or for on-vessel training are classified as trainees. Since the boardings will be confined to daylight hours, no bunk facilities or seating arrangements are planned. The feasible increase in trainee boardings will be held, insofar as possible, within a range that will not affect vessel size. Safety equipment will however be provided for the whole planned number of individuals being carried.

(2) Cruising Range:

In the original Request, the cruising range of the Plan vessel was set at 1,000 nautical miles. In the Team's discussions with MSP, while the Fiji area was designated as the operating area for this vessel, we also discussed the likelihood of the new vessel conducting future surveys in waters of other USP member states - particularly in the Solomon Islands, where the Institute of Marine Research (IMR) is located, and Kiribati, home of the Atoll Research Plan (ARP). Since both of these organizations are attached to MSP, cooperative surveys with them are a distinct possibility. The MSP mission vis-a-vis the member countries, as expressly stated in the founding principles, covers the broad range of works in marine studies, which includes environmental studies in lagoon waters.

Even if the initial operating area for the vessel is restricted to Fiji waters, present survey destinations, as in the case of Rotuma Island, already involve round trip distances of some 900 nautical miles. In addition, there are other areas, such as waters off the north shore of Vanua Levu Island, where a similar length cruise is required to make a tour of fixed survey stations. Since the Aphareus is not seaworthy enough to make such trips, its past service record cannot be used as an indication of future trip frequencies to these distant areas, and, with respect to future plans as well, it should be noted that many aspects of MSP s research programs are determined on the basis of outside project funding, making it difficult at this stage to designate specific area parameters for the new vessel. Although a need has been clearly established, in terms of past research experience at MSP, for survey activity at sites in distant waters, as in the case of the algae study (1993) in intertidal zones and shallow-water areas off Rotuma Island, these examples are not yet sufficient to serve as evaluation materials.

At the present stage, the need for expanding survey programs, centering around oceanographic observations and marine resource studies, has been fully recognized, while the operating waters that have been clearly identified for this Plan exclude areas in which survey works are at variance with the principal objectives of MSP for the scientific marine research. Accordingly, in this stage of the study, we will provisionally plan the required cruising areas on the basis of the Plan operating waters that have been presented to us. That is to say, we shall consider setting a large capacity for the required fuel and freshwater tanks, based on an estimated cruising range of 1,000 nautical miles, subject to the condition that these tank capacities will not impact significantly on vessel size.

(3) Cruising Speed:

Cruising speed of the Aphareus research vessel is estimated at about 6 knots, so that 6-7 hours are required just for a trip to the field station at Dravuni. Thus, a much faster research vessel has long

been desired, which explains the request for a Plan vessel with a cruising speed of 12 knots. In the case of a vessel of this size, which would belong to the small-vessel class among steel ships, the usual means of boosting speed is to install an engine of high horsepower relative to vessel size. Referencing comparable vessels, it is apparent that, to achieve an 11 knot speed, a 1,000 HP engine would be required. From the standpoint of constraints on the engine room arrangement and fuel conditions, it would not be realistic to install a high HP engine capable of generating 12 knots. Thus, in the present Plan, we shall set the engine output on the basis of a target cruising speed of about 10 knots.

(4) Consideration of Relative Size:

In table2.2.3-1 - 3, we have prepared a rough vessel design (Type A), which would almost completely satisfy the above conditions as well the others contained in the Request. In this connection, to provide a comparison of relative fuel consumption, we have also designed a somewhat scaled-down version, designated as Type (B) in the table. Comparing the two designs at a given cruising speed, the Type (B) vessel would show a reduction of about 20% per unit hour in fuel consumption. And, in terms of the maintenance costs as well, a comparable 20% saving is indicated in the cost of painting materials, along with slight economies in the cost of engine parts. However, in terms of relative performance, the Type (B) vessel would be subject to the following constraints:

- Since its fresh water tank capacity would be reduced, the number of cruising days would be limited; for example, to about 6 days with a 6 m3 tank
- No storage space could be provided for observation equipment or specimens.
- It would not be possible to install a sewage disposal tank or toilets for trainees.
- There would be serious constraints in transporting trainees. Although the deck space would permit a maximum of 33 persons, if the weather were to suddenly turn stormy, there would be very little space to house the trainees inside the ship, creating a safety problem.

Considering then the required conditions for the new survey vessel, the above constraints would render the Type (B) vessel unsuitable for Plan purposes. We have, therefore, prepared a Basic Vessel Design based on Type (A) .

Table 2.2.3-1 Major Particulars

	Type (A)	Type (B)
LOA	25.50 M	21.50 M
Lpp	20.80 M	18.50 M
Breadth MLD	6.40 M	5.80 M
Depth MLD	2.55 M	2.65 M
Draft, designed	1.80 M	1.75 M
Gross tonnage	130.0 GT	90.0 GT
Complement	12 crew/scientist, plus 40 students as day-time trainee	12 crew/scientist, plus 33 students as day-time trainee
Fuel oil tank	20.00 M3	8.00 M3
Freshwater tank	10.00 M3	6.00 M3
Service speed	10.00 Kt 15% sea margine, 85% of MCR	8.30 Kt 15% sea margine, 85% of MCR with 50 ps delivery to PTO generator

Table 2.2.3-2 Engines

	Type (A)	Type (B)
Maine engine	750 ps x 1400rpm One unit	450ps x 1300rpm, with PTO generator of 32 KW One unit (for cruising)
Generator engine	100 ps x 1500rpm x 73 KW Two units	100 ps x 1500rpm x 73 KW One unit (for bottom sampling)

Table 2.2.3-4 Fuel Oil Consumption

Type (A)

Ship speed	7.0 Kt	8.0 Kt	9.0 Kt	10.0 Kt
Required BHP (net)	190	271	368	503
Continuous service output (CSO) = BHP+15% as sea margine	219	312	425	580
Maximum continuous output = CSO / 0.85	257	367	500	682
Fuel oil consumption (ltr/hr) by M.E.	42.51	60.56	82.50	112.59
Fuel oil consumption (ltr/hr) by G.E.	10.00	10.00	10.00	10.00
Total fuel oil consumption (ltr/hr)	52.51	70.56	92.50	122.59

Type (B)

Ship speed	7.0 Kt	8.0 Kt	8.3 Kt
Required BHP (net)	95	200	265
Continuous service output (CSO) = BHP+15% as sea margine+50ps	159	280	355
Maximum continuous output = CSO / 0.85	187	329	418
Fuel oil consumption (ltr/hr) by M.E.	30.86	54.35	68.91
Fuel oil consumption (ltr/hr) by G.E.	0.00	0.00	0.00
Total fuel oil consumption (ltr/hr)	30.86	54.35	68.91

2.3 Basic Design:

2.3.1 Design Concept:

2.3.1.1 Facility :

In preparing a optimum facility plan, we have established the following guidelines, taking into account Fiji's natural environment, social conditions, construction and procurement conditions , as well as the special characteristics of the subject project.

(1) The Plan will pay careful attention to natural conditions at the Plan site, such as the high heat and humidity, anticipated cyclones, and other meteorological conditions; as well as vulnerability to damage from sea winds owing to the site's seaside location.

(2) The Plan site is located in a lovely natural area, fronting on Laucala Bay, against a backdrop of luxuriant greenery. Great care will be taken to harmonize the Plan site with both natural conditions and the surrounding environment.

(3) Since the Plan facilities will occupy a portion of the USP campus, the new facilities will be designed to achieve a harmonious balance with the existing USP facilities.

(4) The USP has taken great pains to standardize the quality of its facilities by establishing detailed rules governing specifications for room area, construction materials, furniture, ceiling height, lighting, air conditioning, and many other items. In the Plan facilities, we shall basically adhere to these standards.

(5) The Plan contents will seek to enhance the effectiveness of the current research and educational programs at MSP, while also enabling the facilities to respond flexibly to future demands.

(6) Since the bulk of the key construction materials, other than such items as cement, gravel, sand, and H.C. blocks, will have to be imported, while the local building industry, owing to its limited size, will not be able to respond to a concentrated inflow of orders, the design plan will allow ample leeway in procurement timing.

(7) Since the project is to be implemented on the basis of a grant-aid from the Government of Japan, the construction period will be limited. Every effort will, therefore, be made to shorten construction time by utilizing structural methods, construction materials, and building methods that are fully compatible with building conditions at the Plan site. Moreover, in the course of Plan implementation, special consideration will be given to having the construction program stimulate

the area economy by utilizing, whenever possible, local labor, building materials, and construction equipment.

2.3.1.2 Equipment and Machinery :

Only a very limited portion of the current MSP equipment and machinery inventory is still in usable condition. Thus, while a considerable range of equipment must be considered in connection with the subject Plan, we feel it would be difficult to provide all of the desirable items at one time. We have accordingly, drawn up the Equipment Plan in accordance with the following guidelines :

(1) Priority has been given to expanding those items which are indispensable to the continuation of MSP's present teaching and research programs. Equipment selection has been based on specifications conforming to these requirements.

(2) Other equipment items which have been recognized as necessary to the expansion of MSP's research activities have been deferred to a future plan.

(3) Every effort has been made to encourage joint use of equipment items by various sections whenever feasible.

(4) The Facility Plan has provided space and facilities to permit the future installation of certain requested items that, though deemed to be necessary, cannot be incorporated in the present Plan

2.3.1.3 Research Vessel :

The present research vessel, Aphareus, was donated in 1982 under an EEC aid program and has been used mainly for SPAS and other training cruises, transporting students, and marine observations. However, as this vessel lacks the necessary survey rigging, it cannot undertake proper observation surveys, and furthermore some restriction is observed to transport students and researchers to and from the coastal experimental stations and research sites. In addition, tank capacity is limited, while the crew capacity is also small, at only 4 persons, making it difficult for the vessel to undertake even short cruises of a few days. Finally, after 13 years of service, the Aphareus has become superannuated. In connection with the Plan research vessel, it has been requested to alleviate the above operating constraints -- viz., to increase maximum crew size while expanding the maximum cruising range. At the same time, though, with operating costs being held to an absolute minimum, an unduly large vessel size has not been desired.

2.3.2 Basic Design :

2.3.2.1 Layout Plan :

The layout plan for the facilities has been based on the following considerations.

(1) Since the MS Center will comprise a variety of facilities with separate and distinct functions, while the Plan site incorporates existing facilities which will remain in use, the layout plan gives careful consideration to achieving harmony and organic linkage between these various facilities while also acknowledging their independent nature.

(2) The layout plan is confined to a site of only 2.9 hectares. It is, therefore, designed to achieve optimum site utilization by creating a functional complex of considerable intensity, based on multi-story construction for the main buildings, while also maintaining independence in the component facilities.

(3) The Plan has paid careful attention to natural conditions. The Plan site has a typical sub-tropical marine climate. It is located on the seashore, with high temperature and humidity, and, during cyclones, is exposed to severe winds and rain, while southeasterly trade winds predominate throughout the year.

The Plan area has been prepared on approximately 2.9 hectares on the southeast side of the Lower Campus, which contains about 10 buildings, including the present MSP facility. A few of these structures will be removed to make way for construction of the Plan facilities, including the MS Center, workshop, accommodation, and canteen buildings.

The present access road to the Plan site is a narrow dead-end road branching off from the Queen Elizabeth Road. Since the access point would be in the center of the site, making it difficult to secure a proper buffer zone with a front garden and greenery, between the gate and the Plan facilities, this road would present various problems as the main access artery .

The access point will, accordingly, be placed on the northern perimeter of the site, which connects to the Laucala Bay Road. The primary vertical axis will run through the MS Center - the central Plan facility -, while the horizontal axis will pass through the workshop, accommodation, and canteen area as well as the existing facilities on the site. In this way, the layout plan gives careful consideration to the efficient and smooth flow of both people and goods.

In consideration of convenient access from the main road and the predominant SE winds, the MS

Center Building and Lecture Theater - the principal Plan facilities for education, research, and administration have been placed in the southwest part of the Plan site. The post-harvest laboratory and the chemical store, located in an Annex building, have been positioned on the west side of the MS Center Building, which will be leeward of the predominant wind direction. This was done because, in the post-harvest facility, unpleasant odors and noise may emanate during research experiments, while, in the case of the chemical facility, special precautions must be taken to guard against the possibility of accidents or dangerous effects from the generation of foul smells, excessive heat , or combustion of the stored materials. With regard to the workshop, to facilitate cartage, via the existing jetty, of materials and specimens from the research vessel, and in view of the noise that can expected to develop from machinery installed for this operation, this building will be placed near the jetty, at a considerable distance from the MS Center.

In the case of the accommodation, since this will be a private residential area for students, researchers, and faculty, it will have to be independent of the other facilities and located in a quiet, secluded environment. We have concluded that the northeast corner of the site will be the optimum location for this facility.

The layout plan for the MS Complex facility is shown in Figure 2.3.2-1.

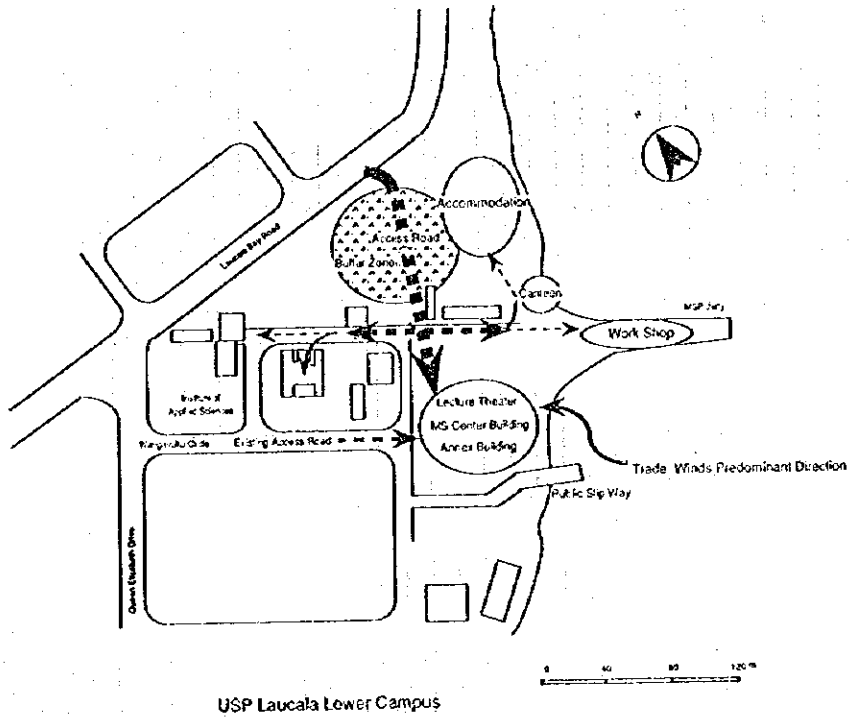


Figure 2.3.2-1 Layout Plan for the MS Complex Facility

2.3.2.2 Building Plan

(1) Floor Plan :

1) MS Center Building :

With a total floor area in excess of 4,000 m^2, the MS Center Building has been planned as a 2-story structure with a view toward preserving the greenery surrounding the facility, achieving optimum site utilization, and minimizing traveling distances within the complex. The building will comprise a large number of rooms, ranging from small to relatively large, as represented by the seminar rooms, research laboratories, library, and researcher rooms.

In the floor plan, taking account of the independent, yet functionally related, character of the component areas, we have used a central corridor style, wherein the rooms are placed on both sides of the corridor. While this method facilitates effective utilization of the facility, since the corridor section becomes closed space, poor lighting and ventilation can develop. This plan, therefore, specifies a wide corridor, with an open area provided from lower to upper floor. This corridor method will greatly improve both light and ventilation.

Span widths have been carefully planned with reference to the component rooms and existing facilities, since these widths will have an effect not only on the floor plan but on external appearance and the structural plan as well. As this plan will align the rooms in parallel rows along a central corridor, considering the room sizes , the basic structural units will be 16.00 m for the short span length and 4.00 m for the lengthwise spans, as also used in the existing facilities.

Turning to the facility shape, a 2-story building with a central corridor arrangement requires a length of over 150m.. The L-type building shape has been chosen as optimum for the Plan site configuration . The longitudinal axle "south wing" will run in an east-west direction so as to capture the prevailing trade winds from the southeast. The short axis "north wing" will be placed at a right angle running north from the west end of the main building.

The teaching and research rooms have been distributed evenly on the ground floor of the facility in the interest of ease of access and movement for both people and goods. The seminar rooms and computer laboratory have been placed in the north wing, and the various research laboratories (physics-science, biological, and seawater) in the south wing.

Joint research facilities, such as the microscope room, oven room , and microbiology laboratory, will be placed in the center of the south wing for the convenience of research personnel. The analytical laboratory facilities, such as that for organic and inorganic substances, will be placed on

the east side of the upper floor, with the specimen collection placed on the west side of this floor. Laboratory stations will be dispersed evenly throughout the north and south wings, on both floors, with due regard for their functional relationship with the various research laboratories and proper flow space.

As to the administrative offices, the MSP Director's office, secretarial services room, and meeting room will be located in the south wing in the central section of the first floor, for the convenience of visitor access, while the Analytical Director's and secretarial offices will be on the eastern side of the upper floor adjacent to the analytical labs.
The library and related publishing functions (printing, binding, and dark rooms) and the electric workshop for precision equipment have been grouped on the upper floor of the north wing so as to provide ready access from the seminar rooms.

Rest rooms have been places on both floors in each wing, while the entrance area has been set in the center of the south wing on the ground floor.

Other common areas, such as the tea rooms and storage facilities, have been distributed evenly on both floors, as appropriate. The total floor area for the MS Center Building has been calculated at 4,054.00m^2, based on consideration of the room layout and span width plans, along with the space requirements for the corridors, entrance area, and other common areas. The floor plan diagram for this building is shown in Basic Design Plan.

2) Annex :

Since the Annex building will house the post-harvest lab., chemical store and machine room with markedly different functions, these facilities have been completely separated, with an open corridor to be built in the center of the facility to maintain the independence of the various rooms.
As the rooms are to be laid out on both sides of this open corridor and will not be overly large, this facility will be an I-shape single-story structure, with 8.00 m span widths used as the basic unit in the short direction and 4.00 m span widths in the long direction, as will be used in the MS Center Building.

The processing lab and freezer coolroom in the post-harvest lab will laid out consecutively to maintain their reciprocal relationship. Machine room has been located next to the coolroom/ ice-making room, which is to be equipped with a freezer unit. In the case of the chemical facility, the chemical store, dangerous chemical store, cleanup room, preparation room, and equipment store will all be centered consecutively around a store issue room in the section adjoining the corridor in

the interest of both control and convenience.

The total floor area of the Annex building has been computed at 344.00m², based on consideration of the layout and span width plans and space requirements for corridors and other common areas. The floor plan diagram for this structure is shown in Basic Design Plan.

3) Lecture Theater :

The Lecture Theater will be the centerpiece of this facility, surrounded by a preparation room, toilets, entrance hall, and other common areas. Since the hall will have a theater configuration, with the floor height at the rear of the hall at the second-story level, the toilets, entrance hall, and other common facilities will be located at the base floor level, with the preparation room and gardener s store placed both sides of the dais.

After allowing for the layout and span width plans as well as the corridors and other common areas, the floor area of the Lecture Theater has been computed at 330.00m².

The floor plan for this facility is shown in Basic Design Plan.

4) Workshop Building :

The workshop building will comprise a maintenance, research, administration, and common rooms. Considering the size of the facility and well as the fact that it will be located at the base of the jetty on a long and narrow site, we have decided to make the building I-shaped and, in view of the need for direct outside access in a majority of the Plan rooms, the facility will be single-story. However, the night-watch quarters have been located on the 1st floor, since a high location will afford a better line of sight for watching over the facilities and research vessel.

There is no need for a particularly large span width, with 8.0 m spans to be used in the short direction and 4.00 m units in the long.

The room layout has been planned taking into account the operating efficiency and inter-relationships among the various areas as well as the need for ready access from outside. The toilets / shower room and diving gear store have been placed at the eastern edge of the workshop, near the tip of the jetty, owing the relationship of these facilities to the research vessel. The electrical workshop, machine workshop, garage, and boat shed repair shop will follow in sequence. Finally, at the west end of the workshop building, adjacent to the MS Center facility, will come the field equipment store and geology preparation room.

The night quarters have been located in the 1st floor area on the east side of the facility close to the

tip of the jetty, in consideration of the requirement for watching over the research vessel and lending assistance on the jetty to vessels returning to port at night.

Based on the above considerations, we have prepared a floor plan for the workshop building, with the floor area set at 576.00m^2.
The floor plan diagram for this facility is shown in Basic Design Plan.

5) Accommodation :

The accommodation will be composed of a residential block for students and visiting researchers and a recreational block. The building will be 2-story so as to make effective use of the construction site. As the facility is to be a private living area, with the priority placed on maintaining a relaxing environment and privacy, the living units have been arranged in such a way as to prevent neighbors from looking into one another's rooms.
The recreational block has been located in the center of the building to afford easy access from the various residential units.

Based on the above considerations, a floor plan has been prepared, composed of residential and recreational blocks, yielding a total floor area requirement of 711.40m^2 for the accommodation.
The floor plan diagram for this facility is shown in Basic Design Plan.

6) Canteen:

The rooms making up the canteen include a dining area for students and staff personnel, kitchen, pantry, employees' rest area, and rest room.
The dining area has been placed on the eastern side of the building on the water, thereby providing an open and relaxing atmosphere.
It is planned to locate the kitchen and pantry at the west end of the facility, close to the road, to facilitate ingredient deliveries and garbage disposal.
Based on the above factors, a floor plan has been prepared, yielding a total floor area requirement of 113.50m^2 for the dining facility.
The floor plan design for this building is shown in Basic Design Plan.

The required scale of the various Plan facilities, as computed from the above floor and layout plans, is summarized in Table 2.3.2-1.

Table 2.3.2-1 Required Scale of Plan facilities

Name of Room	No.of psn/rm	No.of Room	Room Are (m^2)
MS Center			
1) Teaching and Research Areas			
1. Seminar Room	96	1	144.00
2. Laboratory Station			
Laboratory Station	1-2	18	360.00
Associated Marine Organization	1-2	6	120.00
Visitor s Research Laboratory	1-2	2	40.00
3. Specimen Storage Room	-	-	384.00
Specimen Storage Room	-	2	
Research Room	5	4	
Preparation Room	-	1	
Anteroom	-	2	
4. Computer Teaching Room	32	1	96.00
Computer Lab.	8	1	48.00
5. Laboratory	-	-	-
Physico-chemical Laboratory	50	1	224.00
Biological Laboratory	50	1	224.00
Seawater Laboratory	-	1	192.00
Seawater Lab.	-	1	
Researching Lab.	2-12	1	
Water lab. & Store	-	1	
6. Inorganic / Organic Laboratory		1	192.00
Inorganic Lab.	4-12	1	
Organic Lab.	4-12	1	
Chemical Storage	1	1	
Preparation Room	2	1	
Isotope Room	-	1	
Balance Room	1-2	1	
7. Microbiology Laboratory	1-4		60.00
Incubator	-	1	
Autoclave	-	1	
Dark Lab.	2-4	1	
8. Attached Research Room			
Microscope Room	1-3	1	20.00
Balance Room	1-2	1	10.00
Oven Room	1-2	1	20.00
Analytic Laboratory	1-2	3	60.00
Clean Room	1-3	1	20.00
Fumecuboard Room	1-2	1	10.00
2) Administration Area			
1. MSP Director's/Secretarial Room, Records Room	1/3/-	3	60.00
2. Director's Office/Secretarial Room, Records Room	1/2	2	40.00
3. Meeting Room	18	1	48.00
4. Library	-	-	288.00
Reading Room	60	1	
Stack Area	-	1	
Issue Desk	2	1	
AV. User Area	4	1	
Work Room	1-2	1	
5. Printing / Binding Room	1-2	1	20.00
6. Publication Room	1-2	1	20.00
7. Dark Room	1-2	1	20.00
8. Electric Work Shop	1-2	1	20.00
3) Common Area			
Toilet	-	6	132.00
Tea Room	-	3	28.00
Elevator Machine Room	-	1	10.00
Gardener s Store	-	-	-
Machine Room	-	1	24.00
Entrance Hall			
Corridor, Stair, Store			1144.00
Total Floor Area			4054.00

Name of Room	No.of psn/rm	No.of Room	Room Are (m^2)
Annex			
1. Post Harvest Laboratory	-	1	96.00
Freezers Cool Room	-	1	32.00
2. Chemical Storage			
Store Issue Area	2	1	16.00
Preparation Room	1	1	16.00
Dangerous Chemical Store	-	2	48.00
Clean Up Room	1	1	16.00
Equipment Store	-	1	32.00
3. Machine Room	-	1	32.00
Corridor	-	1	56.00
Total floor area			344.00
Lecture Theater			
1. Lecture Theater	200	1	240.00
2. Common Area			
Toilet	-	1	44.00
Preparation Room	-	1	7.00
Gardener s Store	-	1	7.00
Entrance Area, Corridor	-	1	32.00
Total Floor Area			330.00
Workshop			
1) Repair Facilities			
1. Machine Work Shop	2 - 3	1	64.00
2. Chemical Storage	2 - 3	1	32.00
3. Service Room	2 - 3	1	12.00
4. Boat Shed & Garage / Repair Shop	3	1	160.00
2) Research-preparation Facilities	-		
5. Diving Gear Store	1	1	16.00
6. Compressor Room	-	1	12.00
7. Field Equipment Room	-	1	64.00
8. Geology Preparation Room	2 - 6	1	32.00
3) Administrative Facilities			
9. Office	4	1	16.00
10. Living Room	2 - 6	1	76.00
4) Common Rooms			
11. Toilet / Bath Room / Locker Room		2	21.00
12. Machine Room		1	16.00
13. Others (Toilet / Corridor)		-	55.00
Total floor area			576.00
Accommodation			
1. Student Dormitory		20	430.00
2. Visitor Quarter		5	215.00
3. Recreation Room			
Rest Room	10	1	38.40
Kitchen	-	1	7.00
Pantry	-	1	5.00
Laundry	-	1	7.00
Toilet	-	1	9.00
Total Floor Area			711.40
Canteen			
Canteen			
Student Sections	30	1	45.00
Staff Sections	15	1	22.50
Kitchen	-	1	18.00
Pantry	-	1	4.00
Rest Area	-	1	14.00
Toilet	-	-	10.00
Total Floor Area			113.50
Total Floor Area all building			
Connecting Corridors			552.00
Grand Total			6680.90

(2) Sectional Plan :

Since the sectional plan will have a major impact on ventilation, light, and insulation properties in the various rooms, careful consideration has been given in its preparation to natural conditions in the Plan area.

At the MS Center Building, in order to obtain adequate ventilation and light, the sectional plan will use a system of high floors and open corridors, from floor to roof, to stimulate natural ventilation and air flow.

All of the rooms will open directly to the outside, with careful consideration having been given to natural ventilation and lighting.
In addition, by utilizing a pitched roof, natural insulation will be created via air layers in the loft beneath the roof, while direct sunlight will be intercepted by the use of deep eaves.

Throughout the Plan area, natural ventilation and air flow are maximized through the use of high ceilings as a means of alleviating heat, with ceiling heights in existing facilities ranging from 2.7 - 3.0 m.

Ceiling heights in the Plan facilities have been set, as shown in Table 2.3.2-2, taking into account usage in existing buildings as well as the prevailing USP standards.

Table 2.3.2-2 Ceiling Height

Name of Room	Ceiling height (m)
Laboratory, Seminar Room Canteen Kitchen	3.0
Lab. Station, Attached Research Room, Administration Area	2.7
Storage, Rest Room, Dormitory, Living Room	2.5

Floor and eaves heights, as determined from ceiling heights, have been specified in Table.2.3.2-3.

Table 2.3.2-3 Eaves Height

Name of Room	1st Floor height(m)	Eaves height (m)
MS Center	4.7	8.4
Annex, Workshop, Canteen		3.6
Lecture Theater		5.5
Accommodation	3.5	7.0
Canteen, Recreation Room		3.6

(3) Structural Plan :

With the exception of the Lecture Theater, which requires relatively high eaves and considerable space for large spans, the Plan facilities will comprise normal-size rooms, which have been classified broadly into teaching and research rooms and lodging facilities.

The main existing USP facilities number about 50 buildings, with the larger structures providing more than 6,000 m of total floor space in 3 - 4 story configurations. The most common structures use concrete posts and beams, with hollow concrete (H.C.)block walls and galvanized iron roofs.

The structural methods for the Plan facilities have been determined with reference to those used in existing USP buildings, on the basis of facility-size and use as well as ease of procurement and maintenance for the building materials.

1) Structural Method :

Considering the large size of the main Plan facilities and their seaside location, which requires protection from sea wind damage, we have determined that the most suitable structural method will be the one which is most commonly used in USP facilities, embodying concrete posts and beams, H.C. block walls, and galvanized iron roofs.

2) Foundation Method :

In the soil quality survey, it was found that the top soil layer, with a depth of 3.0 m, is a weathered mud-rock layer, known as weathered soapstone, which can be expected to provide a support foundation for the facilities. The layer from the surface to the soft rock stratum is reclaimed land, which has a loose geological composition, with a mixture of sand, clay, and gravel. On this basis, it was confirmed that this layer would be unsuitable as the support foundation for a large structure.

We have studied a pile foundation and a direct foundation method. The average layer thickness from surface to support foundation is relatively shallow, we have determined that a pile foundation method would not be advisable from either an engineering or economic standpoint. The foundations will be improved by replacing the existing fill with higher quality earth and sand. Foundation support will be provided by the direct foundation method.

3) Design Guidelines :

The subject Plan will conform to the Fiji National Building Code, which was basically enacted in 1990. The Fiji Code is based essentially on those in New Zealand and Australia. With respect to seismic strength, all buildings in Fiji must take into account the seismic strength requirements

established in Section B of the above Code ("Structural Provisions"), which relates to a seismatic design standards. This section is based on Section NZ 4203 in the New Zealand standards, wherein the seismic design force with coefficient for seismic load (Cd value) is calculated from the following formula :

$V = Cd \times Wt$,

where: V : total horizontal forces at time of earthquake

Wt = total building weight

$Cd = C \times I \times S \times M \times R$

C : based on the type of foundation, as determined for the area, and the periodicity of the structure. This has been set as C=0.6

I : the importance factor coefficient of the building

S : the direction of coefficient xy, determined on the basis of building structure

M : has been set at M=1, which is the RC structure coefficient, based on the type of building structure

R : the risk coefficient, based on building use.

The following figure shows the applicable area coefficients of earthquake intensity in the Republic of Fiji, as set forth in the above-referenced National Building Code (1990).

Based on this chart, the Plan site in the Suva area is included in Zone 6, designated as an area of medium seismic intensity, with a Zone Factor of 0.6.

(4) Building Materials Plan :

In this section, we will consider the interior and exterior finishes and fittings for the Plan building facilities. In the absence of any comment to the contrary, the materials will be common to all facilities .

1) Exterior finishes :

a) Exterior Wall :

Wall materials in similar USP buildings are either faced H.C. blocks or H.C. blocks with a mortar and paint finish. Reinforced concrete H.C. block is one of the most popular building materials in Fiji, reasonable in price and readily available.

In the subject Plan, therefore, H.C. block has been chosen as the outside wall material for its ease of procurement and construction.

Finishes will be either mortar with paint finish or faced blocks, as appropriate.

b) Openings :

In the existing USP facilities, the bulk of the door openings use wooden doors, with aluminum or steel doors seldom seen. In the subject Plan, wood doors will, in principle, be used in classrooms, research laboratories, laboratory stations, and living areas out of consideration for corrosion caused by sea winds. The bulk of the windows used at the USP facilities are of either aluminum or steel jalousie construction.

Since the Plan facilities are all on the shore, steel jalousies would present many problems in actual use, such as the need for regular painting to prevent rusting. For this reason, we have, in principle, specified aluminum jalousie for the Plan windows. However, aluminum sash windows will be used in air-conditioned areas, owing to their airtight properties.

2) Interior Finishes:

a) Floors:

Based on inspection of existing USP facilities, from the standpoint of maintenance and sanitation, we have specified tile finishes for the principal rooms: the Director's office, meeting room, laboratory stations, analytical laboratories, accommodation units, dining and kitchen areas, and toilets.

In the lecture theater, seminar rooms, library, and clean rooms, long-length vinyl or rubber tiles, with mortar paint finish, will be employed for their soundproofing and dustproofing properties.

In the laboratories, painted floors have been selected, while, in the workshop, cement mortar floors have been specified in the working areas, diving gear store, field equipment store, and geological preparation room.

In the entrance halls and corridors, exterior tile flooring will be laid for their appearance and ease of maintenance and cleaning.

b) Ceiling and wall finishes :

Ceilings will be hung in the general-purpose rooms, such as Seminar Rooms, library, laboratory stations, offices, and meeting room. However, in the machine rooms, workshop, and storage rooms, open ceilings will, in principle, be used.

The following finishing materials will be used, as appropriate, on ceilings and interior walls.

- ceilings : rim decking, sound-absorbent texture, veneers, fireproof board, waterproof board with paint finish, and other materials.
- walls : cement mortar base with point coating; veneer board with paint finish.

(5) Equipment Plan :

1) Electrical facilities :

Power supply for the Plan facilities will be brought in from an 11KVA high-tension overhead line running along the road in front of the site, stepped down to 415v / 240v via a high voltage transformer on the property, brought to a main switchboard and branched from there to the switchboards at the receiving facilities. The trunk lines will, in principle, be buried, with power supplied within each building via PVC conduit pipes.

In planning the electrical facilities, we have avoided equipment that would be difficult to handle or maintain, selecting only simple, effective facilities. From the standpoint of smooth maintenance, we plan to use, to the maximum possible extent, materials and products with standard local specifications that will be readily available.

The electrical system has been classified into two categories: lighting and wall sockets; and powered equipment. The maximum power load has been estimated as Table 2.3.2-4;

Table 2.3.2-4 Maximum Power Load

1. MS Center, Annex, Lecture Theater		
Lighting, Wall Socket	252KVA	
Powered Equipment	366KVA	A/C, Research Equipment
Total	618KVA	
2. Workshop		
Lighting, Wall Socket	19KVA	
Powered Equipment	219KVA	Workshop Equipment
Total	238KVA	
3. Accommodation		
Lighting, Wall Socket	58KVA	
4. Canteen		
Lighting, Wall Socket	5KVA	
Powered Equipment	1KVA	Kitchen equipment
Total	6KVA	

Based on the above considerations and power demand ratios, the required transformer which shall be undertaken of the USP side, capacity may be estimated at 750 KVA.

a) Lighting and wall socket facilities:

The most common lighting facilities used in existing USP buildings incorporate both fluorescent and incandescent lighting fixtures. The equipment used at these facilities comprises imported products distributed on the Fiji market. In the subject Plan, Japanese products will be specified for the main switchboards, owing to their safety and reliability. However, in the case of lighting fixtures and power supply materials, we plan to use locally available products in the interest of replacement compatibility, competitive prices, stable supply, and reliable quality.

Illuminance in the Plan rooms has been set, as shown below, with due regard to USP standards and usage patterns at existing facilities.

Table 2.3.2-5 Illuminance in the Plan Rooms

Name of Room	Illuminance
Computer Room	600 LX
Workshop	400 LX
Administration Room, Lab. Station, Library	400 LX
Kitchen, Tea Room, Rest Room	150 LX
Corridor, Store	150 LX
On the grounds	150 LX

Two types of wall sockets will be used: conventional sockets in seminar rooms, laboratory stations, library, administrative offices, and other standard rooms; and special-purpose sockets for the research equipment, machinery, and tools to be installed in the laboratories and workshop. In the case of the conventional sockets, the load voltage has been set at 240 v, 50 Hz, while, for the specialty outlets, single-phase 240 v, 50 Hz or 3-phase 415 v, 50 Hz will be used, depending on the target equipment involved.

b) Powered equipment :

The target equipment to which power is to be supplied comprises mainly research equipment and air-conditioning systems. Load voltage for this equipment has been set at 415 v, 50 Hz, with special circuits to be provided for equipment with high consumption requirements.

c) Telephone and telecommunications equipment :

Telephone-related construction will be the responsibility of the USP side. The only phase included in this Plan is pipe construction for bringing power onto the Plan site and distributing it within the Plan buildings.

d) Backup generator:

A backup generator will be installed in the machine room within the workshop building to provide emergency power for lighting, air-conditioning equipment for precision machinery and the specimen collection room, and freezing equipment.

The generator specifications will be approximately as followed :

- ·Engine : Diesel Engine
- ·Providing Power : 3-phase, 3 line, 415V / 240V, 50Hz
- ·Generating capacity : 230KVA

2) Water Supply and Drainage:

a) Municipal water supply:

A 150 mm municipal water pipe has been laid up to the road in front of the Plan site, providing excellent water pressure, quality, and supply. The water supply method to be utilized for this project will be a direct linkage system, as already used at existing USP facilities. The intake supply will be distributed from the main pipe through a water meter directly to the consuming terminals.

b) Water heaters :

In the tea rooms and Dark lab. in the MS Center Building, water will be heated by individual electric heaters. In the case of shower water in the apartments for visiting researchers, and night-watch quarters, individual solar heaters will be installed as a supplementary energy source for water heating purposes.

c) Drainage facilities :

The sewage and general drainage to be discharged from the Plan facilities will first be jointly treated in a septic tank and then allowed to permeate through the soil. Special discharges from the research rooms will be collected in a special tank and separately neutralized, sterilized and disinfected via an appropriate process. Drainage from the workshop, including machine lubricants, will be separately treated, with rainwater then discharged into the sea in front of the site via direct drainage ditches on the premises.

3) Air-conditioning equipment :

a) Air-conditioner :

According to USP standards, air-conditioning facilities should be installed in special rooms; thus, such equipment should not, in principle, be placed in general-type rooms. However, for functional reasons, it is planned to install split-type units in the room housing precision equipment, which is vulnerable to damage from moisture and humidity, the specimen collection room, and the clean room, where research must be conducted in a closed, protected environment, the microbiology and dark labs for culturing microorganisms, as well as certain other special areas.

b) Ventilating equipment :

Ceiling fans will be installed in general-use rooms occupied by staff members, such as the laboratory stations, Seminar rooms, research laboratories, and administrative offices, to improve ventilation by mechanical means. Powerful exhaust fans will be installed in laboratories, rest rooms, shower rooms, the kitchen, and certain other areas, where foul odors or dampness are prone to develop.

4) Fire fighting facilities :

This phase of the Plan conforms to the USP standards established for disaster prevention.

The fire fighting equipment mandated by these rules includes indoor and outdoor hydrant facilities, automatic and push-button fire alarms, and small portable fire extinguishers.

In the subject Plan, a thermal fire alarm system will be installed in each room along with fire extinguishers, with hose reels set in each room with a 25m radius. The Plan also specifies push-button fire alarms in the vicinity of staircases and in research laboratories, as well as outdoor fire hydrants.

However, considering the ample water pressure in the area, fire pumps for use with hose reels will not be installed in the Plan facilities, following the pattern in existing USP facilities.

5) Gas facilities :

A main distribution pipe carrying propane gas will be installed to supply gas to the research laboratories, laboratory stations, and kitchen. Gas cylinders will be placed at each building for distribution of the gas via pipes to the individual equipment terminals.

6) Elevator equipment :

An elevator will be installed in the MS Center Building for movement of research equipment as well as for the convenience of handicapped persons.

7) Air Supply and Intake Facilities:

Air supply and intake facilities will be installed in the research rooms, laboratories, analytical labs, and other teaching and research areas. However, in the Seawater Laboratory, reflecting the nature of the research experiments to be conducted there, only air supply facilities will be provided. Table 2.3.2-6 shows the number of terminal nozzles to be provided in the Plan rooms.

Table 2.3.2-6 Number of Terminal Nozzles

Name of Room	No. of Rooms	No. of Nozzles per Room	No. of Air Supply & Intake Nozzles per Room
Laboratories	2	8	16 *
Inorganic / Organic Laboratory	1	8	8
Attached research rooms and Others	-	-	30
TOTAL			54

* excluding the Seawater Laboratory

Based on the nature of the experiments to be performed at these various facilities, the volume of air supply and intake per nozzle has been set at 10 liters/ minute and the simultaneous usage ratio at

10%, which yields a total air volume for all facilities of 54 liters. Vacuum pumps will be used for air intake and compressors for air supply.

In the case of the Seawater Lab, in response to the type of research activity therein, the required air supply volume has been set at about 100% of the target seawater volume, resulting in a total volume of 10,000 liters/hour (165 liters/minute). Since the air supply volume will be relatively large at this facility, while the equipment is expected to be in continuous use around the clock, air blowers will be used as the air supply mechanism.

(6) Exterior Facilities:

1) On-premise Road

A road will be built within the Plan premises to facilitate access to the various facilities from the point of entry. This road will have a width of 6m and will, in principle, be two-lane. With regard to paving specifications, among the three options - asphalt, concrete, and interlocking blocks, we have selected interlocking blocks from the standpoint of ease of maintenance and construction economy.

2) Connecting corridors

Connecting corridors will be provided between the MS Center and the Lecture Theater, the Center and the Annex, and the Accommodation and Recreation Room - the areas where student and staff traffic will be heaviest - to facilitate pedestrian movements and afford protection against rain and direct sunlight.

2.3.2.3 Equipment Plan :

A detailed list of the equipment required to implement this Plan is given in Attached "Equipment List ". The equipment is designed to run on a power supply of either single-phase 240V, 50Hz or 3-phase 415V, 50Hz. The main items are as listed Table 2.3.2-7.

Table 2.3.2-7 Equipment List

Equipment Item	Specifications	No.	Purpose
(1)Laboratory Equipment			
Freezer drier	- 45 °C, Vacuum 100 liters / min , pre-freeze bath	1	To dry bio specimens and heat-damaged substance
Incubator	200 liters, 3 °C - 45 °C	4	To culture bacteria, plankton and so on at constant temperatures
Ultra cold freezer	-85 °C, 300 liters, upright	1	For long-term storage of specimens of marine species and other living organisms
Distillation deionizer	10 liters/h, distilled water tank 100 liters	1	To make distilled water for use in equipment washing and compounding reagents
High-speed centrifuge	20,000 rpm, 0°C - 30 °C	1	For separating microorganisms and biochemical substances
Biological microscope	Binocular, eyepieces 10x , objectives : 4x. 10x, 40x, 100x oil	21	For use in student training
Biological microscope	Trinoculer 40x 100x 400x 1000x, W/camera	1	For research use
Stereoscopic microscope	Binocular, zoom 6:1, total magnification 7x - 40x	11	For use in student training
Stereoscopic microscope	Trinocular, zoom 6.3:1, total magnification 10x - 95x	3	For research use
Inverted microscope	Binocular, 40x - 400x	2	For observation of aquatic microorganisms
Spectrophotometer, UV - VIS	Wavelength range 190 - 900 nm, resolution 0.1nm, Bandwidth 0.1 - 5.0nm	1	For student training use in analysis of chemical substances
Spectrophotometer, AA	Flame & Furnace, 190 - 900 nm, Bandwidth 0.1 - 5.0 nm	1	For Monitoring and analysis of sea water
Protein analyzer	Nitrogen 0.1 - 100.0mg	1	For quantitative analyses of nitrogen in foodstuffs
Balance, analytical	0-2000g, minimum reading 0.1mg	4	For weighing (chemical) reagents
Fume Cupboard	1500W x 750D x 2600H mm	10	To exhaust toxic and offensive-smelling gases
Laminar flow unit	1600W x 1000D x 1800H mm	4	To prevent contamination of microorganisms and dust
(2)Oceanography Research Equipment			
CSTD	C:0-100ms ± 0.25ms, S:0-100‰ ± 0.25‰, T: -5 - +45°C ± 0.2°C	1	For ocean water measurements in shallow waters
Water sampler, Niskin	1.7 litters	10	For collecting water sample
Bottom sampler	Ekman - berge type, 150 x 150 x 150mm	1	For collecting bottom sediment, mud, and benthos
Real time DGPS	5m accuracy, UHF 10W	1	To determine positing at field survey
(3)Fishing gear and materials			
Bench seine net	1 inch str., 1-2m depth x 50m	2	For sampling fish in lagoon area
Trammel net	Nylon multi, 4 x 8 str., 3m depth x100m	5	For sampling fish in lagoon area
Gill net	Nylon mono, 3 str., 3mx100m		For sampling fish in lagoon area
(4)Diving Gear And Equipment			
Air compressor, water cooling	200kg/cm², 13m³/h	1	For refilling diving tanks with compressed air, use in dravuni station
Air compressor, air cooling	200kg/cm², 8m³/h, diesel engine	1	For refilling diving tanks with compressed air, use in Dravuni station
Air tanks	14 litter, 200kg/cm²	15	For diving operations
Regulator	4LP ports, 1HP port	15	For diving operations

Equipment Item	Specifications	No.	Purpose
(5)Equipment for Post-harvest Fisheries			
Chili Store	$6m^3$, 0°C	1	To keep fish at low temperatures for training purpose
Cold store	$6m^3$, -25°C	1	For fish storage for training Purpose
Quick freezer	-30°C - -35°C	1	To quick-freeze fish for training purposes
Band saw	Cutting height 400mm, stainless table 870 x 900 mm	1	For cutting up large-size fish
Fish smoker/drier	50kg capacity	1	For training in developing smoked and dried products
Vacuum packing machine	Seal length 570mm, chamber 610x440 x 80mm	1	For vacuum packing of processed fish
(6)Seawater Laboratory Equipment			
Polycarbonate tanks, clear	500 liters, 1170mm dia x 770Hmm	5	For rearing experiments on marine species
Aquarium	35 liters, 450 x 300 x 300Hmm	10	For rearing experiments on marine species
(7)Audio-visual Equipment			
Video projector	150 , w/ screen 3000 x 2200mm	1	For projecting video-based teaching materials during lectures
(8)Computer and Network			
Workstations	64bit, 100MHz, RAM 16MB, HD 500MB, W/15inch Monitor	16	For training in dataprocessing techniques
(9)Workshop equipment			
Drill press	13mm dia , 360mm swing, 80mm stroke	1	For repairing machinery and fabricating auxiliary teaching materials
Bench grainder	200mm dia , 600W	1	For repairing machinery and fabricating auxiliary teaching materials
(10)Vehicle			
Pickup truck, double cabin	4WD, diesel engine 2600 cc	1	To transport survey personnel and equipment
(11)Others			
Photocopier	A4 - A3, 50 - 200% zoom	2	To duplicate teaching materials
Erdargers	Color and monochrome	1	To enlarge photograph
Print processor	35mm x 5films or 30 x 40cm print	1	To process photograph
VHF radio telephone	Base station 10W	1	For communication between MSP and field survey teams
Furniture	Desks, chairs, cabinets, lockers, shelves, etc.	1	For studying, teaching, working, storage etc.

2.3.2.4 Research Vessel Plan

Results of the basic design for the planned research vessel are as follows;

1) GENERAL DESCRIPTION

Kind of ship	:	Steel fishing research
Flag of ship	:	Republic of Fiji
Regulation	:	Ship s safety laws of Japan
		(for steel fishing research and training ship)
Classification	:	Nippon Kaijyi Kyokai (NK), NMS*, NS*

2) PRINCIPAL DIMENSIONS AND DESIGN CONDITIONS

Length overall	:	25.50M. approx.
Length between p.p.	:	20.80M. approx.
Breadth, molded	:	6.40M. approx.
Depth, molded	:	2.55M. approx.

Designed draft, molded	:	1.80M. approx.
Gross tonnage	:	130 tons approx.
F.O.T. capacity	:	20.00m3 approx.
F.W.T. capacity	:	10.00m3 approx.
Complement	:	12 (6- crew, 6-scientists)
Service speed	:	Approx. 10.0 Knots
		(output of 85% MCR with 15% of sea margin)
Main engine	:	750ps x 1,400 rpm
Generator engine	:	100 ps x 1,500 rpm, 64kw x 2Nos.

3) Deck machinery

Deck machinery shall be equipped as follows:

Windlass, Capstan,

1.5 tons x 3,000m Spool winch,

0.5 tons x 2,500m CTD winch,

0.5 t Deck crane,

FRP dinghy of 4,000mm, 100kg Line hauler, 2- tons A frame

4) Navigation and electronics equipment

25 kW radar, VHF radio telephone, GPS navigator, color echo sounder (3,000m), weather facsimile, inmarsat ship earth station, 150W SSB, gyro compass and others.